

CODE SHEET

		VIS	TA Projects Limited						
		VENDOR DRAWI	NG/DOCUMENT SQ	UAD CHECK					
A	Reviewed without exception. Proceed with fabrication. Issue final drawings/documents.								
B	drawing/document. Shipment will not be released, if any drawings/documents requiring approval, as per purchase order conditions, are at this code.								
C	Not accepted. Revise as marked and resubmit drawing/document for review. Shipment will not be released, if any drawings/documents requiring approval, as per purchase order conditions, are at this code.								
D .	Not re	quired for review. Rece	eived for information.						
drawing, detail ar	ineer do /documo id dimei	oes not warrant or repr ent is either accurate o	esent that the informa r complete. Sole rest	ncept and specifications provided. ation contained on this consibility for correct design, g the drawing/document.					
SDR C	DR CODE EQUIPMENT TAG REVIEWED BY DATE								
DBO	1	134-1100	PIVALLA	21 Jan 2013					

PROJECT NAME:	MURPHY CADOTTE / 1780
VENDOR NAME:	ABB-BER-MAC / 1780-024
DOCUMENT NUMBER:	1780-024-DATABUDK
VENDOR REVISION:	2
DOCUMENT DESCRIPTION:	DATA BOOK MCC BUILDING
VENDOR TRANSMITTAL NUMBER:	

Table of Contents

- 1. Purchase Order
 - Change Orders N/A
- 2. As Built Data Sheets N/A to Scope
- 3. As Built Drawings
- **HVAC Drawings**
- 1780-52-001-1 REV 0
- 1780-52-002-1 REV 0
- 1780-52-003-1 REV 0
- 1780-53-001-1 REV 0
- 1780-53-002-1
- 1780-53-003-1
- 1780-53-004-1
- 1780-53-005-1
- 1780-53-006-1
- 1780-53-007-1
- 1780-53-008-1
- 1780-53-009-1
- 1780-53-010-1
- 1780-53-011-1
- 1780-54-001-1
- 1780-54-002-1
- 1780-57-002-1
- 1780-57-003-1
- 1780-57-004-1
- 1780-57-005-1
- 1780-64-030-1

- 1780-67-001-1
- 1780-67-001-2
- 1780-68-001-1
- 1780-68-001-2
- 1780-68-001-3
- 1780-68-001-4
- 1780-68-001-5
- 1780-68-001-6
- 1780-68-001-7 1780-69-005-1
- 1780-69-006-1
- 1780-69-007-1
- 1780-69-008-1
- 1780-69-040-1 1780-69-014-1
- 1780-81-003-1
- 1780-81-004-1
- 1780-81-005-1
- 1780-81-006-1
- 1780-81-008-1
- 1780-81-009-1
- 1780-81-010-1

- 1780-81-014-1
- 1780-81-015-1
- 1780-81-016-1
- 1780-81-017-1
- 1780-81-019-1
- 1780-81-020-1
- 1780-81-021-1
- 1780-81-022-1
- 1780-81-023-1 1780-81-024-1
- 1780-81-001-001-1 REV B
- 1780-81-002-1
- 1780-81-007-1
- 1780-81-011-1
- 1780-81-012-1
- 1780-81-013-1
- 1780-81-018-1
- Structural Drawings

4. Catalogue Data & Manuals

- Fiber Glass Building Insulation
- **Supreme Windows**
- Wall Mount Air Conditioner
- Suspended Unit Heater
- Photoelectric T900 Series
- Receptacles
- Single Phase Nema Manual Starting Switches
- Cooper Lighting Metalux
- 5. QAQC Documents



PROJECT INFORMATION SHEET

A MEMOER OF THE ABB SHOUP	SUEEI				
	Project Data				
Sales Order Type:	PSO - Project Sales Order				
Project Classification:	CPC - Construction and Professional Services Combined				
Field Rate Sheet:	Use Services Rate Sheet Attached				
Professional Services Rate Sheet:	Use Services Rate Sheet Attached				
Sell Price:	\$289,000				
Currency:	Canadian Dollars				
Material Mark-Up = Landed Cost +	15.0%				
End User:	Murphy Oil				
Project Description:	MCC Bldg Seal				
Project Location:	Alberta				
Location Details:					
Legal Survey Description:					
Originating Quote Number:	Q2012-039				
Assigned Project Number / Sales Order Number:	。 1. 10 10 10 10 10 10 10 10 10 10 10 10 10				
Project Start Date:	February 28, 2012				
Expected Project Finish Date:	August 31,2012				
Sales Group:	C - Calgary (601)				
Project Sponsor - Corporate Account Manager:	Tony Manning				
Project Manager (Person Responsible):	Dale Williams				
Electrical Permit Details:	Alberta				
Inv	voicing Information				
Revenue Recognition Method:	CCM - Completion Contract Method				
Inco terms:	FCA - Free Carrier				
Inco terms location:	Calgary				
Billing Type:	LS - Lump Sum				
Billing Plan:	BOC - Bill on Completion				
SAP WBS Template to Use:	Role Based - Simple (TBM8295P1)				
Sold To Party:	Murphy Oil				

Inco terms location:	Calgary
Billing Type:	
Billing Plan:	
SAP WBS Template to Use:	Role Based - Simple (TBM8295P1)
Sold To Party:	Murphy Oil
Ship To Party:	
Client AFE #:	
Client PO #:	
Client Job #:	
Additional Client Coding:	A STATE OF THE PARTY OF THE PAR
Bill To:	Murphy Oil Canada
C/O (if applicable):	
Street Address:	4000,520 - 3 Avenue SW
City / Province:	
Postal Code:	T2P 3Y3
Attention:	Procurement Project Accounting
Client Project Contact Person:	Brant Lu
Telephone Number:	
Cell Phone Number:	
Email Address:	
Fax Number:	403-258-2192
GST:	5% GST
PST:	
HST:	
Will Invoice "Hold Backs" be required?	Yes - 10%
	This is a comment that will go to the billing department and describe special
Project Comments:	circumstances for the project. If additional comments are required then attach

Estimated Project Hours / Activity Type / Job Cost

separate sheet(s) to the PIS.

	WBS	Hours	Payroll	Estimated Costs
PROJECT TOTAL:		925	Activity Type	
Professional Services Group Total:	PSG	117	N/A	
Field Services Group Total:	FSG	808	N/A	
Panel Shop Labour Total:	PNLP	0	N/A	
Panel Shop Material Total:	PNLM			\$0.00
Material Total:	MAT			\$191,141.00
Equipment Total:	EQP			\$3,780.00
Expenses Total:	EXP			\$0.00



T: 403-831-1617

Direct Questions About This PO To

E: shane.c.carnahan@ca.abb.com

PURCHASE ORDER 54115177-120

54115177-120 ABB BER-MAC PO Description MURPHY OIL CANADA 28-Feb-2012 MCC BUILDING 4000, 520 - 3 Avenue SW Involce Payment Terms Project Name **EPC Company** Calgary, AB, CA T2P 3Y3 Vista Projects Limited Net 45 Days Seal CSS Pilot B Ryan Dick EPC Project Number Order Currency T: 403-294-8038 Location E: ryan_dick@murphyoilcorp.com 13-09-85-17 W5M 1780 CDN\$ Murphy AFE Number Vendor Quotation Reference Delivery Shipping Terms 54115177 FCA, Sellers Facility Q2012-039-01 09-Jul-2012 Invoice To
MURPHY OIL CANADA Vendor Ship To ABB BER-MAC 4000, 520 - 3 Avenue SW 250 42 Avenue SE Calgary, AB, CA T2G 1Y4 Calgary, AB, CA **T2P 3Y3** Shane Carnahan **Facilities**

ITITIO				MCC BUILDING
Quantity	Description	Major-Minor	Unit Cost	Total
1.00 set	TAG #: BU-1100 - MCC BUILDING PACKAGE -Includes Documentation Requirements of 3 Hordcopies and 2 Electronic -Includes Inspection Requirements Details of the MCC Building shall be as per all attached PO documents (Commercial and Technical)	9024-449	\$289,000.00	\$289,000.00
_	Quantity 1.00	1.00 TAG #: BU-1100 - MCC BUILDING PACKAGE set -Includes Documentation Requirements of 3 Hardcopies and 2 Electronic -Includes Inspection Requirements Details of the MCC Building shall be as per all attached PO documents	Quantity Description Major-Minor 1.00 TAG #: BU-1100 - MCC BUILDING PACKAGE -includes Documentation Requirements of 3 Hardcopies and 2 Electronic -includes Inspection Requirements Details of the MCC Building shall be as per all attached PO documents	Quantity Description Major-Minor Unit Cost 1.00 TAG #: BU-1100 - MCC BUILDING PACKAGE 9024-449 \$289,000.00 set Includes Documentation Requirements of 3 Hordcopies and 2 Electronic Includes Inspection Requirements Details of the MCC Building shall be as per all attached PO documents

Attn: Ryan Dlck

Brant Lu @ Vista Projects Ltd. T: 403-258-4678 E: brant.lu@vistaprojects.com Sub Total

\$289,000.00

(plus GST)

Instructions to Vendor

- Show PO Number 54115177-120 on all invoices and correspondance pertaining to this order

- Attach a copy of this Purchase Order to ALL INVOICES when submitting for payment

- Attached as Exhibit 'A' are Terms and Conditions which are made a part hereof for all purposes

- One (1) copy of this order is to be duly signed and returned upon receipt. Retention for more than ten (10) working days shall constitute acceptance of this order in its entirety

- No costs are to exceed the amounts Indicated on this Purchase Order

· Work performed is not to deviate from the scope of this Purchase Order

Order Prepared By

Order Approved Ex

Shella Dykstra

Total Value of Purchase Order

\$289,000.00

(plus GST)

Ryan Dick, Jeff Sand, Cal Buchanan

\$289,000.00

54115177-120 Page 1 of 1

CONFIDENTIAL / PROPRIETARY INFORMATION OF MURPHY OIL COMPANY LTD. AND ABB BER-MAC FOR AUTHORIZED COMPANY USE ONLY



Purchase Order #: 1780-024 Murphy Oil Company Ltd. Murphy Cadotte Pilot CSS Project



1780-024 (Vista)

Purchase Order Number: 54115177-120 (Murphy)

MCC Building

PO Total Commitment: \$289,000.00 + gst

Required Delivery Date: July 9, 2012

CORPORATION

Murphy Oil Company Ltd

PROJECT CONSULTANT Vista Projects Limited Attention: Brant Lu

Telephone: (403) 258-4768

Fax: (403) 258-2192

Email: brant.lu@vistaprojects.com **VENDOR NAME**

ABB Ber-Mac

250 42 Avenue SE Calgary AB T2G 1Y4 **Attention: Shane Carnahan**

Telephone: 403-831-1617

Email: Shane.c.carnahan@ca.abb.com

March 7, 2012

PO Issue Date

Seller's Acceptance

Please sign and return this cover page

Seller's Signature

MAN, 19, 2012

Date

ABB Ber-Mac

March 19,2012

PO 1780-024

Page 1 of 11

Is this a FIRM BID select one

YES

BID Type-select one

Lump Sum

Business area - select one



					Client	's Ref.		ABB ref.
Murphy Oil Company Ltd. (Vista) xx			·					
BU-1100 MCC/Instrument Air Bldg xxx	•			COST		SELL		Revision no.
22012-039 Feb. 17th Clarifications			<u> </u>	CAD		CAD	Mark up %	
	Customer Price if no detailed breakdown							-
Purchases:					l			-
	Material		\$	35,643.49	\$ 4	2,892.29	20.34%	
	Engineering and Services (not including DSP)		\$	148,600.00	\$ 17	4,004.68	[#] 17.10%	
Third Party	Installation				\$	-		
Production of the Control of the Con	Equipment		\$	4,413.29		5,167.79	₹ 17.10%	
	Other		\$	1,772.13		2,075.09	≠ 17.10%	Array of the control
	Insurance, Bonds, Permits		<u> </u>		\$			
***************************************	Freight		\$	713.00	\$	834.89	√ 17.10%	
Own cost	Project/Construction Management	Hours QTY 28.41	\$	3,125.10	\$	3,659.37	4 +2 +00/	
	Craft labour	779.36		39,512.66		6,267.75	4 17.10% 17.10%	
	Engineering labour	779.30		3,073.20	***************************************	3,598.59	17.10%	
	Design and Drafting labour	87		5,116,47		5.991.18	17.10%	
	Panel shop labour				\$	-	***************************************	
***************************************	Health and Safety				\$	-		
	Project support (admin,scheduling etc)				\$	-		
-	Trucks	200	\$	3,780.00	\$	4,426.23	17.10%	
	Travel				\$	-		
	Subsistence/LOA				\$	-		
	Health & Safety				\$			
	Material Overhead			980		\$		
	Insurance overhead	***************************************		722		\$		0.25%
Provision	Contingency			5,780		\$		2.00%
***************************************	Warranty			722		\$		0.25%
	Additional Risk / Accubid Final Adjustment			0		\$82	#DIV/0!	
	TOTAL PRODUCTION COST /SELL			253,955	\$	289,000	13.80%	
	Gross Profit					\$35,045		
	Gross Margin %					12.13%		
	SG&A (internal from table)					\$24,276		8.40%
	TOTAL SG&A			į		\$24,276		
	SG&A %					8.40%		
	Net Profit					\$10,769		
	Net Margin %					3.7%		
	TOTALS				(CAD	ì	
Tota	al Gross Result			·	`	\$35,045		
Tota	al Gross Margin %					12.13%		
	al SG&A					\$24,276		
	al Contingency & Risk al Net Result					\$5,780 \$10,769		
	il Net Result %					3.7%		

Bid Validity Date	
Bid Submission date	
Approval from Table of Authority	
Terms & Conditions Reviewed	
Approved by Controller	talingez Haren 19,201:
Approved by General Manager	
Approved by Business Line Manager	
Approved by Project Manager	

SAP 255,709 FCM 253,955 1754, most 04

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Cost Center	. Acty Type	Cost ctr short text	Act. type short text	Profit Cantor	DTIOT	eens.	Indian CYTY()	definition (and the common
2855	ADM0	PANEL SHOP	Admin	PNL	RT	фф/пі г 60.00	lours QTY La	Dour cost 0.00
2855	PM03	PANEL SHOP	PROJ MGR-3	PNL	RT	92.00		0.00
2855	PNLP	PANEL SHOP	PANEL PERSONNEL	PNL	RT	71.97		0.00
2855	PNLR	PANEL SHOP	CONT SYS SHOP RATE	PNL	RT	57.91		0.00
1295	P005	MATERIAL BU 4443-O	PURCHSG FOR CLIENT	PSO/POLY	RT	65.00		0.00
2123	ADM1	ORDER ADMIN	Project Support	PSO/POLY	RT	60.00		0.00
2125	ADDC	PROJECT MANAGEMENT	PROJ DOC CONTROL	PSO/POLY	RT	60.00		0.00
2125	PM01	PROJECT MANAGEMENT	PROJ MGR-1	PSO/POLY	RT	100.00		0.00
2125	PM02	PROJECT MANAGEMENT	PROJ MGR-2	PSO/POLY	RT	110.00		0.00
2125 2125	PM03 PSRV	PROJECT MANAGEMENT	PROJ MGR-3	PSO/POLY	RT	121.78		0.00
5047	PSHV PM03	PROJECT MANAGEMENT	PROJ SERVICES	PSO/POLY	RT	100.00		0.00
2128	DN01	ENG. CUST. MGMT	PROJ MGR-3	PSO/POLY	RT	125.00		0.00
2128	DN02	POLYMER HYDRATION	DESIGN TECH-1	PSO/POLY	RT	81.48		0.00
2128	DN03	POLYMER HYDRATION POLYMER HYDRATION	DESIGN TECH-2	PSO/POLY	RT	81.48		0.00
2128	EE03	POLYMER HYDRATION	DESIGN TECH-3	PSO/POLY	RT	81.48		0.00
2128	ME01	POLYMER HYDRATION	ELECTRICAL ENG-3	PSO/POLY	RT	81.48		0.00
2128	PM03	POLYMER HYDRATION	Mechanical Engineer	PSO/POLY	RT	81.48		0.00
5039	ADMDC	DESIGN & DRAFTING	PROJ MGR-3 Doc admin	PSO/POLY	RT	121.78		0.00
5039	DF01	DESIGN & DRAFTING	DRAFT TECH-1	PSO/POLY	RT	60.00		0.00
5039	DF02	DESIGN & DRAFTING	DRAFT TECH-2	PSO/POLY	RT	48.96		0.00
5039	DF03	DESIGN & DRAFTING	DRAFT TECH-3	PSO/POLY	RT	53.88		0.00
5039	DN01	DESIGN & DRAFTING	DESIGN TECH-1	PSO/POLY	RT	58.81	87.00	5,116.47
5039	DN02	DESIGN & DRAFTING	DESIGN TECH-2	PSO/POLY	RT	65.93		0.00
5039	DN03	DESIGN & DRAFTING	DESIGN TECH-3	PSO/POLY	RT	72.88		0.00
5039	DNC1	DESIGN & DRAFTING	DESIGN COORDINATOR	PSO/POLY PSO/POLY	RT	90.51		0.00
5041	ADMDC	DESIGN&DRAFT-OFFSITE	Doc admin	PSO/POLY	RT	90.51		0.00
5041	DF01	DESIGN&DRAFT-OFFSITE	DRAFT TECH-1	PSO/POLY	RT	60.00		0.00
5041	DF02	DESIGN&DRAFT-OFFSITE	DRAFT TECH-2		RT	60.00		0.00
5041	DF03	DESIGN&DRAFT-OFFSITE	DRAFT TECH-3	PSO/POLY PSO/POLY	RT RT	66.68		0.00
5041	DN01	DESIGN&DRAFT-OFFSITE	DESIGN TECH-1	PSO/POLY		69.21		0.00
5041	DN02	DESIGN&DRAFT-OFFSITE	DESIGN TECH-2	PSO/POLY	RT RT	69.34		0.00
5041	DN03	DESIGN&DRAFT-OFFSITE	DESIGN TECH-3	PSO/POLY	RT	76.12		0.00
5041	DNC1	DESIGN&DRAFT-OFFSITE	DESIGN COORDINATOR	PSO/POLY	RT	90.80 90.51		0.00
5042	AE01 / AS01	SAGD	Automation Eng-1/ Automation Spc-1	PSO/POLY	RT			0.00
5042	AE02 / AS02	SAGD	Automation Eng-2/ Automation Spc-2	PSO/POLY	RT	56.41 71.54		0.00
5042	AE03 / AS03	SAGD	Automation Eng-3/Automation Spc-3	PSO/POLY	RT	96.67		0.00
5042	PM01	SAGD	PROJ MGR-1	PSO/POLY	RT	100.00		0.00
5042	PM02	SAGD	PROJ MGR-2	PSO/POLY	RT	110.00		0.00
5042	PM03	SAGD	PROJ MGR-3	PSO/POLY	RT	121.78		0.00
5043	AE01 / AS01	FIELD AUT. & SERVICE	Automation Eng-1/ Automation Spc-1	PSO/POLY	RT	60.41		0.00
5043	AE02 / AS02	FIELD AUT. & SERVICE	Automation Eng-2/ Automation Spc-2	PSO/POLY	RT	75.54		0.00
5043	AE03 / AS03	FIELD AUT, & SERVICE	Automation Eng-3/Automation Spc-3	PSO/POLY	RT	100.67		0.00
5044	ADM0	INDUSTRIAL AUT. PRG	Admin	PSO/POLY	BT	60.00		0.00
5044	ADM1	INDUSTRIAL AUT, PRG	Project Support	PSO/POLY	BT	60.00		0.00
5044 5044	AE01 / AS01	INDUSTRIAL AUT. PRG	Automation Eng-1/ Automation Spc-1	PSO/POLY	RT	61.50		0.00
5044	AE02 / AS02	INDUSTRIAL AUT. PRG	Automation Eng-2/ Automation Spc-2	PSO/POLY	RT	76.49		0.00
5044	AE03 / AS03	INDUSTRIAL AUT. PRG	Automation Eng-3/Automation Spc-3	PSO/POLY	RT	106.69		0.00
5044	PM01	INDUSTRIAL AUT. PRG	PROJ MGR-1	PSO/POLY	RT	100.00		0.00
5044	PM02 PM03	INDUSTRIAL AUT. PRG	PROJ MGR-2	PSO/POLY	RT	110.00		0.00
5045	EE01 / ES01	INDUSTRIAL AUT. PRG	PROJ MGR-3	PSO/POLY	RT	121.78		0.00
5045	EE02 / ES02	ENGINEERING-OFFSITES	ELECTRICAL ENG-1/ELECTRICAL SPC-1	PSO/POLY	RT	58.93		0.00
5045	EE03 / ES03	ENGINEERING-OFFSITES	ELECTRICAL ENG-2/ELECTRICAL SPC-2	PSO/POLY	RT	80.90		0.00
5046	IS01	ENGINEERING-OFFSITES	ELECTRICAL ENG-3/ELECTRICAL SPC-3	PSO/POLY	RT	106.42		0.00
5046	IS02	INDUST ENG-OFFSITES INDUST ENG-OFFSITES	INSTRUMENT SPC-1	PSO/POLY	RT	60.00		0.00
5046	IS03	INDUST ENG-OFFSITES	INSTRUMENT SPC-2	PSO/POLY	RT	82.00		0.00
5048	IS01	INDUST ENG-OFFSITES	INSTRUMENT SPC-3	PSO/POLY	RT	97.16		0.00
5048	IS02	INDUST ENGINEERING	INSTRUMENT SPC-1	PSO/POLY	RT	52.25		0.00
5048	IS03	INDUST ENGINEERING	INSTRUMENT SPC-2	PSO/POLY	RT	67.09		0.00
5049	EE01 / ES01	ENGINEERING	INSTRUMENT SPC-3	PSO/POLY	RT	86.83		0.00
5049	EE02 / ES02	ENGINEERING	ELECTRICAL ENG-1/ELECTRICAL SPC-1	PSO/POLY	RT	54.81		0.00
5049	EE03 / ES03	ENGINEERING	ELECTRICAL ENG-2/ELECTRICAL SPC-2	PSO/POLY	RT	73.56		0.00
VEHICLES		VEHICLES	ELECTRICAL ENG-3/ELECTRICAL SPC-3	PSO/POLY	RT	102.44	30.00	3,073.20
All Branches	E001/I001	All Branches	VEHICLES	PSO/POLY	RT	18.90	200.00	3,780.00
All Branches	E002/1002	All Branches	Elec. AP-1YR/INST APPR - 1YR	FS	RT	36.33		0.00
All Branches	E003/1003	All Branches	Elec. AP-2YR/INST APPR - 2YR Elec. AP-3YR/INST APPR - 3YR	FS	RT	42.38	194.84	8,257.32
All Branches	E004/1004	All Branches		FS	RT	48.44		0.00
		, or wellfulled	Elec. AP-4YR/INST APPR - 4YR	FS	RT	54.49	194.84	10,616.83

All Dranahas	F 104 // 104							
All Branches	EJ01/IJ01	All Branches	1 yr Elec Journey/1 yr Inst Journeyman	FS	RT	60.55	194.84	11,797.56
All Branches All Branches	EJ02/IJ02 EJ03/IJ03	All Branches	2 yr Elec Journeyman/2 yr Inst Journeyman	FS	RT	63.58		0.00
All Branches	ELH/ILH	All Branches	3 yr Elec Journeyman/3 yr Inst Journeyman	FS	RT	65.39		0.00
All Branches	EFM/IFM	All Branches	Electrical Lead Hand/Instr. Lead Hand	FS	RT	68.02		0.00
All Branches	ET03	All Branches	Electrical Foreman 1/Intrumentation F-1	FS	RT	74.02	194.84	14,422.06
All Branches	FC01/FC02/FC03/PM1	All Branches	Estimator	FS	RT	77.50		0.00
VEHICLES	. Julin Guzir GuzirMT	All Branches	Branch Manager/Project Manager	FS	RT	79.08		0.00
3892/3894	CM01	VEHICLES	VEHICLES	FS	RT	18.90		0.00
3892/3894	CM02	LFP/Ehouse all cost centers	CONSTRUCT.MGR-1	LFP/Ehouse	RT	110.00	28.41	3,125.10
3892/3894	CM03	LFP/Ehouse all cost centers LFP/Ehouse all cost centers	CONSTRUCT.MGR-2	LFP/Ehouse	RT	110.00		0.00
3892/3894	PSRV	LFP/Ehouse all cost centers	CONSTRUCT.MGR-3	LFP/Ehouse	RT	110.00		0.00
3892/3894	QA01	LFP/Enouse all cost centers LFP/Ehouse all cost centers	PROJ SERVICES	LFP/Ehouse	RT	110.00		0.00
3892/3894	ADMO	LFP/Ehouse all cost centers	QA/QC Admin	LFP/Ehouse	RT	110.00		0.00
3892/3894	CS1	LFP/Ehouse all cost centers	Admin SAFETY	LFP/Ehouse	RT	60.00		0.00
3892/3894	CS1OT	LFP/Ehouse all cost centers	SAFETY OT	LFP/Ehouse	RT	65.00		0.00
3892/3894	CSO	LFP/Ehouse all cost centers	SAFETY OFFICER	LFP/Ehouse	OT	88.00		0.00
3896	ET03	Estimating		LFP/Ehouse	RT	110.00		0.00
VEHICLES		VEHICLES	Estimator	LFP/Ehouse	RT	77.50		0.00
3323	E001/I001	E-HOUSES APPRENTICE	VEHICLES	LFP/Ehouse	RT	18.90		0.00
3323	E001/001OT	E-HOUSES APPRENTICE	Elec. AP-1YR/INST APPR - 1YR	LFP/Ehouse	RT	26.00		0.00
3323	E002/1002	E-HOUSES APPRENTICE	Elec. AP-1YR OT/INST APPR - 1YR OT	LFP/Ehouse	OT	34.90		0.00
3323	E002OT/1002OT	E-HOUSES APPRENTICE	Elec. AP-2YR/INST APPR - 2YR	LFP/Ehouse	RT	32.00		0.00
3323	E003/1002	E-HOUSES APPRENTICE	Elec. AP-2YR OT/INST APPR - 2YR OT	LFP/Ehouse	OT	42.68		0.00
3323	E003OT/1003OT	E-HOUSES APPRENTICE	Elec. AP-3YR/INST APPR - 3YR Elec. AP-3YR OT/INST APPR - 3YR OT	LFP/Ehouse	RT	37.00		0.00
3323	E004/1004	E-HOUSES APPRENTICE		LFP/Ehouse	OT	49.46		0.00
3323	E004OT/1004OT	E-HOUSES APPRENTICE	Elec. AP-4YR/INST APPR - 4YR Elec. AP-4YR OT/INST APPR - 4YR OT	LFP/Ehouse	RT	42.00		0.00
3325	EJ01_3/IJ01_3	E-HOUSES -JOURNEYMEN	Elec. AP-4YR OT/INST APPR - 4YR OT Elec Journey/Instr Journeyman	LFP/Ehouse	OT	56.24		0.00
3325	EJ01_3OT/JJ01_3OT	E-HOUSES -JOURNEYMEN	Elec Journey/Instr Journeyman OT	LFP/Ehouse	RT	52.00		0.00
3325	EJ05/IJ05	E-HOUSES -JOURNEYMEN	5 yr Elec/Instr Journeyman	LFP/Ehouse	OT	69.80		0.00
3325	EJ05OT/IJ05OT	E-HOUSES -JOURNEYMEN	5 yr Elec/Instr Journeyman OT	LFP/Ehouse	RT	90.00		0.00
3325	ELH1/ILH1	E-HOUSES -JOURNEYMEN	Electrical/InstrLead Hand	LFP/Ehouse	OT	121.56		0.00
3325	ELH1OT/ILH1OT	E-HOUSES -JOURNEYMEN	Electrical/Instr Lead Hand OT	LFP/Ehouse LFP/Ehouse	RT	55.00		0.00
3325	EFM1/IFM1	E-HOUSES -JOURNEYMEN	Electrical Foreman 1		OT	73.55		0.00
3325	EFM1OT/IFM1OT	E-HOUSES -JOURNEYMEN	Elect Foreman 1 OT	LFP/Ehouse LFP/Ehouse	RT	64.00		0.00
3893	NEE1/NEI1	APPRENTICE CONSTR	NE ELEC /INSTR APRENTICE 1	LFP/Ehouse	OT	85.25		0.00
3893	NEE1OT/NEI1OT	APPRENTICE CONSTR	NE ELEC/INSTR APPRENT 1 OT	LFP/Ehouse	OT	29.50		0.00
3893	NEE2/NEI2	APPRENTICE CONSTR	NE ELEC / INSTR APRENTICE 2	LFP/Enouse	RT	38.77		0.00
3893	NEE2OT/NEI2OT	APPRENTICE CONSTR	NE ELEC/INSTR APPRENT 2 OT	LFP/Ehouse	OT	34.50		0.00
3893	NEE3/NEI3	APPRENTICE CONSTR	NE ELEC / INSTR APRENTICE 3	LFP/Ehouse	BT BT	45.62		0.00
3893	NEE3OT/NEI3OT	APPRENTICE CONSTR	NE ELEC / INSTR APPRENT 3 OT	LFP/Ehouse	OT	39.50		0.00
3893	NEE4/NEI4	APPRENTICE CONSTR	NE ELEC / INSTR APRENTICE 4	LFP/Ehouse	RT	52.48 44.50		0.00
3893	NEE4OT/NEI4OT	APPRENTICE CONSTR	NE ELEC / INSTRAPPRENT 4 OT	LFP/Ehouse	OT	59.33		0.00
3893	WBE1/WBI1	APPRENTICE CONSTR	WB ELEC / INSTR APRENTICE 1	LFP/Ehouse	RT	31.50		0.00
3893	WBE1OT/WBI1OT	APPRENTICE CONSTR	WB ELEC / INSTR APPRENT 1 OT	LFP/Ehouse	OT	41.56		0.00
3893	WBE2/WBI2	APPRENTICE CONSTR	WB ELEC / INSTR APRENTICE 2	LFP/Ehouse	RT	36.50		0.00
3893	WBE2OT/WBI2OT	APPRENTICE CONSTR	WB ELEC / INSTR APPRENT 2 OT	LFP/Ehouse	OT	48.57		0.00
3893	WBE3/WBI3	APPRENTICE CONSTR	WB ELEC / INSTR APRENTICE 3	LFP/Ehouse	RT	41.50		0.00 0.00
3893	WBE3OT/WBI3OT	APPRENTICE CONSTR	WB ELEC / INSTR APPRENT 3 OT	LFP/Ehouse	ОТ	55.58		0.00
3893	WBE4/WBI4	APPRENTICE CONSTR	WB ELEC / INSTR APRENTICE 4	LFP/Ehouse	RT	46.50		0.00
3893	WBE4OT/WBI4OT	APPRENTICE CONSTR	WB ELEC / INSTR APPRENT 4 OT	LFP/Ehouse	OT .	62.60		0.00
3895	NEEJ1_3/NEIJ1_3	JOURNEYMAN CONSTR	NE ELEC / INSTR JOURNEYMAN 1_3	LFP/Ehouse	RT	55.50		0.00
3895 3895		JOURNEYMAN CONSTR	NE ELEC / INSTR Journey 1_3 OT	LFP/Ehouse	OT	74.04		0.00
3895 3895	NEEJ5/NEIJ5	JOURNEYMAN CONSTR	NE ELEC / INSTR JOURNEYMAN 5	LFP/Ehouse	RT	80.00		0.00
3895 3895	NEJ5OT/NEIJ5OT	JOURNEYMAN CONSTR	NE ELEC / INST Journey 5 OT	LFP/Ehouse	ОТ	107.50		0.00
3895	NEELH1/NEILH1	JOURNEYMAN CONSTR	NE ELEC / INSTR LEAD HAND	LFP/Ehouse	RT	57.50		0.00
3895 3895	NELHOT	JOURNEYMAN CONSTR	NE ELEC / INSTR LEAD HAND OT	LFP/Ehouse	OT	76.79		0.00
3895	NEEFM1/NEIFM1 NEFMOT	JOURNEYMAN CONSTR	NE ELEC/INSTR FOREMAN 1	LFP/Ehouse	RT	60.00		0.00
3895		JOURNEYMAN CONSTR	NE ELEC/INSTR FOREMAN 1 OT	LFP/Ehouse	OT	80.04		0.00
3895	WBEJ1_3/WBIJ1_3	JOURNEYMAN CONSTR	WB ELEC / INSTR JOURNEYMAN 1_3	LFP/Ehouse	RT	58.50		0.00
3895 3895	WEJ1_3OT/WU1_3OT	JOURNEYMAN CONSTR	WB ELEC / INSTR Journey 1_3 OT	LFP/Ehouse	OT	78.62		0.00
3895	WBEJ5/WBIJ5 WEJ5OT/WIJ5OT	JOURNEYMAN CONSTR	WB ELEC / INSTR JOURNEYMAN 5	LFP/Ehouse	RT	80.00		0.00
3895	WBELH1/WBILH1	JOURNEYMAN CONSTR	WB ELEC / INST Journey 5 OT	LFP/Ehouse	OT	107.50		0.00
3895	WEL10T/WBILH1	JOURNEYMAN CONSTR	WB ELEC / INSTRILEAD HAND	LFP/Ehouse	RT	61.00		0.00
3895	WBEFM1/WBIFM1	JOURNEYMAN CONSTR	WB ELEC / INSTRILEAD HAND OT	LFP/Ehouse	QT	81.88		0.00
3895	WEF10T/WIFM10T	JOURNEYMAN CONSTR	WB ELEC/INSTR FOREMAN 1	LFP/Ehouse	RT	63.50		0.00
The second	TO TO IT WILMIOT	JOURNEYMAN CONSTR	WB ELEC/INSTR FOREMAN 1 OT	LFP/Ehouse	OT.	85.13		0.00
					inanamio			

Is the final customer outside of Canada? No	ABB BID PRE	PARATION C	HECKLIST		
Enter Currency quoted. CAD There all Hedging costs are accounted for. List hazarons for not grading in Comment section below. Export Validation Is the final customer outside of Canada? No TaC's Are "ABB Standard Terms and It access rays is no - allower following spation. Confirmed It device rays is no - allower following spation. Confirmed Is the Bid confirmed Terms and It access rays is no - allower following spation. Confirmed Is the Bid confirmed Terms and It access to the		-, 	<u> </u>		
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Is the final customer outside of Canada? No	Enter Currency quoted.	CAD			reasons for not quoting in CAD in
Are "ABB Standard Terms and it above relysive no - answer fedowing question Confirm ABB Legal Dept reviewed Is the Bid conditional on credit approval It above reply as no - univertification of provided approval on the standard provided as per the Current Full Cost Calculation model - Risk, Warranty, Project manager costs are based on: Historical Basis Engineering Labour costs been considered as per the Current Full Cost Calculation model - Risk, Warranty, Yes Confirmed No Project manager costs are based on: Historical Basis O.0% Historical Basis Fram Oudgetary Outle O.0% Fram Outle Fram Total Total Total Fram Total Fram Total Fram Total Total Fram Total Fram Total Fram Total Total Fram Total Total Fram Total Fram Total Fram Total Total Fram Total		No			
Material & sub-supplier costs are Discription Discrip	Are "ABB Standard Terms and If above reply is no - answer following question Confirm ABB Legal Dept reviewed Is the Bid conditional on credit approval If above reply is no - answer following question	Confirmed			
Material & sub-supplier costs are Down	Cost Assessment Completion/Realistic/Accurac	y/Reliability/ Consister	<u>nt</u>		
Engineering Labour costs are based Historical Basis	Material & sub-supplier costs are			Quote/Established Price List	
Project manager costs are based on: 0.0% Manager sign off Model 10(a)	Engineering Labour costs are based		sign off		
General Confirm Bid has been reviewed as per the Table of Authority? a bid require on site services of any type? OHS: Risks to our personnel (or Environment: No Is a Risk Review required? (See Note 1) No No	•	0.0%	Manager sign off 0.0%	Model 100.0%	100.0%
Confirm Bid has been reviewed as per the Table of Authority? E bid require on site services of any type? OHS: Risks to our personnel (or Environment: No Is a Risk Review required? (See Note 1)	Have all other costs been considered as per t	he Current Full Cost C	alculation model - Ris	k, Warranty,	Yes
OHS: Risks to our personnel (or No Environment: No Is a Risk Review required? (See Note 1)	Confirm Bid has been reviewed as per	Confirmed			
Environment: No Sea Risk Review required? (See Note 1)	e bid require on site services of any type?	No			
Is a Risk Review required? (See Note 1)	OHS: Risks to our personnel (or	No			
(See Note 1)	Environment:	No			
Prepared by: Dale Williams Last Modified Date: 19-Mar-2012		No			
	Prepared by: Dale Williams		Last Mo	dified Date:	19-Mar-2012
Comments:	Comments:				

- Notes
 1) Use the Risk Review process as per the following guidelines
- 1a) Use ABB Ber-Mac risk review process for Lump Sum proposals with a value greater than \$500KCAD
- 1b) Use the ABB Canada Process Automation Divison risk review process for proposals with a value greater than \$2MCAD and less than \$5MCA

1c) Use the ABB Group risk review process using the Risk Review database for all proposals with a value greater than \$5MCAD

Approvals

Name Signature Name Signature

Name Signature
Add names and signature as per ToA

M

Contract Review Checklist

YES NO N/A A Written and signed (or equivalent authorization) X Customer PO is supports the Order to be booked The PO received matches the tender submitted by ABB X and all differences are clarified in writing with the Documents handed over from the Bid Team include: Full Cost model and costing details X SOX Bid Checklist X Risk Review. (Ref No. ___ _ where X applicable) ABB internal authorizations and risk review requirements were obtained in accordance with the Non Standard T&C's are reviewed and approved by the Corporate Legal department X Prepared by: Dale Williams

Date: Feb.18/12

Project Manager: Dale Williams

Project Name : Seal CSS Pilot B Customer Name: Murphy Oil

Project No.:

M

ABB BER-MAC



Friday, February 17, 2012

Letter: Q2012-039-01_cb

Murphy Oil Company Ltd. c/o Vista Projects Limited Vista Projects Ltd. #330-4000 4 Street SE, Calgary, Alberta, T2G 2W3

Attention:

Brant Lu

Subject:

Quote # 1780-RFQ-024

Project Name:

MCC/Instrument Air Building BU-1100 Construction

Dear Brant:

ABB Ber-Mac is pleased to submit our proposal for MCC Construction, in the Lump Sum amount of <u>TWO HUNDRED</u>, <u>EIGHTY-NINE THOUSAND CANADIAN DOLLARS (CAD 289,000.00)</u> excluding taxes, with regards to the scope of work as indicated below, for <u>one</u> building.

DU

INCLUDED IN OUR PROPOSAL:

Table 1 Self Framing Building

Item	Qty	Description
1.	1	14'-10" wide x 48'-2" long x 12'-6" eave (4.53M x 14.683M x 3.81M), gable style with 4:12 slope
2.	Lot	22 gauge galvalume exterior walls and roof
3.	Lot	R12 batt insulation in walls, R20 batt in roof with 6 mil vapor barrier throughout
4.	Lot	20 ga white perforated aluminum interior liner (10% free area) above 3' with 24 gauge white fluted aluminum below 3'
5.	Lot	Caulked interior joints
6.	Lot	Climaseal fasteners
7.	1	Inactive ridge (non-ventilating)
8.	2	6' x 7' steel man doors (20 ga doors, 18 ga frames, R12 insulated) with locking panic hardware and hydraulic door closures on active leafs, barrel bolts on inactive leafs, 24" x 24" IWG windows on both leafs, check chains, weather stripping, and aluminum thresholds
9.	2	double door bolt-on transoms
10.	1	full height and width partition wall with 10% perforated white aluminum interior liner on one side and 3" Roxul insulation
11.	Lot	Misc. wall cutouts as required
12.	Lot	Ice rakes at lower eaves
13.	Lot	Continuous eaves trough with 2 – downspouts
14.	Lot	Designed to accommodate a wind load of 150 km/hr and snow load of 2.2 kPa
15.	Note	Engineer stamped building drawings (AB registered)
16.	Lot	Building to be installed on the following steel skid in Vendors Calgary yard

0/2

Table 2 Skid Base, Upper Steel and Platforms

Item	Qty	Description
1.	1	14'-10" wide x 48'-2" long skid base
2.	Lot	Material and fabrication
3.	Lot	Structural steel to conform to CSA-G40.21, Grade 300W/350W
4.	Lot	Welding to conform to CSA W59 and CSA W47.1
5.	Lot	Metal cored arc welding (MCAW)
6.	Lot	W18x50 perimeter and main beams w/ W16x36 intermediate members
7.	Lot	C4x5.4 cross members on 24" centers
8.	Lot	HSS 3"x3"x1/4" posts welded inside of the walls and attached to W6x15 cross members at top for 2 level cable tray supports (x3 frames)
9.	8	Eight (8) removable lifting lugs
10.	Lot	Non-destructive testing (NDT): - 100% MPI on lifting lugs - 10% MPI on fillet welds - All other NDT is extra, if required
11.	Lot	1/4" flat plate decking w/anti-slip paint
12.	Lot	Floor plate fully seal welded at all seams and stitch welded around the perimeter and u/s to floor members
13.	Lot	Painting, excluding u/s of floor plate as follows: Surface preparation as per SSPC-SP-6, commercial blast cleaning prime with 1 coat of Cloverdale 710 series primer (1.5 - 2.0 mils DFT) topcoat with 1 coat of Cloverdale 74 series industrial enamel (1.25 - 1.75 mils DFT) Underside of building floor plate is bare metal (unpainted) Finish color (TBC)
14.	Lot	3"- R20 spray foam polyurethane insulation c/w Towerthon II fire retardant coating u/s of the building floor
15.	****	Standard QC package
16.		Engineer stamped building drawings (AB registered)

Table 3 HVAC

Based on non-classified area 5 kW of heat gains ASSUMED (to be confirmed) Based on 3 ACPH continuous

Item	Qty	Description
1.	1	MCC/IA Building: (4530x14683x3800) Based on 5 kW of heat gain 1 – Bard Packaged Wall mount units W42A1-C15EPXXXJ c/w 3.5 ton cooling and 15 kW of heat 480/3/60 Supply/Return Grilles J control module Economizer TEC 40 Temperature controller Tec 40 to control Bard Unit and unit heater c/w fire shutdown contact, common trouble alarm from unit Note: Fan to run continuously, balanced to 3 ACPH 8 week delivery
2.	1	1 – 15 kW OAS Electric unit heater 480/3/60 c/w wall bracket and built in thermostat (installation by others)
3.	1	Compressor Room: $1 - \text{ET12-1 GP}$ exhaust fan $120/1/60~1140~\text{rpm}$ motor TEFC c/w shutter, back guard and hood $1 - 12'' \times $
4.	1	HVAC platform supported by the building on the north side of the building.
5.	Note	Price includes Eng/Drwgs/Startup/Balancing – on site in Vendors yard in Calgary
6.	Note	Not included in HVAC: Sliders if required Design and supply of stand/platform/access platform for HVAC units Humidity control BAS building automation system Gas or fire detection systems Fire extinguishers Alberta building code schedules Site Work

Table 4 Supply, Installation and Connection of the following:

Item	Qty	Description						
1.	Lot	Cables as per cable schedule.						
2.	1	CPNL-100 Contactor Panel						
3.	1	TNS-100 45 KVA 480-120/208 3 Phase Dry Type Transformer						
4.	1	DP-100 Distribution Panel						
5.	12	ndustrial 2 lamp 4' fluorescent light fixtures c/w Gards.						
6.	2	1-pole switch's for interior lights.						
7.	3	70W HPS wall mount outdoor light (Hubbell PVL-070S-521 or equivalent)						
8.	4	Wall Pack 313-175MAL-T 175w MH (In Compressor Room)						
9.	2	EXIT SIGN Install						
10.	1	Tork1 photo cell						
11.	2	Receptacle 15A/120V						
12.	1	Exterior GFCI Receptacle Install						
13.	2	Emergency Stop ESD stations. (Cooper GHG series)						
14.	2	Crusader weather shrouds for ESD stations.						
15.	2	MMS for exhaust fans						
16.	3	Smoke Detectors (2 - MCC room, 1 – Compressor Room)						
17.	1	Red Strobe						
18.	1	Blue Strobe						
19.	1	Amber Strobe						
20.	Lot	Grounding of Equipment						
21.	Lot	Cable Tray as per drawings						
22.	4	1/4" X 2" X 24" isolated ground bars						
23.	2	Thermostats for H-VAC Control						
24.	1	Power connections Unit Heater						
25.	1	Power connection of Exhaust fan c/w MMS Install						
26.	1	Power connection o Bard Packaged Wall mount units W42A1-C15EPXXXJ f						
27.	Lot	Visual inspection and cleaning of the Owner supplied equipment						
28.	Lot	Preparation of the Building Electrical for transportation						

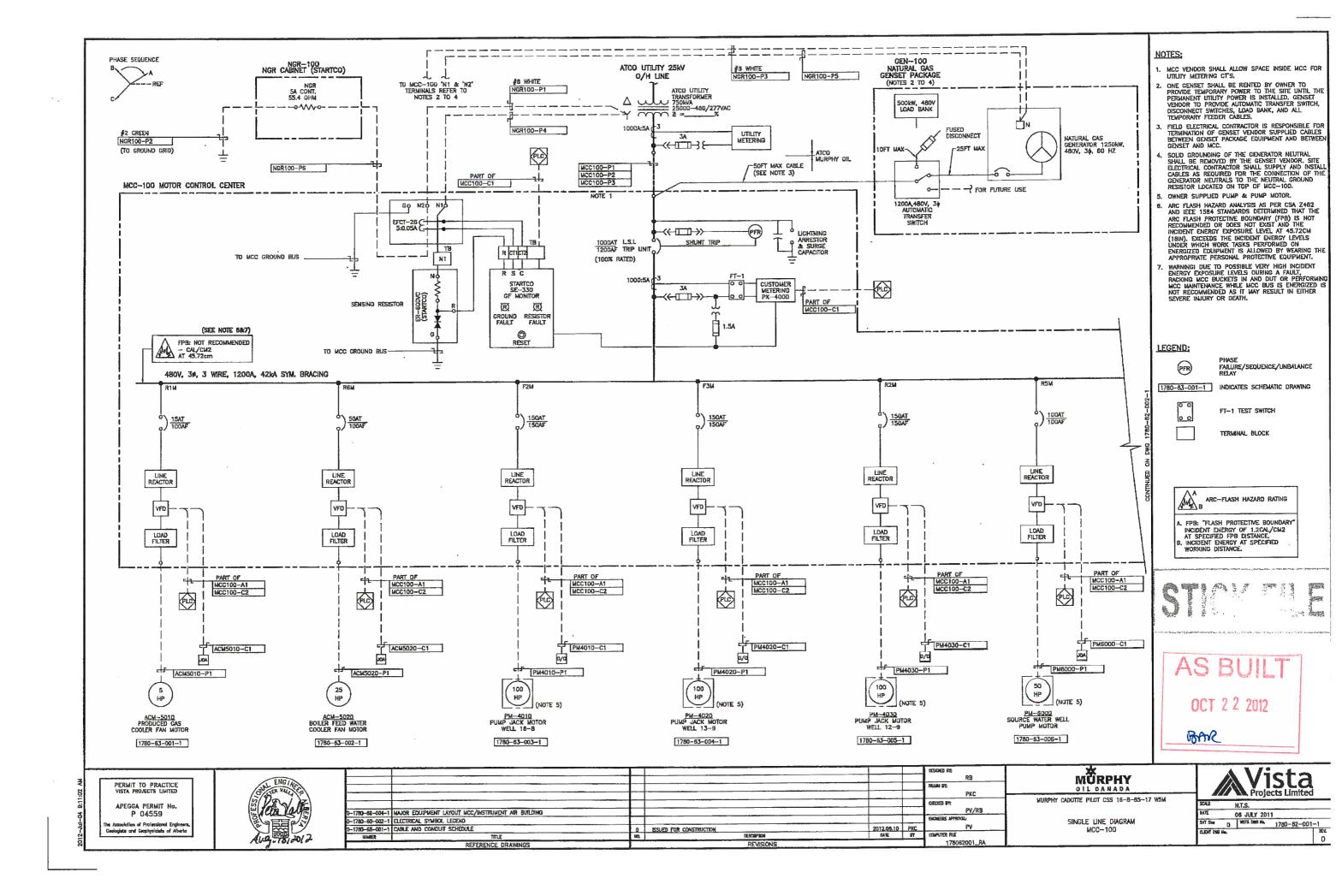
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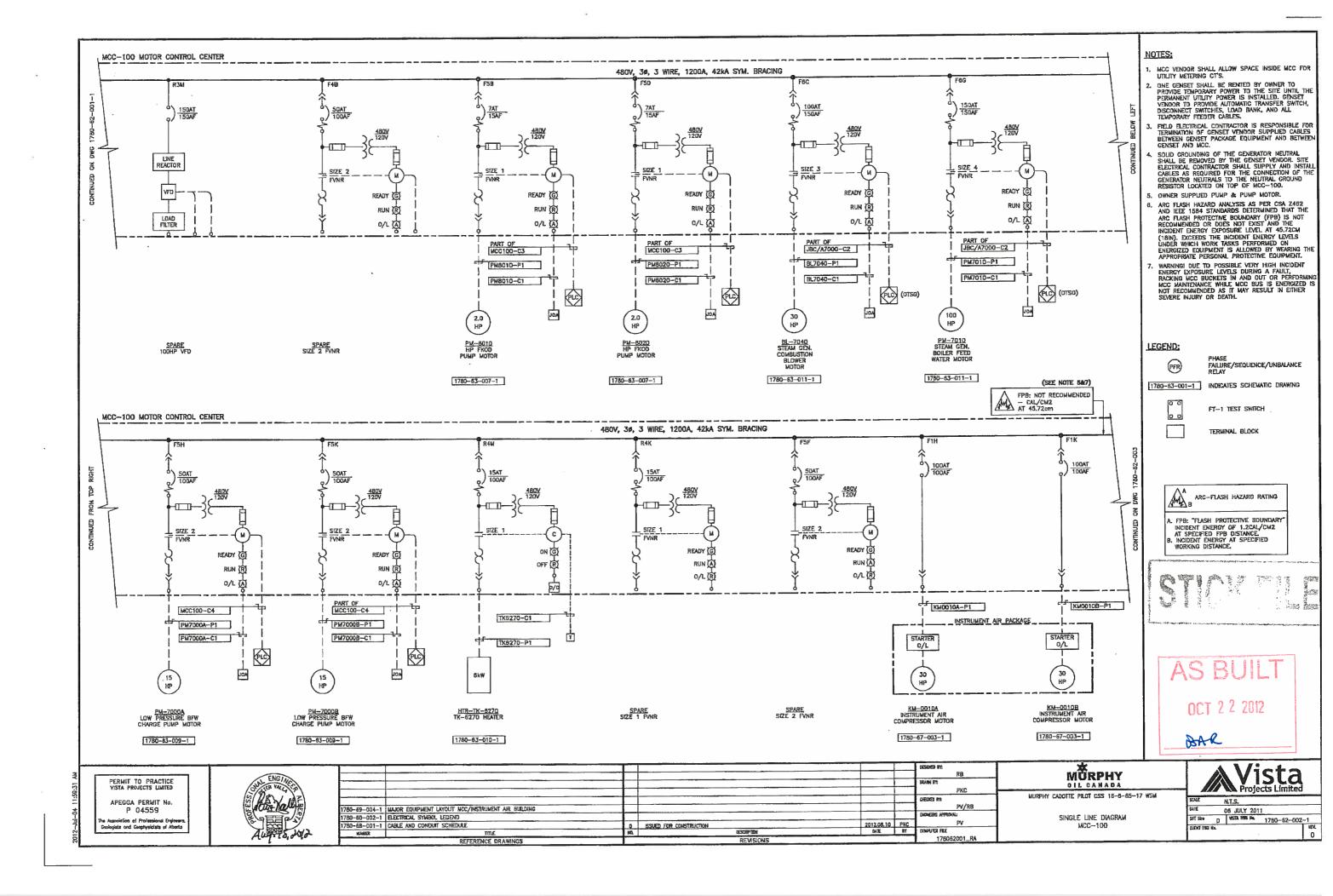
Table 5 Installation and Connection of Owner Supplied Equipment

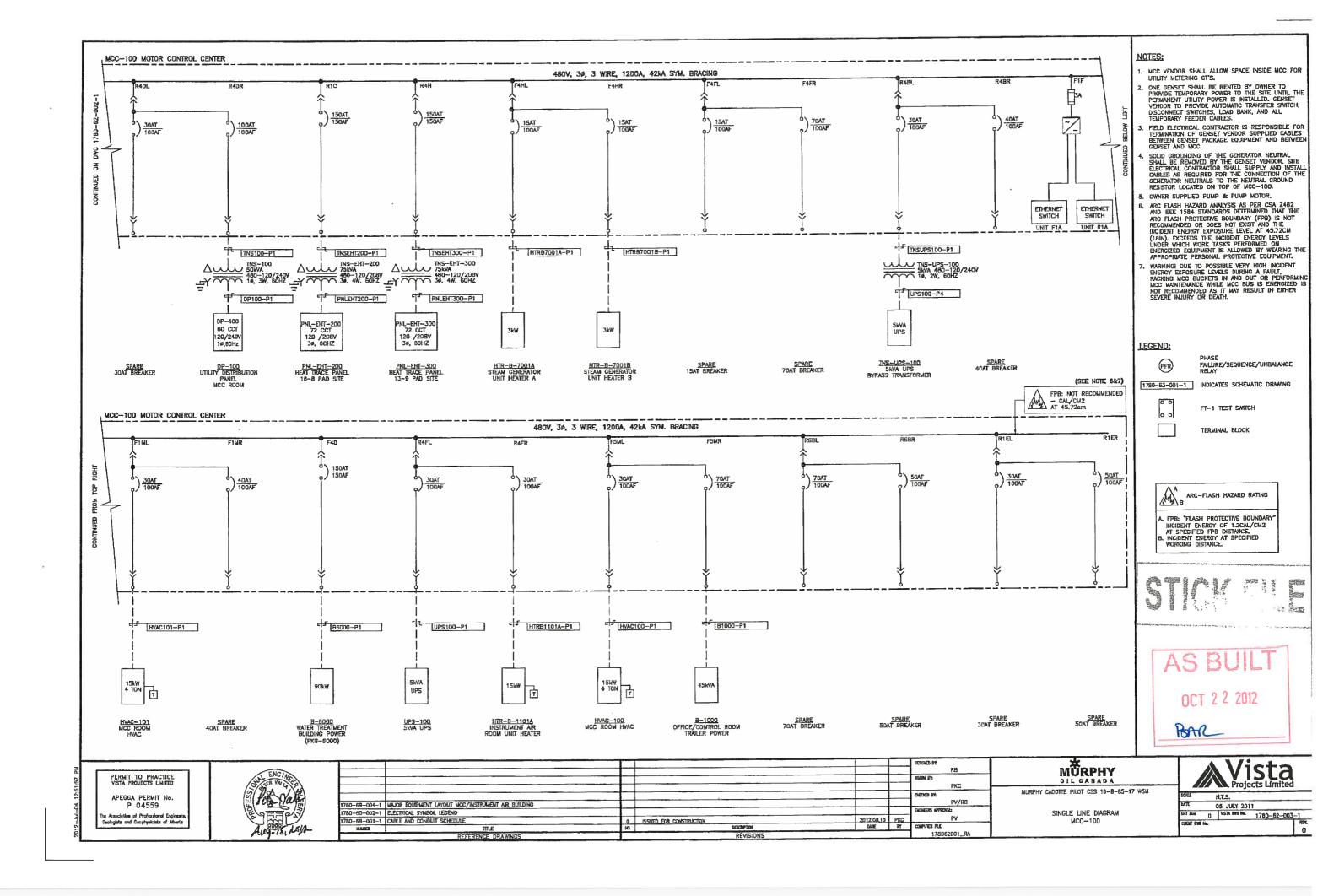
Item	Qty	Description
1.	1	Set Owner supplied PNL-PLC-100
2.	1	Set Owner supplied TNS-UPS-100
3.	1	Set Owner supplied DP-UPS-100
4.	1	Set Owner supplied BATT-100
5.	1	Set Owner supplied MCC-100
6.	1	Set Owner supplied PNL-101 (Well Monitoring Panel)
7.	1	Set Owner supplied PNL-102 (PROMORE Panel)
8.	1	Set Owner Supplied NGR-100

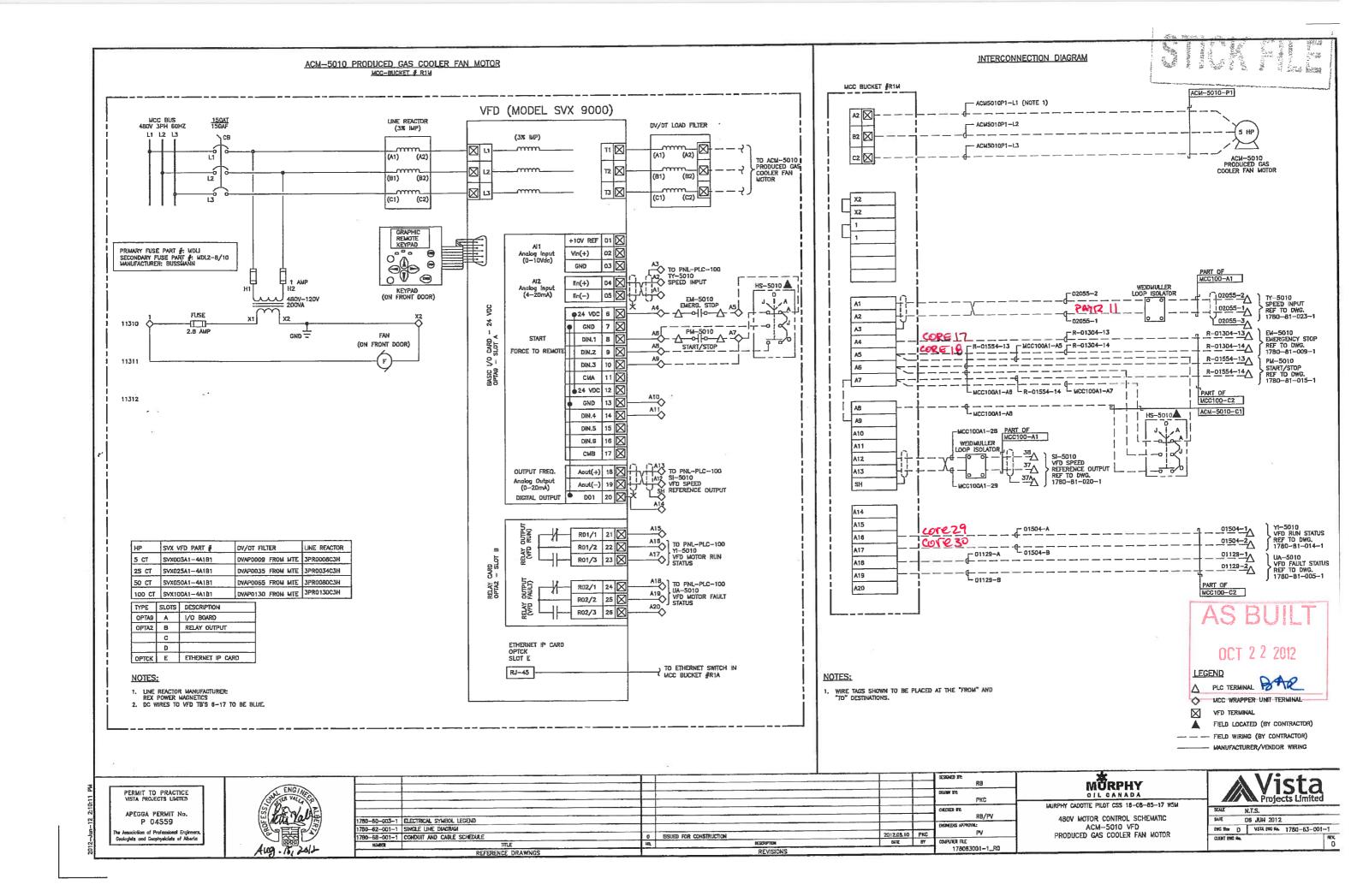
Table 6 Clarifications & Exceptions

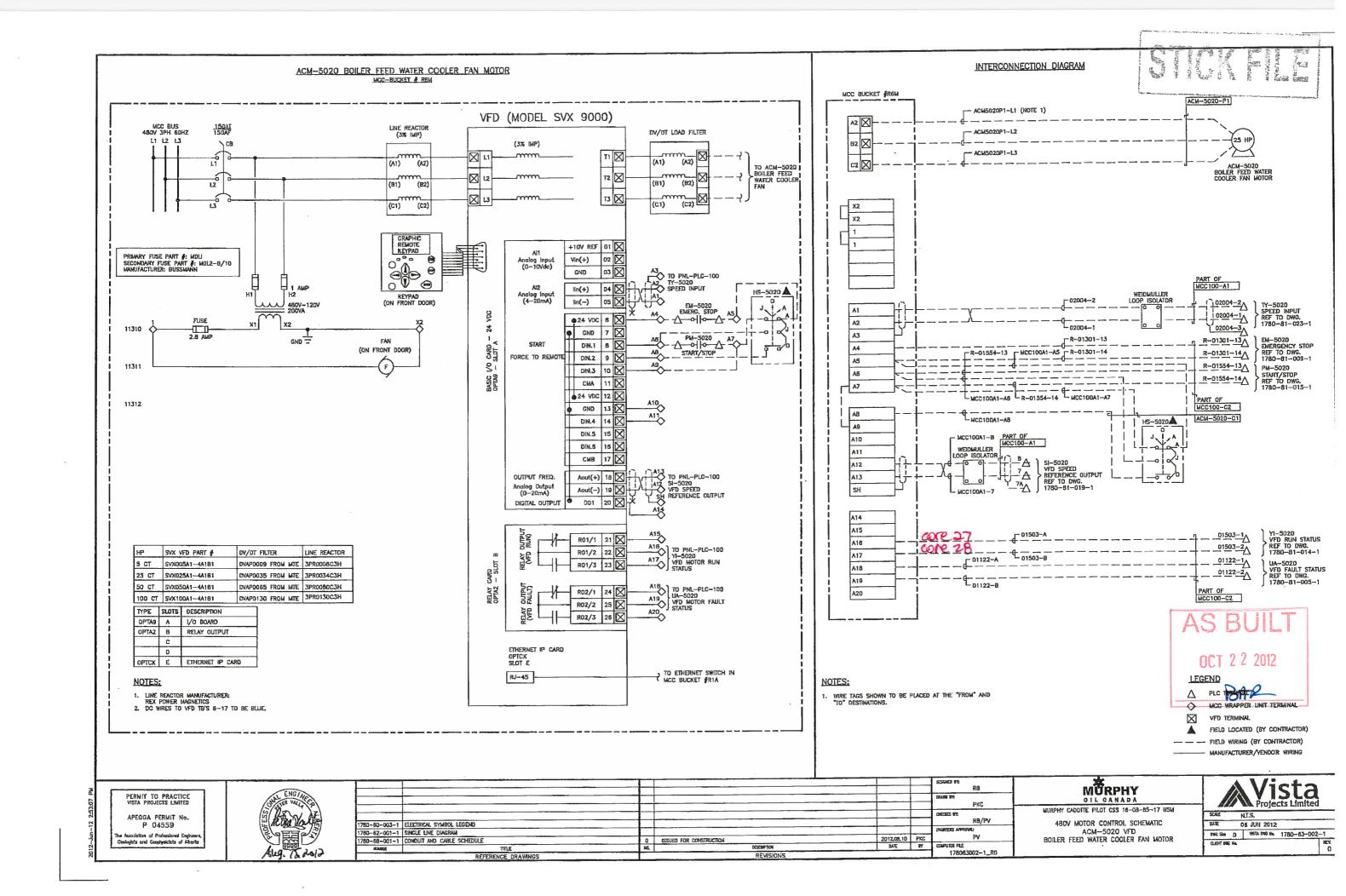
Item	Clarifications & Exceptions Description
1.	Quotation to be reviewed upon receipt of IFC drawings.
2.	We have quoted our standard gable and shed style self-framing buildings with typical materials, finishes and hardware
3.	Building wiring quoted as general purpose.
4.	E.M.T. conduit to be used inside the building. Rigid aluminum conduit will be used outside.
5.	We have not included on/off switches for IA Compressors as most of these units are furnished with control stations and starters as part of the package.
6.	Electrical permit has been included in quotation.
7.	One set of red line as-built drawings has been included in the quotation.
8.	QA/QC as per ABB Ber-Mac standards has been included in the quotation.
9.	Continuity testing and meggar testing has been included in the quotation.
10.	Loading of completed building package onto Owner supplied transport has been included in quotation.
11.	Work to be carried out in Calgary, Alberta.
12.	If the building Vendor's standard colors cannot be used, additional charges will apply for powder coating.
13.	Building Permits by others.
14.	The building and doors are not fire rated.
15.	Building accessories (unless otherwise noted) are not included.
16.	Building security swipe card system not included.
17.	Door platforms & stairs not included.
18.	Work schedule based on 10 hours per day 5 days per week. Weekends and Statutory holidays not included.
19.	We have included temporary heat and power for construction with quotation.
20.	We have included 480vac temporary power for testing.
21.	Fire suppression system has not been included in the quotation.
22.	Transportation of building to site has not been included in the quotation.
23.	Load calculations and all transportation insurances are by others.
24.	All Mechanical and Instrumentation on Instrument Air compressor unit.
25.	Site work has not been included in the quotation.
26.	Electrical Engineer stamped drawings have been included in the quotation.
27.	All commissioning assistance will be at force account rates.
28.	All information provided within this quote is confidential.
29.	Quotation validity 30 days
30.	Payment terms net 45 days.
31.	Please see attached ABB Inc exceptions to Terms and Conditions

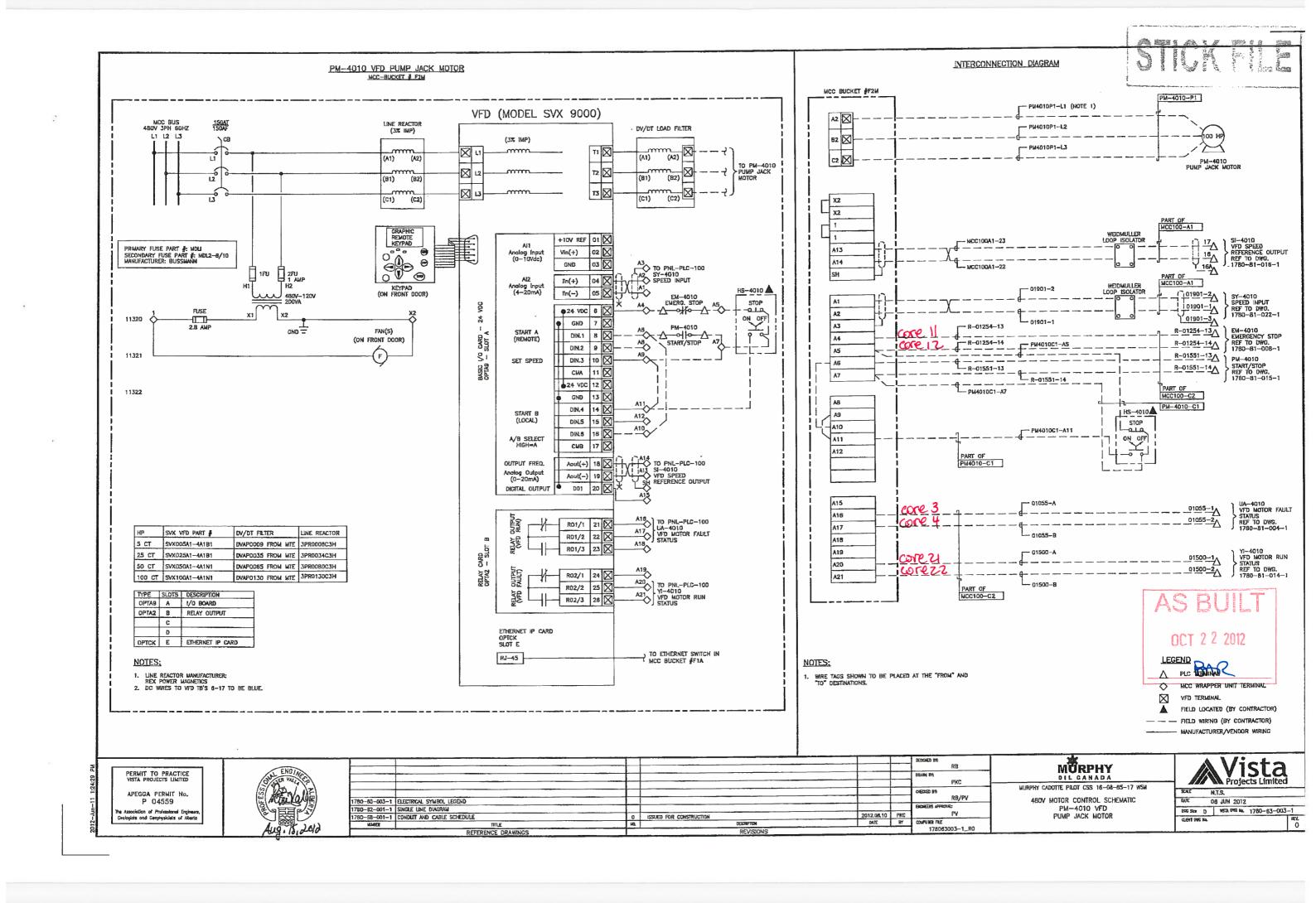


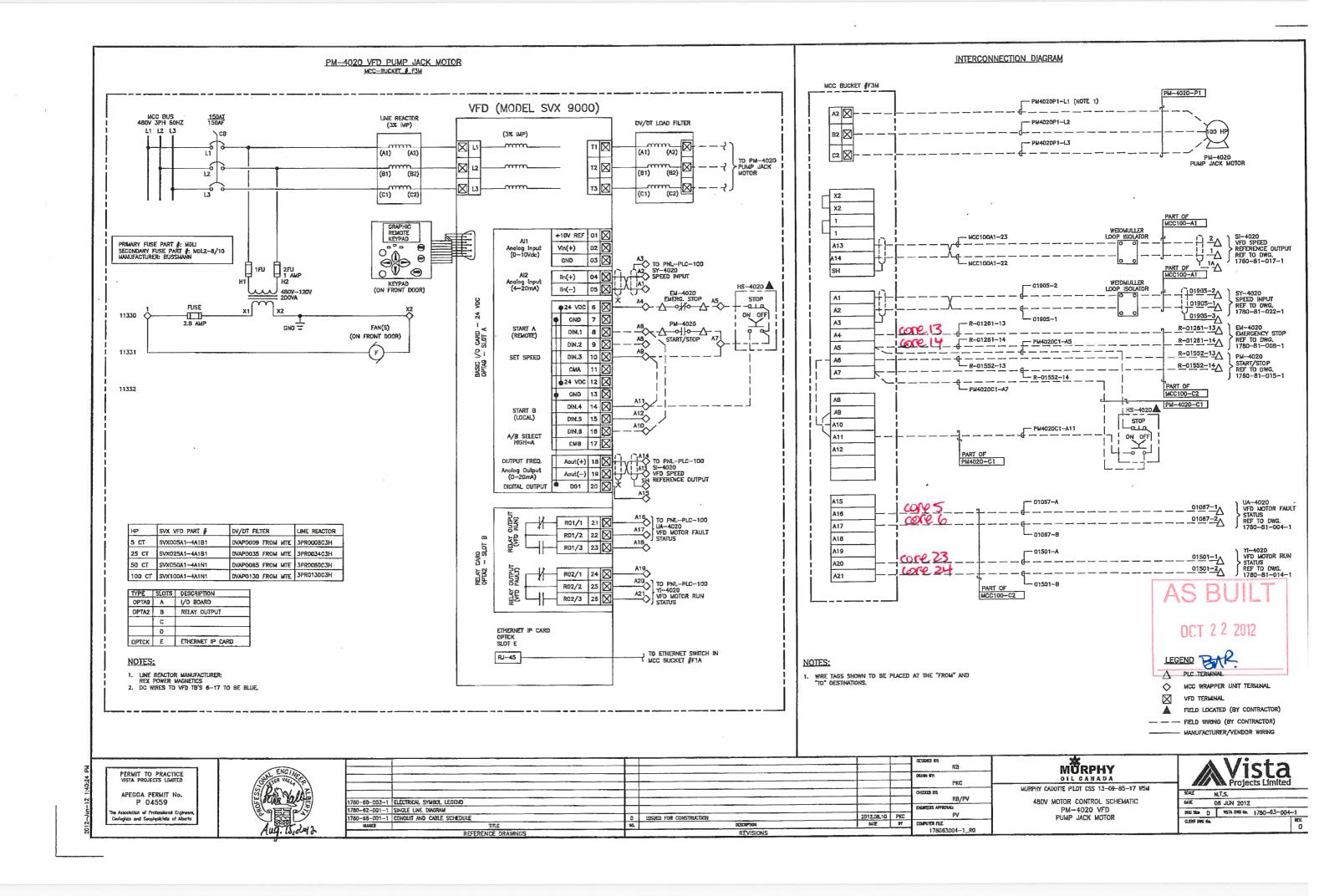


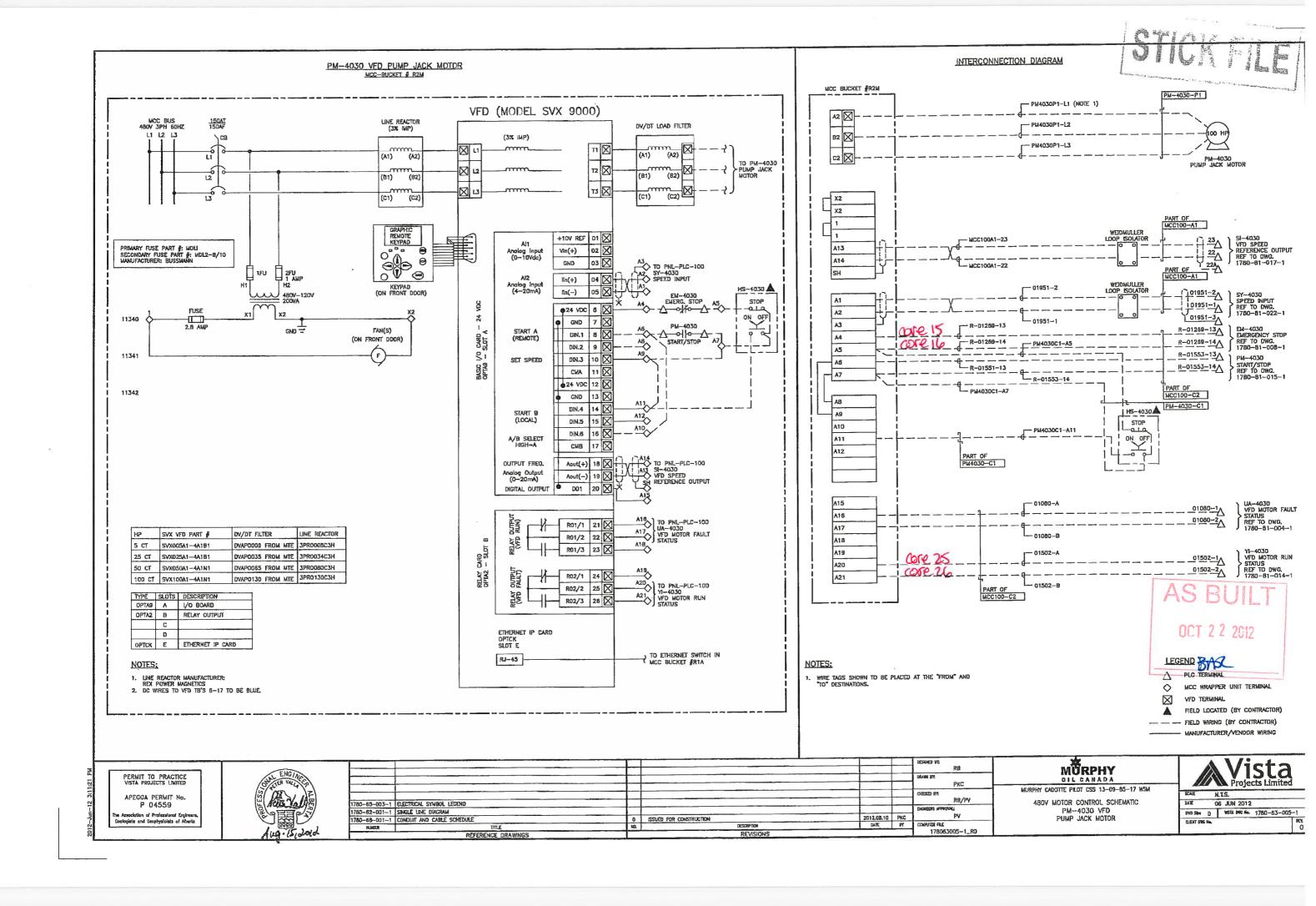


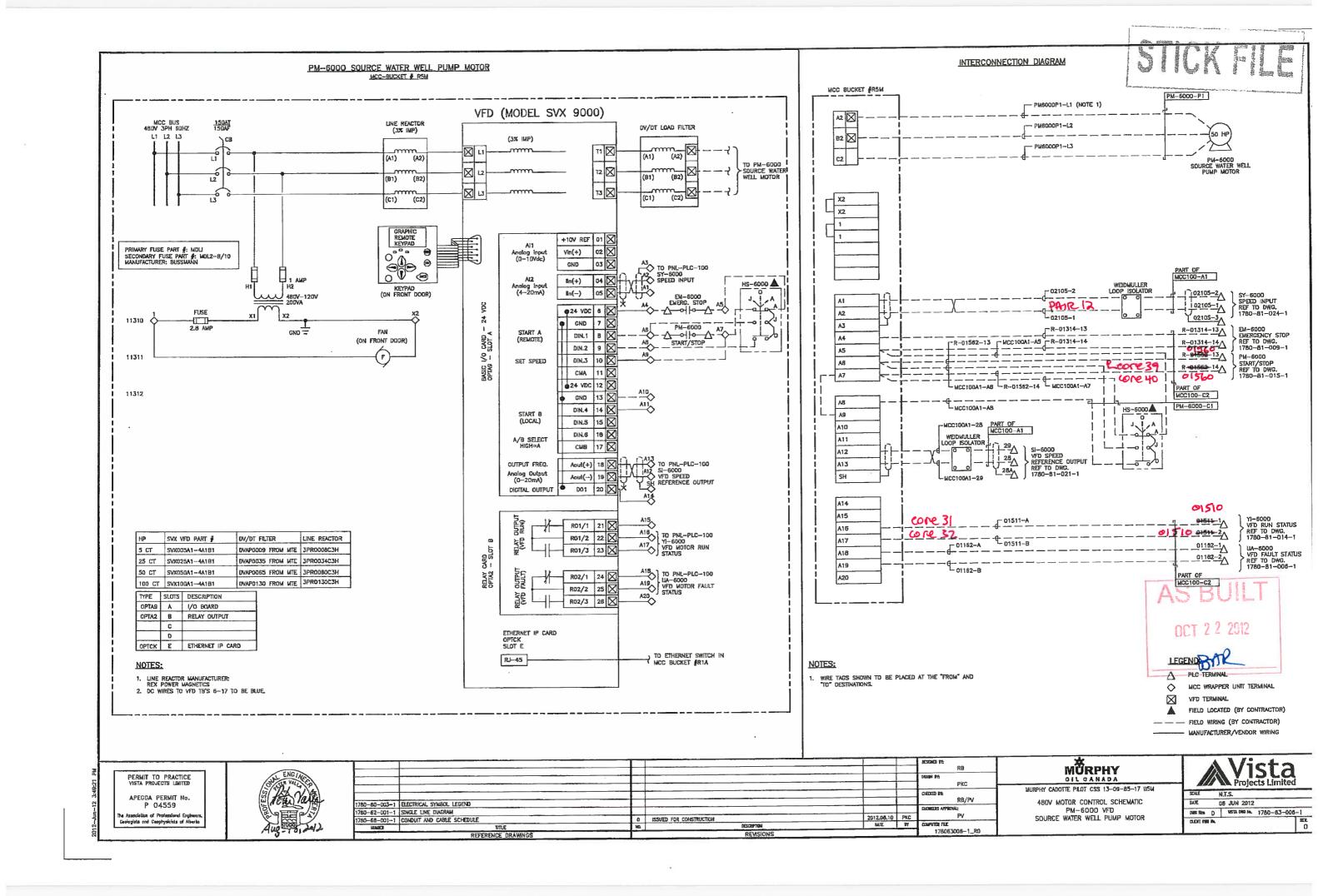


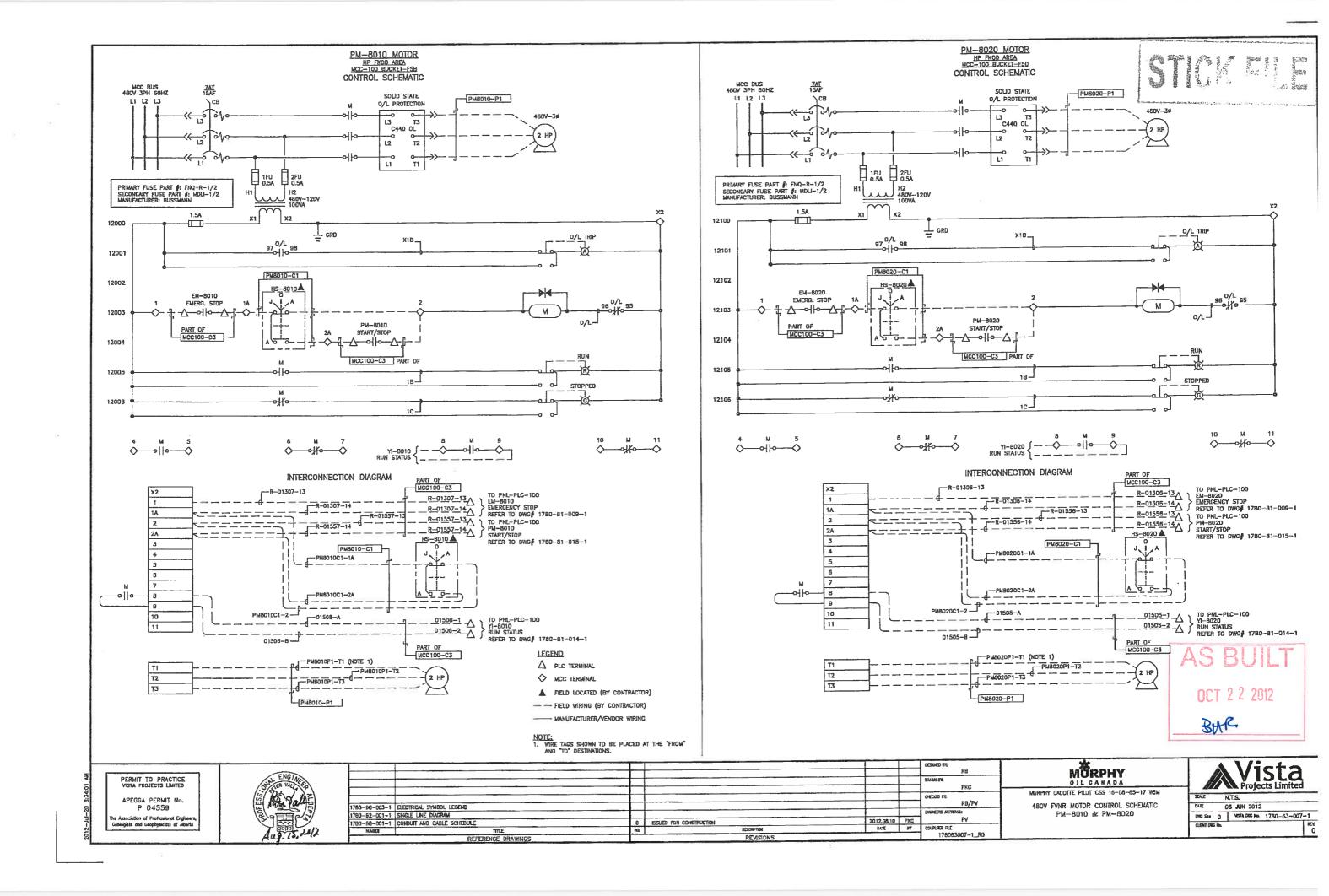


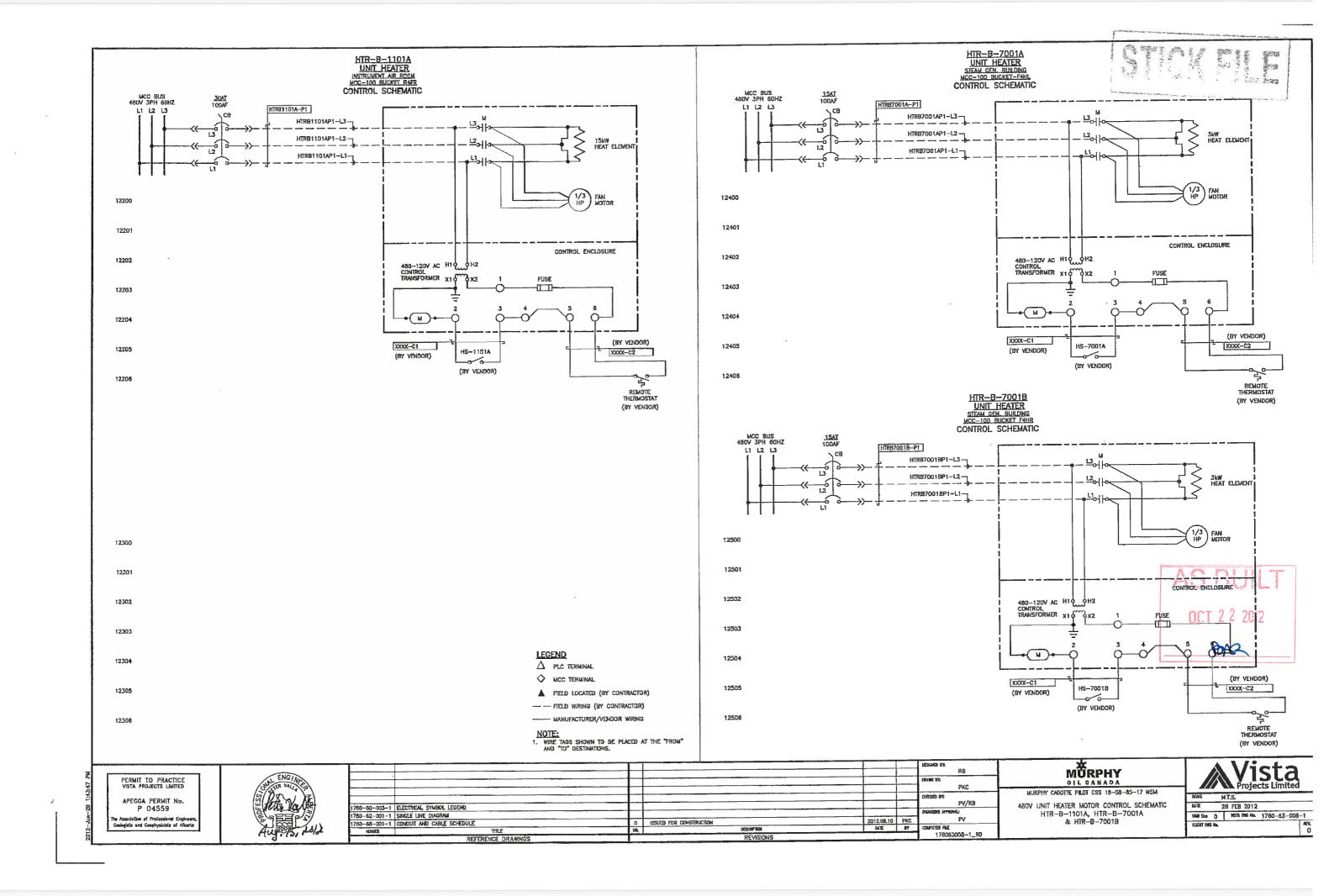


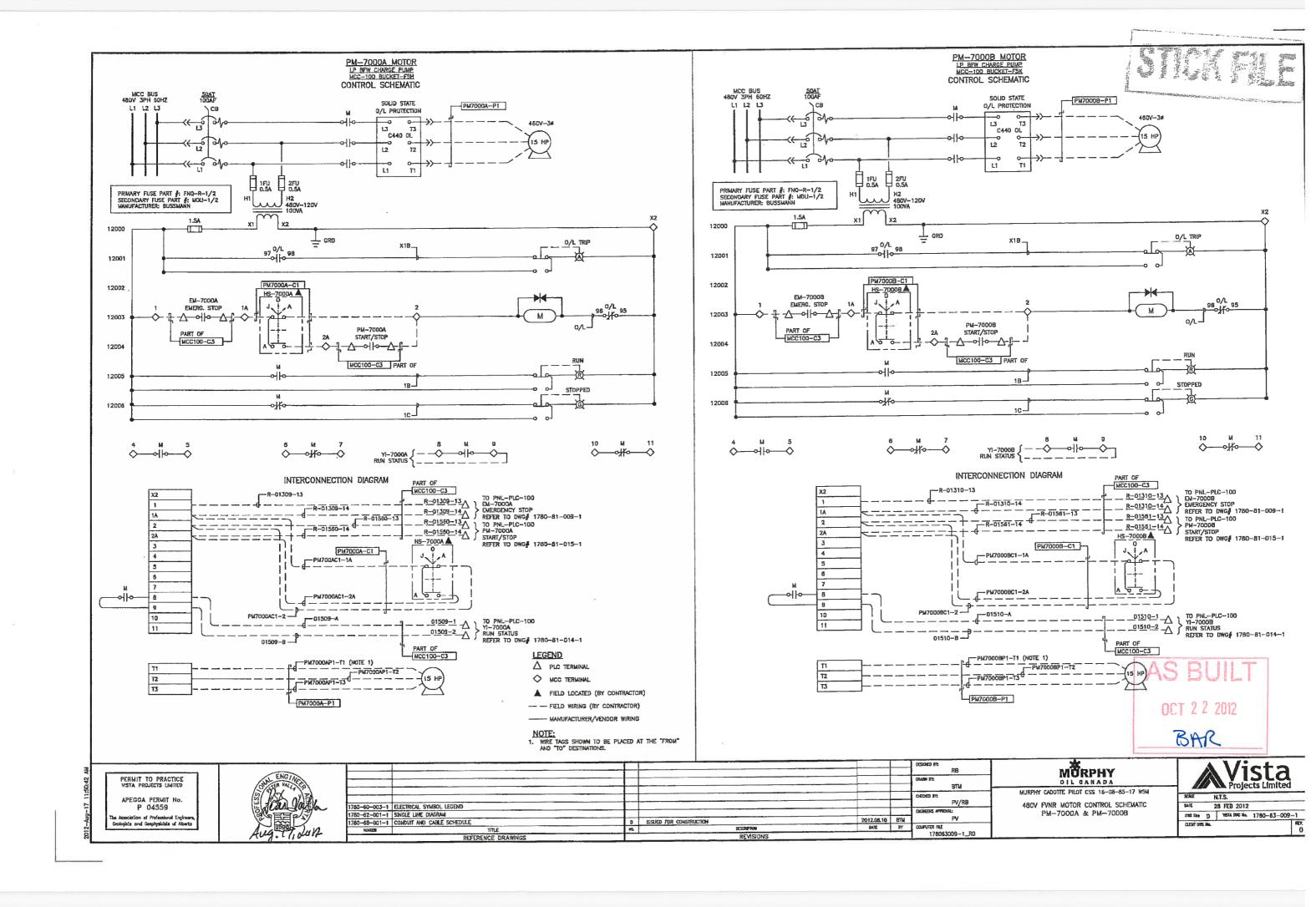


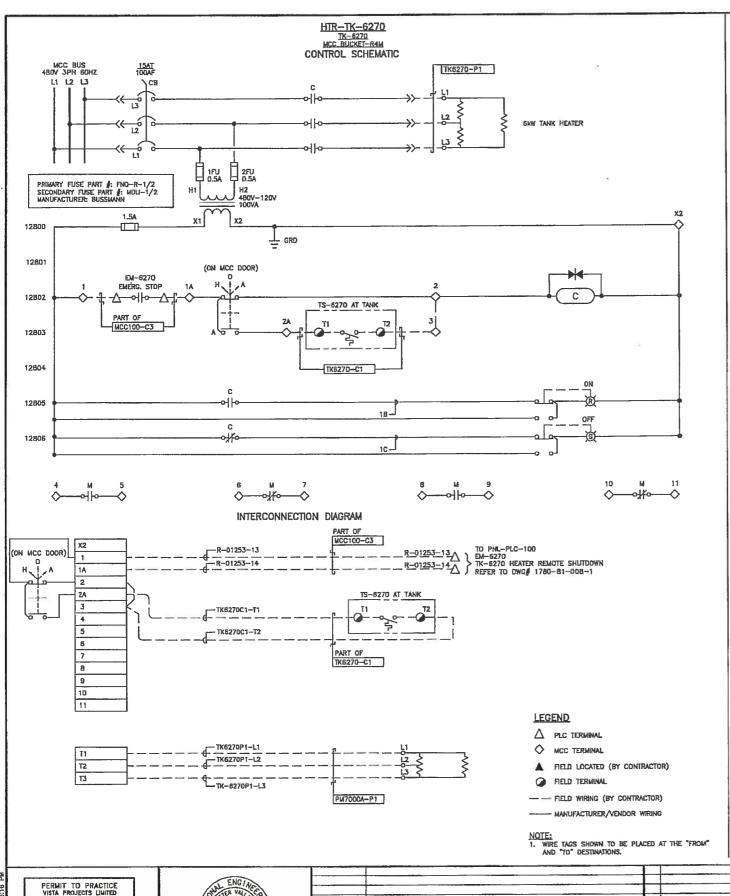












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Projects Limited

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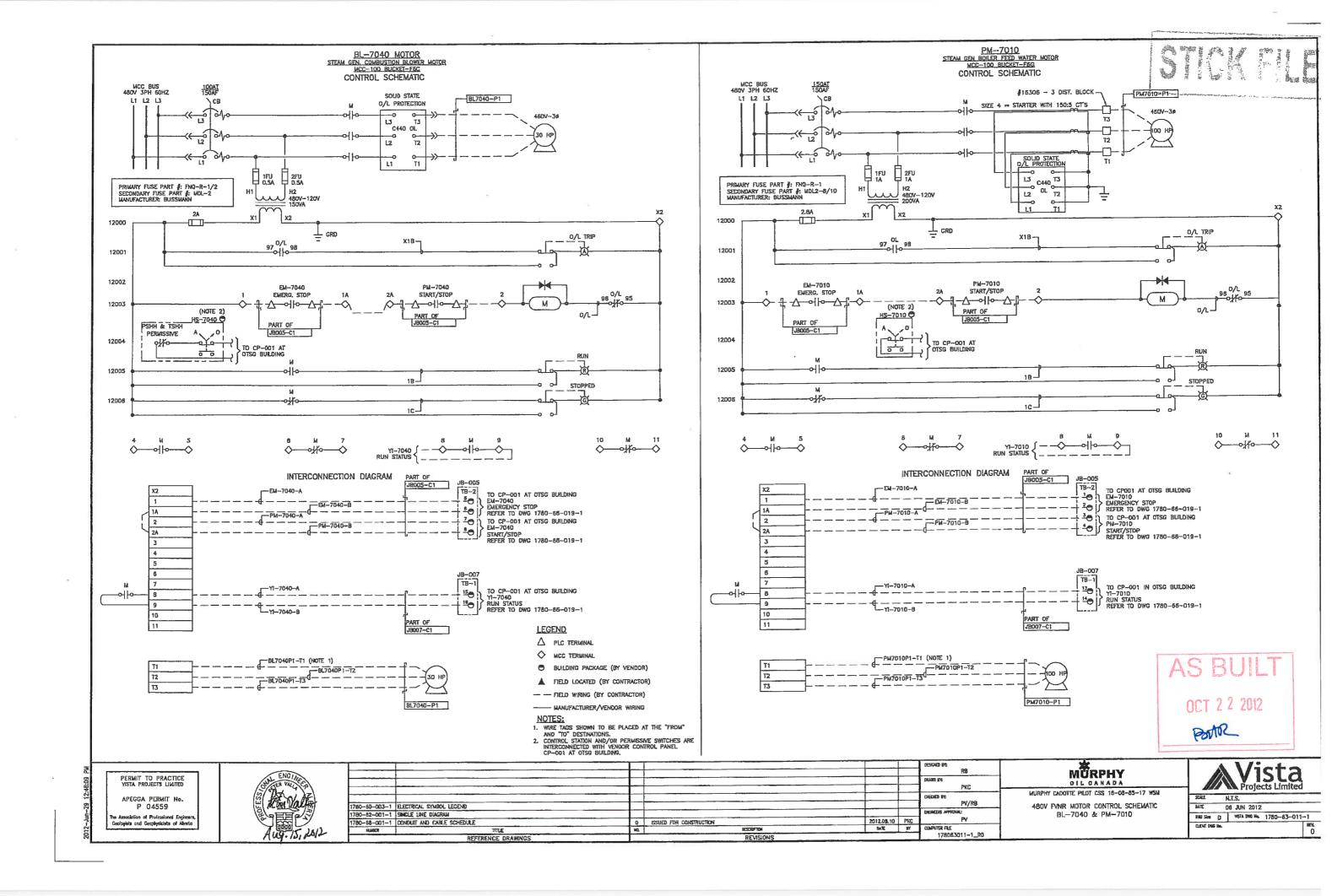
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D ISSUED FOR CONSTRUCTION

REVISIONS

1780-60-003-1 ELECTRICAL SYMBOL LEGEND 1780-62-001-1 SINGLE LINE DIAGRAM 1780-68-001-1 CONDUIT AND CABLE SCHEDULE MARKET



VOLTS 120/240 PANEL DP-100 225 AMP BUS												
HERTZ					-	XFMR _50					AMP MAIN CB SOLID NEUTRAL	
WIRE3 FEEDE	R	250 MCM			-	SIZ	Ε, .	480-1	20/240	v		SURFACE MOUNTING
LOAD DESCRIPTION	LO.	AD B	BKR	CCT.		BUS B		CCT. BKR No. SIZE		LO.	AD B	LOAD DESCRIPTION
PNL-CPNL-100 CONTROL	600		15	1	\neg		H	2	15	420		PROCESS BUILDING INTERIOR LIGHTS
MCC BUILDING INTERIOR LIGHTS		700	15	3	_		-	4	15		140	PROCESS BUILDING EXTERIOR LIGHTS
MCC BUILDING EXTERIOR LIGHTS	140		15	5	_		_	6	15	233	_	PROCESS BUILDING INTERIOR RECEPTACLE
MCC BUILDING RECEPTACLES		400	15	7	_			8	15		700	PROCESS BUILDING EXTERIOR FAN EF-B-4000
MCC BUILDING EXTERIOR RECEPTACLES	200		15	9			L	10	15	733		PROCESS BUILDING EXTERIOR FAN EF-B-4000
I/A ROOM INTERIOR LIGHTS		420	15	11	_	ļ	_	12	15		200	PROCESS BUILDING EXTERIOR RECEPTACLE
1/A ROOM RECEPTACLE	200		15	13	_		<u> </u>	14	15	900		P-6280 WATER DRAIN TANK PUMP
I/A ROOM EXTERIOR RECEPTACLE		200	15	15	_	_	-	16	15		280	OFFICE TRAILER EXTERIOR LIGHTS
I/A ROOM EXHAUST FAN EF-8-1100	1200		20	17	_	 	-	18	20	230		WATER TREATMENT BLDG. EXTERIOR LIGHTS
MCC BUILDING EMERGENCY AND EXIT LTG		200	15	19	_	<u> </u>	₩.	20	15		1000	YARD LIGHT YL-001
FUEL GAS BUILDING EXTERIOR LIGHTS	28D		15	21	-		\vdash	22	15	1000		YARD LIGHT YL-DD2
STEAM GEN, BUILDING EXTERIOR LIGHTS		280	15	23	_	<u> </u>	₩.	24	15		1000	YARD LIGHT YL-003
CHARGE PUMP SKID EXTERIOR FAN EF-8-7005	700		15	25		_	-	26	15	1000		YARD LIGHT YL-004
SPARE		-	15	27	_		-	28	15		750	YARD LIGHT YL-005
CHARGE PUMP SKID EXTERIOR LIGHTS	210		15	29	_	-	\vdash	30	15	500		YARD LIGHT YL-008
SPARE		-	15	31	-	<u> </u>	-	32	15		750	YARD LIGHT YL-007
PNL-HVAC-TOO WINTER STIPPLY	400		15	33	-		\vdash	34	15	143		STEAM GEN BUILDING INTERIOR LIGHTS
EF-B-7000A STEAM GEN EXTERIOR FAN A		1175	15	35		-	-	36	15		240	FUEL GAS BUILDING INT. & EMERG LIGHTS
SPARE	-		15	37	-		-	38	15	100		FUEL GAS BUILDING CATADYNE IGNITION
EF-8-7000B STEAM GEN EXTERIOR FAN B		1176	15	39	l —		-	40	100/		3600	CHORE DOMED CENT SET
EF-8-6000 WATER TREATMENT EX. FAN	1176		15	41			┡	42	2P	3500		SHORE POWER - GEN SET
		3600	30 /	43	-		-	44	15		100	CHARGE PUMP SKID EMERGENCY LIGHTS
EMERGENCY SHOWER POWER SUPPLY	3600		/2P	45	_		 	46	15	350		CHARGE PUMP SKID INTERIOR LIGHTS
SPARE		-	15	47	1 —		-	48	15		200	CHARGE PUMP SKID RECEPTACLE
SPARE	-		15	49] —		-	50	15	-		SPARE
OTSG DRAINAGE TANK PUMP		720	15	51	1 —	<u> </u>	┢	52	15		-	WELLHEAD LIGHTING JUNCTION BOX
FUEL GAS SKID EXTERIOR FAN A	700		15	53	-	_	\vdash	54	15	-		SPARE
FUEL GAS SKID EXTERIOR FAN B		700	15	55] —	<u> </u>	+	58	15		-	SPARE
SPARE	-		15	57			\vdash	58	15	700		FROD BUILDING EXTERIOR FAN
SPARE		-	15	59	1 –		₽	60	15		140	FKOD BUILDING EXTERIOR LIGHTS
REWARKS: PHASE A - 19298 W REWARKS: PHASE B - 18672 W	9406	9572			-					9890	9100	
PANEL TOTAL - 37968 W							_					

DELETED

AS BUILT OCT 2 2 2012

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PERMIT TO PRACTICE VISTA PROJECTS LIMITED APEGGA PERMIT No. P 04559 Association of Professional Engineers, Augista and Geophysicials of Alberta



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MURPHY
OIL OANADA
MURPHY CADOTTE PILOT CSS 16-08-085-17 W5M DISTRIBUTION PANELS
DP-100

		ista rojects Limited
SCALE	N.T.S.	

VOLTS 120V AC HERTZ 50			PAN				1.02-lm	225A AMP BUS 100A AMP MAIN CB
	TION <u>B-1100</u> ER <u>2C #8</u> AW					5 KJ	45-100	N/A SOLID NEUTRAL
LOAD DESCRIPTION	LOAD (W)	TRIP AMP	CCT.	BUS L1 N	CCT.	TRIP AMP	LOAD (W)	LOAD DESCRIPTION
CONTROL PANEL PNL-PLC-100	1800	20A	1	+	2	15A	200	PROMORE PANEL IN B-1100
B-1000 OFFICE RECEPTW	400	15A	3	 	4	15A	200	KM-0010 CONTROL PANEL IN B-1100
B-1000 OFFICE RECEPTE & B-1000 SMOKE ALARMS	400	15A	5		6	15A	400	SPARE UPS FEED TO OFFICE 8-1000
SPARE	_	15A	7		8	15A	180	POWER SUPPLY IN JBP1000
SPARE	_	15A	9	— —	10	15A	-	SPARE
CP-001 STEAM GENERATOR PLC PANEL	1200	15A	11	1	12	15A	500	FLARE STACK IGNITION FL-8010
SPARE	_	15A	13	1	14	15A	500	FLARE STACK IGNITION FL-8020
SPARE	-	15A	15	1	16	15A	-	SPARE
BMS JUNCTION BOX 16-08 POWER	250	15A	17	│ - 	18	15A	300	BMS JUNCTION BOX 13-09 POWER
SPARE	-	15A	19]	20	20A	-	SPARE
	4050						2280	
REMARKS: PANEL TOTAL - 6330W		•						

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OCT 2 2 2012

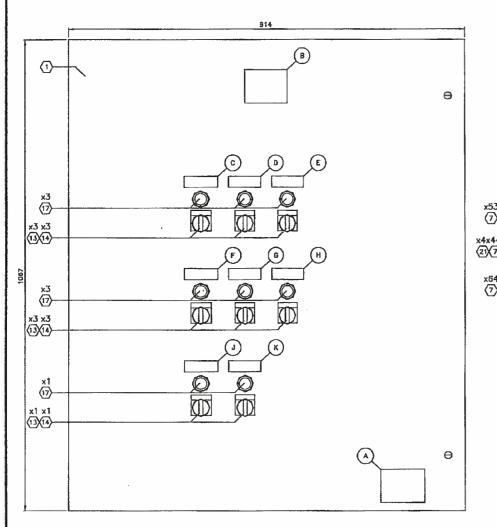
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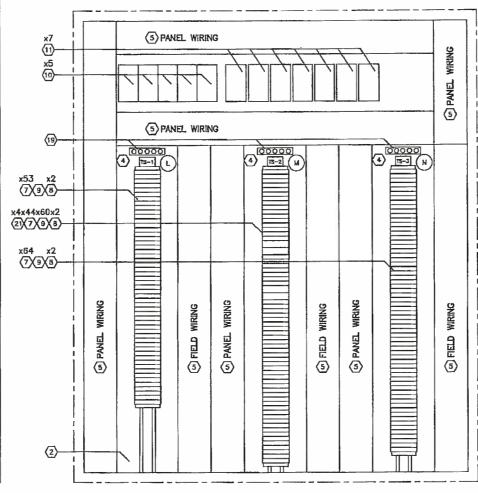
PERMIT TO PRACTICE VISTA PROJECTS LIMITED APEGGA PERMIT No. P 04559

REFERENCE DRAWINGS				REVISIONS	 		1/8064	1002-1_23	Ŧ
HUMBER	TITLE	M).	B.	DÉSCRIPTION	 BATE	BY	COMPLIENT FILE	4 30	ı
1780-68-001-1	CABLE AND CONDUIT SCHEDULE	0	1	ISSUED FOR CONSTRUCTION	 2012.08.10			PV	4
1780-62-001-1	SINGLE LINE DIAGRAM		_				EXPRESS APPROP	YAL: DAJ	1
	SINGLE LINE DIAGRAM		_		 	 	 	PV/RB	ł
1780-62-003-1	SINGLE LINE DIAGRAM		\perp		 	<u> </u>	CHECKED BITS	m.r /mm	ı
1780-89-004-1	MCC/INSTRUMENT AIR BLILDING LAYOUT		\perp		 			PKC	╀
					 		IMATER STO	DVD.	Ì
			7		 		ļ	RB	1
			Т				SCHOOLS ELF		ŀ

WURPHY
OIL CANADA
MURPHY CADOTTE PILOT CSS 16-08-085-17 W5M DISTRIBUTION PANELS
DP-UPS-100

	Vista Projects Limited									
-	SCALE	N.T.S.								
- 1	DATE	11 FEB 2012								
ı	DWB State D	WSTA DRIS No. 1780-64-002	-1							
	CLOST DISC No.		REV C							





	MATERIAL LIST								
ITEM	QTY	DESCRIPTION	MANUFACTURER	CATALOG No.	SIZE	SUPPLIER			
1	1	CONTACTOR PANEL	HOFFMAN	CSD423610	1067Hx914Wx254D				
2	1	BACK PAN	HOFFMAN	CP4236	1021Hx859W	VENDOR			
3									
4	3	SCHT 5S RAIL MARKER	WEIDMULLER	1631930	6x38	VENDOR			
5	AS REQ'D	WIREWAY	OPEN	GREY	75x100	VENDOR			
6									
7	177	TERMINAL	WEIDMULLER	1020300000	WDU 10	VENDOR			
В	6	TERMINAL END BRACKET	WEIDMULLER	1061200000	WEW 35/2	VENDOR			
9	AS REQ'D	TERMINAL MOUNTING RAIL	WEIDMULLER	0498000000	TS 35x15	VENDOR			
10	5	CONTACTOR	ALLEN-BRADLEY	100L-C20ND4		VENDOR			
11	7	CONTACTOR	ALLEN-BRADLEY	100-C09D400		VENDOR			
12									
13	7	H.O.A. SELECTOR SWITCH	ALLEN-BRADLEY	B00T-J2A	-	VENDOR			
14	7	HAND-OFF-AUTO STANDARD LEGEND	ALLEN-BRADLEY	800T-X511		VENDOR			
15									
16									
17	7	PILOT LIGHT	ALLEN-BRADLEY	800T-Q10G	GREEN	VENDOR			
18									
19	3	GROUND BAR	OPEN	-		VENDOR			
20									
21	4	TERMINAL	WEIDMULLER	1028800000	WDU35	VENDOR			
22									
23									
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NOTES

- 1. ALL DIMENSIONS ARE IN MILLIMETERS UNLESS SHOWN OTHERWISE.
- TERMINAL STRIPS TO BE RAISED UP OFF THE BACK PAN BY STEEL SECTION TO ALLOW FOR EASE OF ACCESS TO TERMINALS.
- 3. DOOR TO BE PROVIDED WITH ALL AROUND NEOPRENE GASKET.
- 4. CONTACTOR PANEL TO BE PROVIDED WITH A POCKET TO STORE ASSOCIATED DARAWINGS AND/OR HANDBOOKS INSIDE THE PANEL.
- 5. ALL WIRING FROM CONTACTOR TERMINALS TO BE MIN. #12 AWG COPPER.

 -HOT WIRING SHALL BE BLACK.

 -SWITCHED WIRING SHALL BE BROWN.

 -NEUTRAL WIRING SHALL BE WHITE.

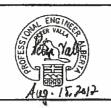
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OCT	2	2	2	01	2	

NAMEPLATE SCHEDULE (X)							
ПЕМ	QTY	COLOUR	ENGRAVING DESCRIPTION	SIZE			
Α	1	WHITE ON RED	CAUTION / VOLTAGES FROM MORE / THAN ONE SOURCE	-75x100			
В	1	BLACK ON WHITE	CPNL-100 CONTACTOR PANEL	75×100			
С	1	BLACK ON WHITE	EXTERIOR AND YARD LIGHTING	25x75			
D	1	BLACK ON WHITE	EF-B-1100 I/A EXHAUST FAN	25x75			
E	1	BLACK ON WHITE	EF-B-4000A/B EXHAUST FAN	25x75			
F	1	BLACK ON WHITE	EF-B-7005A/B EXHAUST FAN	25×75			
G	1	BLACK ON WHITE	EF-B-7000A/B EXHAUST FAN	25×75			
Н	1	BLACK ON WHITE	EF-B-6000 EXHAUST FAN	25×75			
J	1	BLACK ON WHITE	EF-B-5030 EXHAUST FAN	25×75			
К	1	BLACK ON WHITE	EF-B-8000 EXHAUST FAN	25×75			
L.	1	BLACK ON WHITE	TS-1	6x38			
М	1	BLACK ON WHITE	TS-2	6x3B			
N	1	BLACK ON WHITE	TS-3	6x38			

PERMIT TO PRACTICE VISTA PROJECTS LIMITED

APEGGA PERMIT No. P 04559

The Association of Professional Engineers, Cacologists and Geophysichists of Alberta



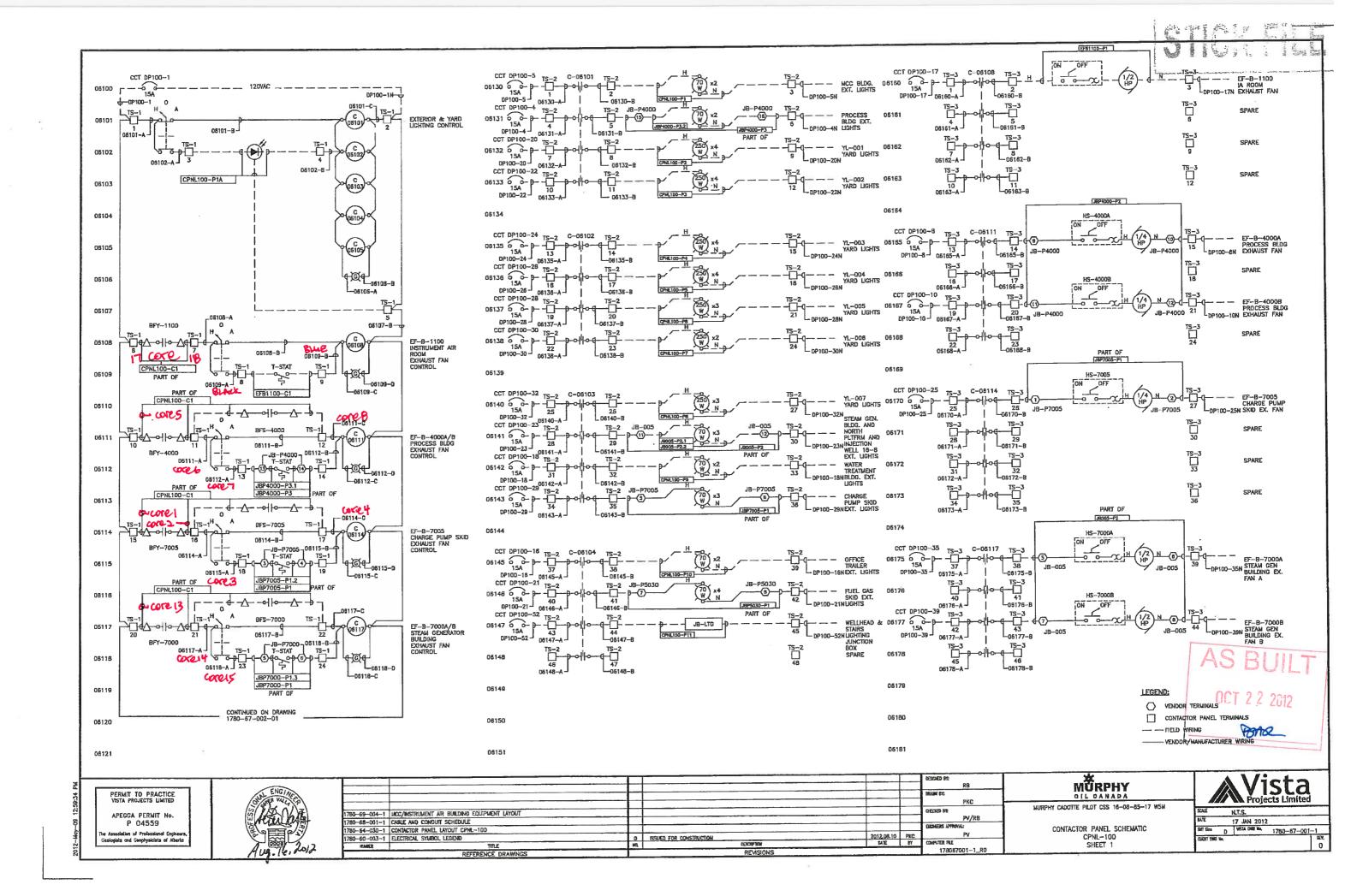
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							RB
			\Box				DEASE STO
\Box			\Box				PKC
							CHECKED BY
1780-6	9-001-1	MAJOR EQUIPMENT LAYOUT MCC/INSTRUMENT AIR BUILDING					PV/RB
1780-6	57-001 -1	CONTACTOR PANEL SCHEMATIC					DIGMETIS APPROVAL:
1780-6	58-001-1	CABLE AND CONDUIT SCHEDULE	0	ISSUED FOR CONSTRUCTION	2012.08.10	PKC	PV
	ALMER	WLE	Id.	COMPAN	DATE	84,	COMPUTER FILE
	REFERENCE DRAWINGS			REVISIONS	178064030-1_R0		

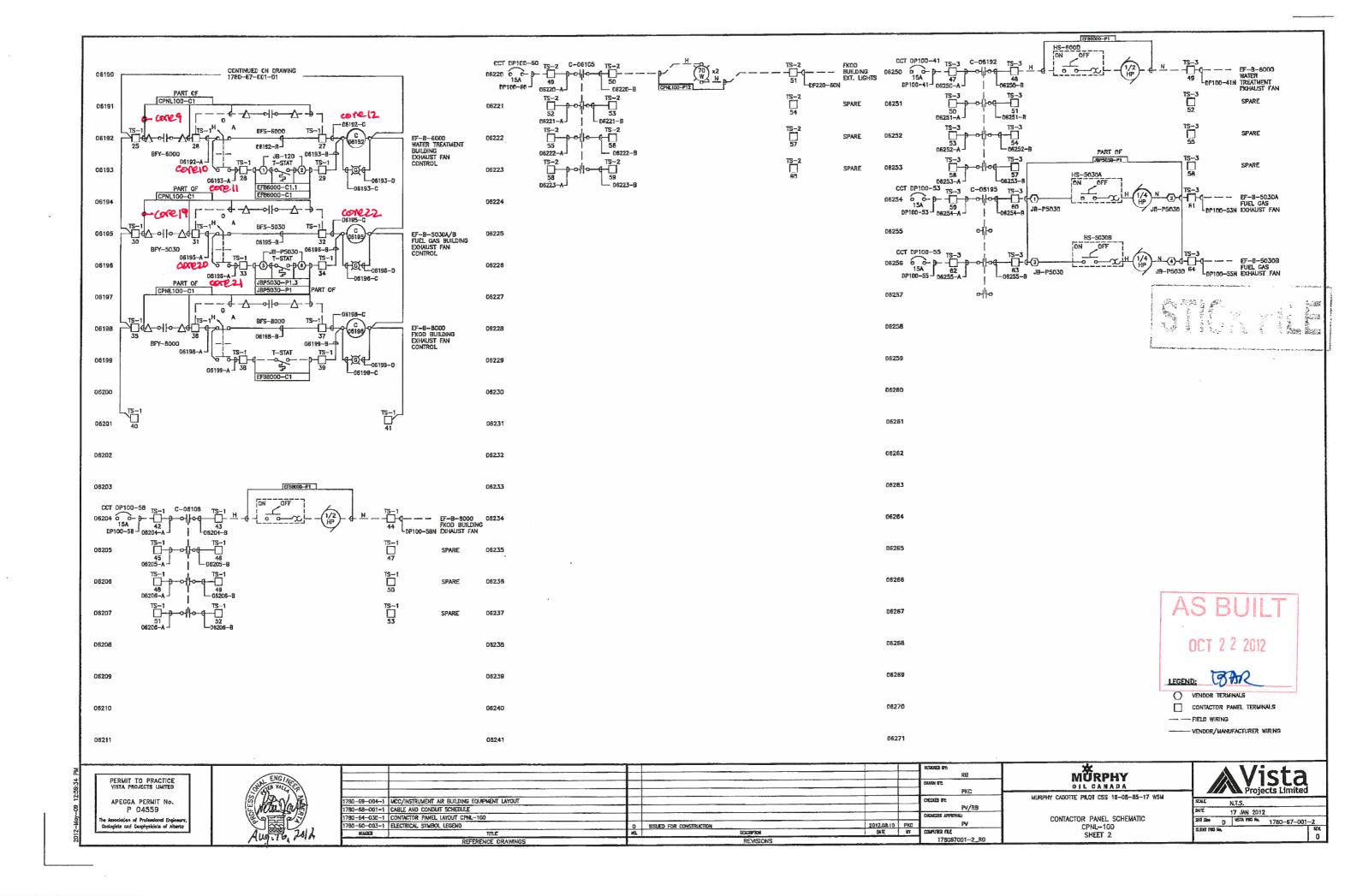
MÖRPHY

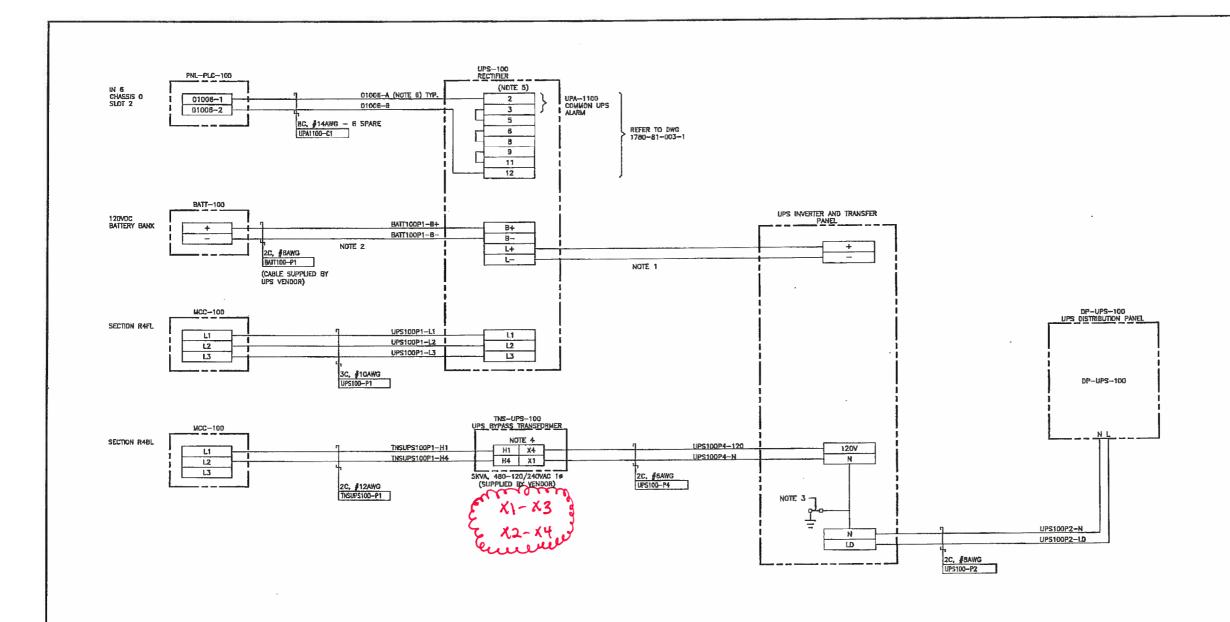
MURPHY CADOTTE PROT CSS 13-9-85-17 WSM

CONTACTOR PANEL LAYOUT CPNL-100

	Vista Projects Limited	
SCALE	1;4	









OCT 2 2 2012

BAK

LEGEND:

- - FIELD WIRING MANUFACTURER/VENDOR WIRING

NOTES:

1. INTERWIRING FACTORY INSTALLED.
2. BATTERY CABLES SUPPLIED BY VENDOR, INSTALLED BY OWNER.
3. REMOVE JUMPER.
4. INTERCONNECT H2 TO H3 AND X2 TO HE.
5. SERIES WIRE ALL ALARM COMMON CONTACTS TO PROVIDE ONE CONTACT CONNECTION POINT.
6. WIRE TAGS SHOWN ARE TO BE PLACED AT THE "FROM " AND "TO" DESTINATIONS.

PERMIT TO PRACTICE VISTA PROJECTS LIMITED APEGGA PERMIT No. P 04559 Association of Professional Engineers sologists and Geophysicists of Alberta



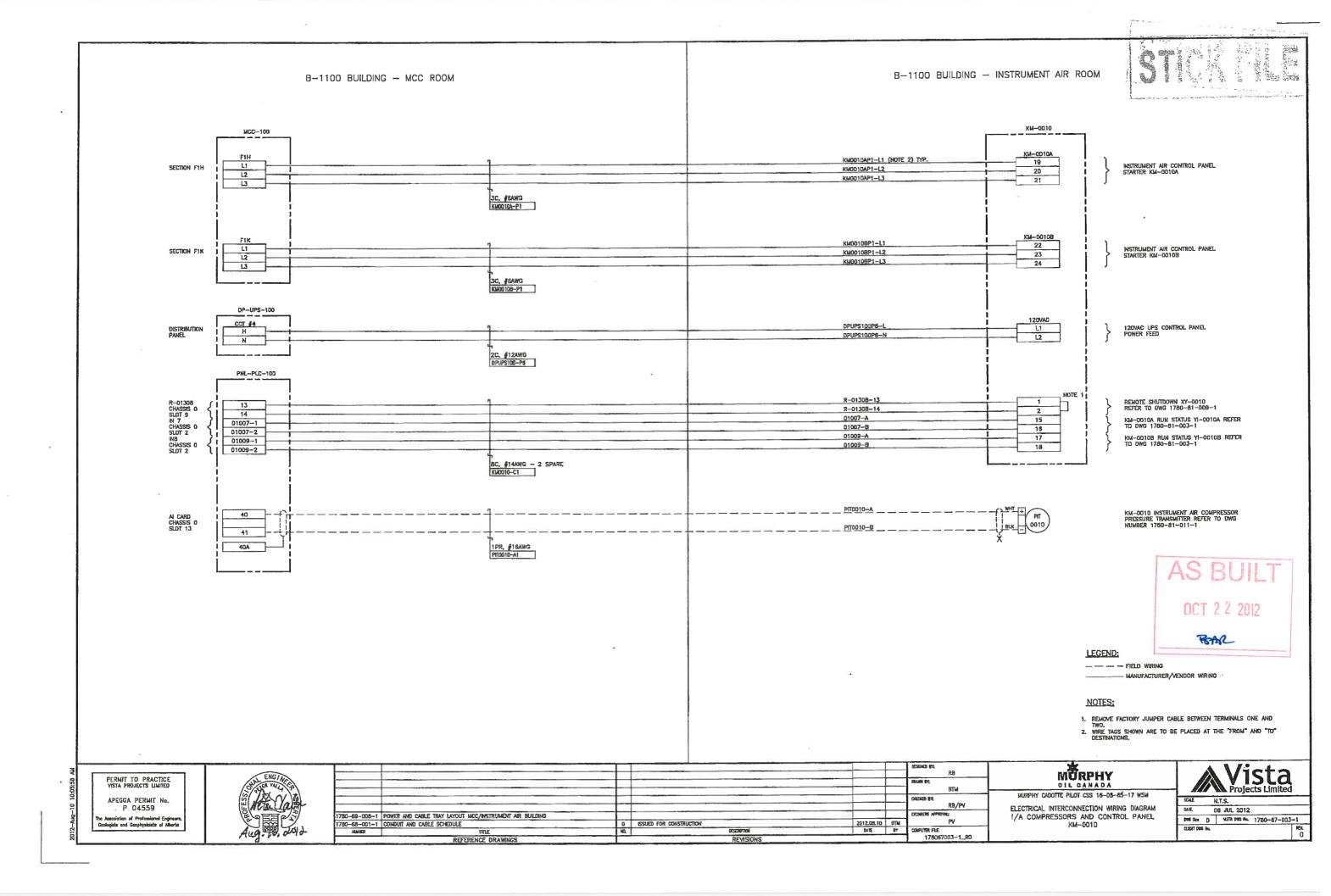
T						DESIGNED ET.
						RB
						BRAIN ITÉ
						BIM
						CHECKED BY:
						RB/PV
1780-69-005-1	POWER AND CABLE TRAY EAYOUT MCC/INSTRUMENT AIR BUILDING				Ĺ	EHOMEERS APPROYAL:
	CONDUIT AND CABLE SCHEDULE	D	ISSUED FOR CONSTRUCTION	2012.08.10	BTM	PV
HUNSER	TITLE	HQ.	DESCRIP TION	DATE	EY	COMPUTED PLE
	REFERENCE DRAWINGS		REVISIONS			178067002-1_R0

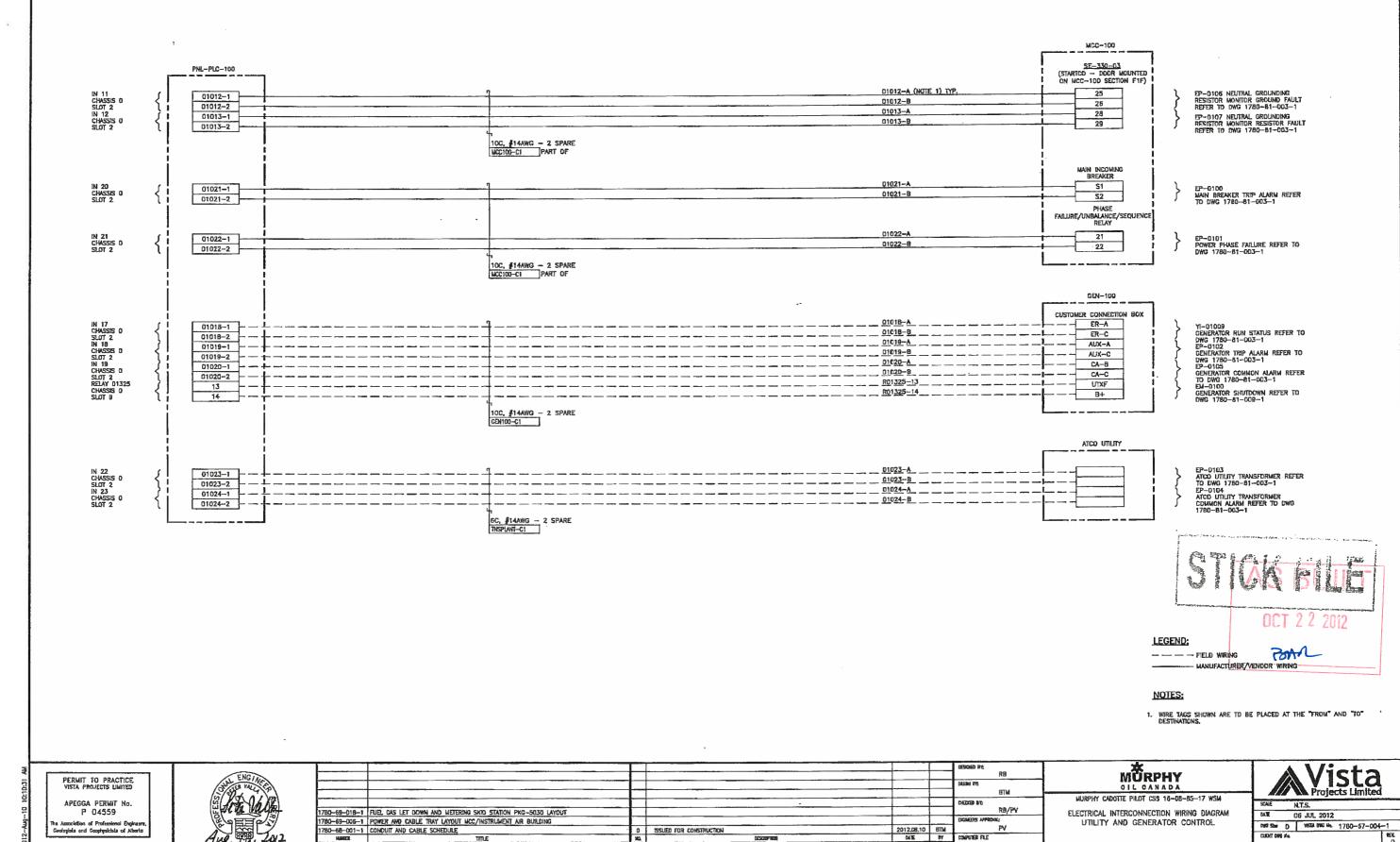


MURPHY CADOTTE PROT CSS 16-08-85-17 WSM ELECTRICAL INTERCONNECTION WIRING DIAGRAM
UPS SYSTEM



08 JUL 2012 376 She D 1554 580 Hr. 1780-67-002-1

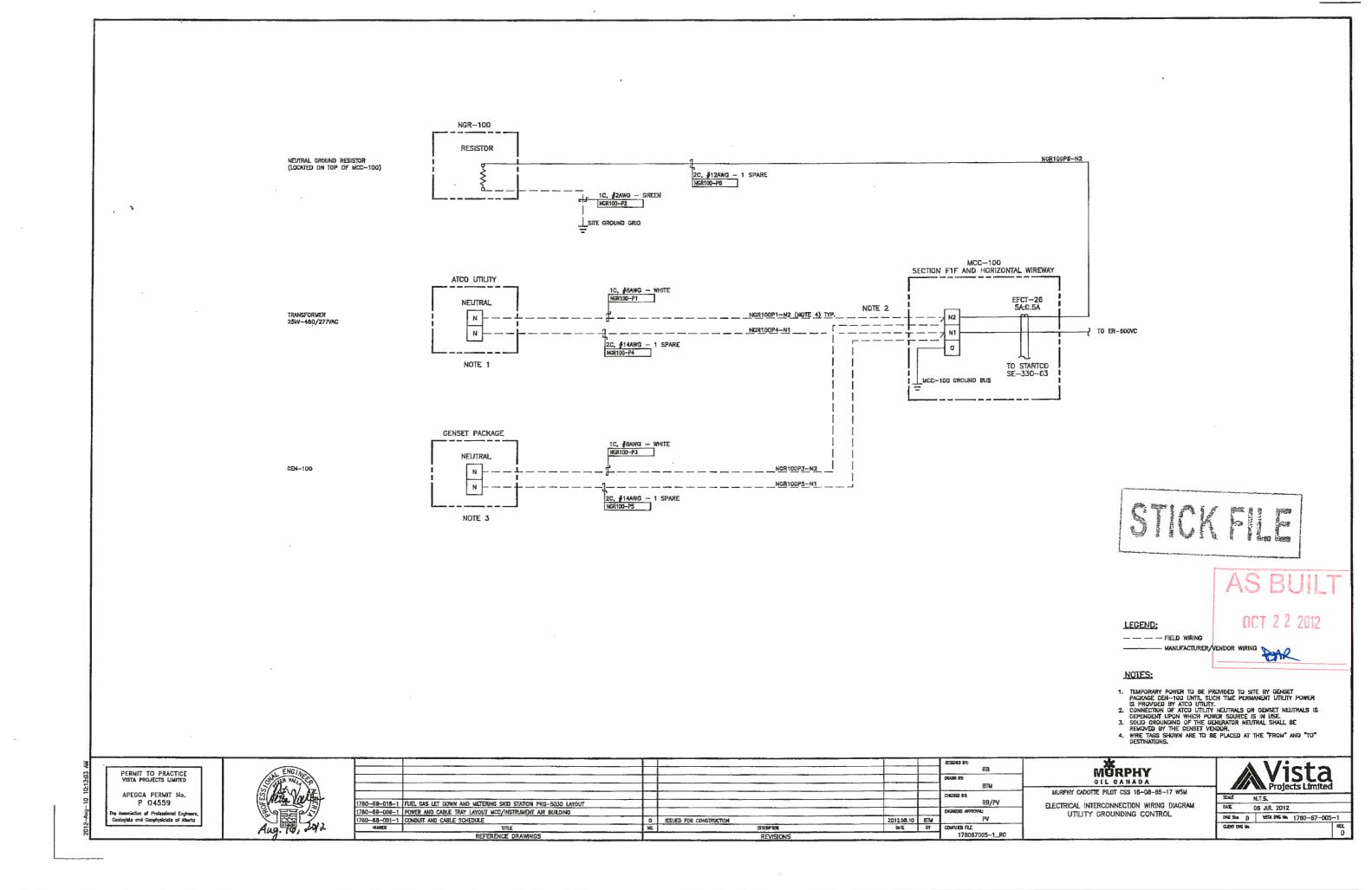




REVISIONS

REFERENCE DRAWINGS

COMPUTER FILE 178067004-1_R0



	L'	OAD		RUN		CONDUIT			ONDUCTORS	T. 100 - 100 -	T	Length	REMARKS
CABLE/CONDUIT NO.	UD!! CAD	VOLTAGE	FROM	VIA	то	SIZE/TYPE	TOTAL NO.	SIZE	INSULATION	VOLTAGE	SP ,	NOTE 1	
	HPICUAD			1	MCC-100 MAIN INCOMING SECTION		3C	500	XLPE/TECK			14	MAINTAIN 100% SPACING
MCC100-P1	<u> </u>		UTILITY TRANSFORMER		MCC-100 MAIN INCOMING SECTION		3C	500	XLPE/TECK	(1000V		14	MAINTAIN 100% SPACING
MCC100-P2			UTILITY TRANSFORMER		MCC-100 MAIN INCOMING SECTION		3C	500	XLPE/TECK	(1000V		14	MAINTAIN 100% SPACING
MCC100-P3		480V	UTILITY TRANSFORMER	TRAY	MCC-100 WAIN INCOMING SECTION		+	(1			1
	′	 ′			THOS HAS FEST OF TERMINAL NO.		1C	8	XLPE	1000V		14	CABLE SHALL BE WHITE IN COLOR
NGR100-P1			UTILITY TRANSFORMER NEUTRAL		MCC-100 EFCT-26 TERMINAL N2	+	1C	2	XLPE	1000V		20	CABLE SHALL BE GREEN IN COLOR
NGR100-P2			NGR-100 GROUNDING RESISTOR		GROUND CONNECTION		1C	8	XLPE	1000V		20	CABLE SHALL BE WHITE IN COLOR
NGR100-P3			GENERATOR NEUTRAL		MCC-100 EFCT-26 TERMINAL N2			14	XLPE/TECK		1 1	2	
NGR100-P4	_		UTILITY TRANSFORMER NEUTRAL		MCC-100 EFCT-28 TERMINAL N1		2C	14	XLPE/TECK		11	14	
NGR100-P5	+		GENERATOR NEUTRAL		MCC-100 EFCT-26 TERMINAL N1		2C				111		NOTE 2
NGR100-P8			MCC-100 EFCT-26 TERMINAL N2	TRAY	REMOTE NEUTRAL GROUNDING RESISTOR		2C	12	XLPE/TECK	1 0000	 	20	10122
NORTOON 0	+	 	Midd for Life Land and Life Life Life Life Life Life Life Life						1	1 000 F	+ -+		NOTE 2 (EP-0108, EP-0107, EP-0100, EP-0101)
140C400 C4		24//DC	MCC-100 MAIN INCOMING SECTION	TRAY	PNL-PLC-100 CONTROL PANEL	I	10C	14	XLPE/TECK		2		NOTE 2
MCC100-C1					PNL-PLC-100 CONTROL PANEL		40C	14	XLPE/TECK				
MCC100-C2			MCC-100 VARIOUS SECTIONS		PNL-PLC-100 CONTROL PANEL	4100	390	14	XLPE/TECK	K 600V	В	8	NOTE 2
MCC100-C3			MCC-100 VARIOUS SECTIONS				25C	14	XLPE/TECK	K 600V	12	58	NOTE 2
MCC100-C4	I		MCC-100 VARIOUS SECTIONS		PNL-PLC-100 CONTROL PANEL		16PR	16	ACIC	300V		8	NOTE 2
MCC100-A1	1	4-20 mA	MCC-100 VARIOUS SECTIONS	TRAY	PNL-PLC-100 CONTROL PANEL		10111		 	1	1	, —	
					ſ		1 20	- 8	XLPE/TECK	K 1000V	+	10	NOTE 2
KM0010A-P1	30HP	480V	MCC-100 (SECTION F1H)	TRAY	INSTRUMENT AIR PACKAGE CONTROL PANEL		3C	6			++	10	NOTE 2
KM0010B-P1	30HP		MCC-100 (SECTION F1K)	TRAY	INSTRUMENT AIR PACKAGE CONTROL PANEL	T	3C	6	XLPETTECK		+		NOTE 2 (YI-0010A, YI-0010B, XY-0010)
	3000		INSTRUMENT AIR PACKAGE CONTROL PANEL		PNL-PLC-100 CONTROL PANEL		8C	14	XLPE/TECK		2	10	NOTE Z (TI-DUTUA, TI-DUTUB, AT-DUTUS)
KM0010-C1					PNL-PLC-100 CONTROL PANEL		1PR	16	ACIC	300V		15	
PIT0010-A1		4-20 mA	PIT-0010 VA PRESSURE TRANSMITTER	INA	FILTEGIBO CONTROL FAILE		1			· [1
		· ['		'		+	3C	10	XLPE/TECK	K 600V		187	
ACM5010-P1	5 HP	480V	MCC-100 (ACM-5010 VFD SECTION R1M)		AERIEL COOLER FAN MOTOR (ACM-5010)		2PR	16	ACIC	300V	1	187	OVERALL/INSIDE SHIELD
ACM5010-C1		24VDC	MCC-100 (ACM-5010 VFD SECTION R1M)	TRAY	AERIEL COOLER FAN JOA (ACM-5010)		450	- 10	AUIO	1-00-	+	, 	
Admosto C.		1	mod too	,				4	VI DECEC	400m/	+	55	1
AC145020 P4	25 HP	480V	MCC-100 (ACM-5020 VFD SECTION R6M)	TRAY	AERIEL COOLER FAN MOTOR (ACM-5020)	T	3C	4	XLPE/TECK		+		OVERALL/INSIDE SHIELD
ACM5020-P1	ZOTIF			TRAY	AERIEL COOLER FAN JOA (ACM-5020)		2PR	16	ACIC	300V	11	55	UVERALDINGIDE GINELS
ACM5020-C1		24VDC	MCC-100 (ACM-5020 VFD SECTION R6M)	11011	AERIEL GUOLEN FAIN BOA PLON BOAS		 					'ـــــــه	1
			1	TDAY	THE PARTY OF THE P	-	3C	250	XLPE/TECK			136	MAINTAIN 100% SPACING
PM4010-P1	100 HP		MCC-100 VFD (VFD-4010 SECTION F2M)		WELLHEAD PUMPJACK MOTOR (PM-4010)		2PR	16	ACIC	300V	1 1	136	OVERALL/INSIDE SHIELD
PM4010-C1	1			TRAY	WELLHEAD PUMPJACK START/STOP(PM-4010)		451	10	FIVIU		+	1	
		1		,				1-250	PETEC.	K 1000V	++	302	MAINTAIN 100% SPACING
PM4020-P1	100 HP	480V	MCC-100 VFD (VFD-4020 SECTION F3M)		WELLHEAD PUMPJACK MOTOR (PM-4020)		3C	350	XLPE/TECK		++		OVERALL/INSIDE SHIELD
	10011		MCC-100 VFD (VFD-4020 SECTION F3M)		WELLHEAD PUMPJACK START/STOP(PM-4020)		2PR	16	ACIC	300V		302	OVERALLINGIDE OF RELEGI
PM4020-C1		24VDC	MCC-100 VFD (VFD-4020 SECTION FOW)	11011	WELLINEAU FORM WHORE THE THE THE THE THE THE THE THE THE TH		 					<u>'</u> '	Control of the contro
		 ,	Total Sala	TRAV.	THE STATE BOY MOTOR (PM ANSA)		3C	350	XLPE/TECK	K 1000V		302	MAINTAIN 100% SPACING
PM4030-P1	100 HP	480V	MCC-100 VFD (VFD-4030 SECTION R2M)	TRAY	WELL HEAD PUMPJACK MOTOR (PM-4030)	-+	2PR	16	ACIC	300V	1	302	OVERALL/INSIDE SHIELD
PM4030-C1		24VDC	MCC-100 VFD (VFD-4030 SECTION R2M)	TRAY	WELLHEAD PUMPJACK START/STOP(PM-4030)	$\overline{}$	4115		1	1	+	(
		1	f					49	XLPE/TECK	K 800V	+	250	1
PM8010-P1	1 HP	480V	MCC-100 (PM-8010 STARTER SECTION F5B)		HP FLARE KNOCK OUT DRUM PUMP MOTOR PM-8010		3C	12			11	250	OVERALL/INSIDE SHIELD
PM8010-C1			MCC-100 (PM-8010 STARTER SECTION F5B)		HP FLARE KNOCK OUT DRUM PUMP JOA(PM-8010)		2PR	16	ACIC	300V		250	OVERVIEW INDICE OF ITEMS
PMOUTU-O1	-	160.	MOD-100 (FARGOTO OTTALTELL GRO	1121	10 I be a sequence	T	T				4		
77 79000 B4	4 440	1001	THE ARE CORD STARTED SECTION ESD)	TRAY	HP FLARE KNOCK OUT DRUM PUMP MOTOR PM-8020		3C	12	XLPE/TECK		البل	250	The state of the s
PM8020-P1	1 HP		MCC-100 (PM-8020 STARTER SECTION F5D)		HP FLARE KNOCK OUT DRUM PUMP JOA(PM-8020)		2PR	16	ACIC	300V	1	250	OVERALL/INSIDE SHIELD
PM8020-C1		120V	MCC-100 (PM-8020 STARTER SECTION F5D)	TRAY	HP FLAKE KNOCK OUT DRUM FOME BUILTINGSES		+	1	+			,	
	T						3C	8	XLPE/TECK	K 1000V	+	45	
PM7000A-P1	15 HP	480V	MCC-100 (PM-7000A STARTER SECTION F5H)		LP BFW CHARGE PUMP MOTOR (PM-7000A)				ACIC	300V	1 1	45	OVERALL/INSIDE SHIELD
PM7000A-C1			MCC-100 (PM-7000A STARTER SECTION F5H)	TRAY	LP BFW CHARGE PUMP JOA (PM-7000A)		2PR	16	AUIU	3004	+		O TEL STEEL
Fill Goores,	+	+	MOO-100 (1 M. 1000 II O. 10 II							100014	+	+ 4E	4
S1470000 D4	45 UD	1001	MCC-100 (PM-7000B STARTER SECTION F5K)	TRAY	LP BFW CHARGE PUMP MOTOR (PM-7000B)		3C	8	XLPE/TECK		البلك	45	1 AND DE CUIELD
PM7000B-P1	15 HP				LP BFW CHARGE PUMP JOA (PM-7000B)		2PR	16	ACIC	300V	1	45	OVERALL/INSIDE SHIELD
PM7009B-C1		120V	MCC-100 (PM-7000B STARTER SECTION F5K)	IIVAI ,	The Bran Charles Loisin again in transact		+				1	1	
				7041/	TOTAL STREET STREET STREET STREET		3C	1	XLPE/TECK	K 1000V	1	150	
PM6000-P1	50HP		MCC-100 VFD (VFD-6000 SECTION R5M)		SURFACE WATER WELL PUMP MOTOR (PM-6000)		2PR	16	ACIC	300V	4-7-	150	OVERALL/INSIDE SHIELD
PM6000-C1		24VDC	MCC-100 VFD (VFD-6000 SECTION R5M)	TRAY	SURFACE WATER WELL PUMP JOA (PM-6000)		ZPK	10	AUIU	0004			
		1							DECTE C	10001		200	1
B1000-P1	45KVA	480V	MCC-100(SECTION F5MR)	TRAY	OFFICE TRANSFORMER (B-1000)		3C	2	XLPE/TECK	K 1000V		1 200	
Blower	700747	1000	MICO-100(OEO (10141 DIMIT)				T				 '		
0.0000 04	001041	4007	LICO LONDEOTICN FADA	TRAY	WATER TREATMENT BUILDING POWER (B-6000)		3C	4/0	XLPE/TECK			32	1
B6000-P1	90KW	480v	MCC-100(SECTION F4D)	TDAY	WATER TREATMENT BUILDING POWER (8-8000) WATER TREATMENT BUILDING PLC CONTROL PANEL	+	15C	14	XLPE/TECK		7	32	EM-6001, PM-6001, YI-6001, XA-6001
B6000-C1		24VDC	PNL-PLC-100 CONTROL PANEL	IKAT	WATER TREATMENT BUILDING FLG CONTROL TAKE	$\overline{}$	25C	14	XLPE/TECK				ASH-6000A, ASH-6000B, ESD-6000, AL-6000A, AL-6
B6000-C2	T	24VDC	PNL-PLC-100 CONTROL PANEL	TRAY	CONTROL JUNCTION BOX IN WATER TREATMENT			16	ACIC				
B6000-A1		4-20mA	PNL-PLC-100 CONTROL PANEL	TRAY	CONTROL JUNCTION BOX IN WATER TREATMENT		6TRI	10	- Auto	- 5004	+	1	Wil-ong William
20000		1	111111111111111111111111111111111111111							2000/	4-	1 20	
10004000 84	-	120V	PNL-EHT-300 HEAT TRACE PANEL	TRAY	PROCESS BUILDING CATADYNE HEATER IGNITION		2C	12	XLPE/TECK	K 600V		20	
HTRB4000-P1		1200	PNL-ENT-NUMEAT INVOETABLE	- 1 ""	FROCEOG DOLLDING WITH STREET		1	1	T	Τ		1	
		·	A A M A A A 1995	THAY '	CHARGE PUMP SKID CATADYNE HEATER IGNITION		2C	12	XLPE/TECK	K 600V	T,	20	
HTRB7005-P1		120V	PNL-EHT-200 HEAT TRACE PANEL	TRAY	CHARGE PUMP SKID CATAUTNE REALESTIGNITION		+			1	+		
							- 100	250	XLPE/TECK	CK 1000V	+	80	
PM7010-P1	100HP	480V	MCC-100(PM-7010 STARTER)		B-7000 STEAM GEN BLDG WATER PUMP (PM-7010)		3C						OVERALL/INSIDE SHIELD
PM7010-C1	+	120V	MCC-100(PM-7010 STARTER)		STEAM GEN BLDG WATER PUMP JOA (PM-7010)		2PR	16	ACIC	300V	1 1	1 00	OVERVED HOLDE OF HEED
PMIOLOGI		1207	MOOTOUR M-1010 OTTACLETY		J. J		T				 '	4	
	20110	4001/	TOTAL TOTAL OTALITED	TRAY	B-7000 STEAM GEN BLDG COMB. BLOWER (BL-7040)		3C	4	XLPE/TEC	CK 1000V		80	
BL7040-P1	30HP			TRAY	STEAM GEN BLDG COMB BLOWER JOA (BL-7040)		2PR	16	ACIC	300V	1	80	OVERALL/INSIDE SHIELD
BL7040-C1			MCC 100/DL 7040 STADILES		IS FAM GEN HUBBLARME DE CAVER DOOR DE L'ANDE							and the second second	

NOTICES:

1. ESTIMATED CABLE LENGTHS ARE SI METERS. PIELD CONTRACTOR TO CONFIRM CABLE RUM LENGTHS BEFORE DRUGGING.

2. CASLE SHALL HE SUPPLIED AND INSTALLED BY MICO BULEDING VENDOR

3. CASLE SHALL HE SHEPLES AND INSTALLED BY MICO BULEDING VENDOR

4. CASLE DEPLIED BY LIPS VENDOR AND INSTALLED BY MICO BULEDING VENDOR

4. CASLE TO BE ARMOURED FIRED OFTIC - CONMIND FART NO. 12TUTG-T-113 1028 CW FAM INT FAM-0023-M AND STIST CONNECTIONS

5. CASLE TO BE ARMOURED CATS-6 - SELDEN PART NO. 12TY-90A OR EQUIVALENT CW FLI-S CONNECTIONS

STALL FILL	VIST	-	<u>`</u>										1
Limited	Projects Limit		ENGINEER'S STAMP	PERINT STARP	R	DAPPR	CHICE	MENSION				REFERENCE DRAWINGS	
			ENGINO	PERMIT TO PRACTICE		BY	BY	lectional B.	1	DATE	MO.	TITLE	CAVOL HOL
e Pilot CSS 2AV	Murphy Cadotte Pilo		CHESTER VALLE GO	VISTA PROJECTS LIMITED	(L)	B PV	PVAGE	RS	USUED FOR CONSTRUCTION	2912-08-17	0		
FILECOS OFFICE	marphy sales in	Į.	(2/ 1/ XZ)	APEGGA PERMIT No.	1	┵,							
8/13-09-405-17 WSM	16-03/120-01	LSD;	(EL KOM JONE)	P 04559		-	+						
	1780 DWGL NO.	JOB NO.	を日田中立	teacher of the following finite end		+	+-				\Box		
CONDUIT & CARLE SCHEDULE - SHEET 1 0	CONDIT	CLIENT DWG, NO.		Company of Second Liver Berns		+-	+-				\sqcup		
AND THE PERSON NAMED IN COLUMN TO PERSON NAM	R.T.S.	Sealer	Aug. 884 8012	ENGINEER'S AND FURNIT		+	+-		 		\vdash		
. 7	1780 DWG.	JOB NO.		P 04559 tea Anna and Galeriana Definition Contract Congression (Contract Congression) Contract Congression (Contract Congression) Contract Congression (Congression) Congress									

EFBH00-PI Deleted and substituted WITH EFB1100-CI 4c #10 contains creats from EFB1100-P1

DPEH1200-P1		2087	INS-EHI-200 EHI IRANSFORMER BY IR-6030	IRAT	ENT DISTRIBUTION PANEL DF-ENT-200 BT TR-9030		<u> </u>							
TNSEHT300-P1	75kVA	480V	MCC-100(SECTION R4H)	TRAY	TNS-EHT-300 EHT XFMR BY AIR COOLER ACM-5010		3C	2/0	XLPE/TECK	1000V		184		0
DPEHT300-P1	IORVA	208V	TNS-EHT-300 EHT XFMR BY AIR COOLER ACM-5010		EHT DISTRIBUTION PANEL DP-EHT-300 BY AIR COOLER 5010		4C	250	XLPE/TECK	1000V		3		0
DE ENTIQUO-FI	1	2004	THE PROPERTY OF SHARE PARTY OF SHARE SALE	11741	mit plotingotionitianes, mit oos private occupitation		_					\Box		
COMM-1	+	-	PNL-PLC-100 CONTROL PANEL	TRAY/UG	B-1000 OFFICE BUILDING MEDIA CONVERTER		FIBER OPTIC			MULTI MODE		260	NOTE 4	0
COMM-2		 	PNL-PLC-100 CONTROL PANEL		B-6000 WATER TREATMENT BUILDING PLC CONTROL PANEL		4PR	24	CAT5e	ARMOURED		30	NOTE 5	0
COMM-3	1	 	PNL-PLC-100 CONTROL PANEL		B-7000 STEAM GEN BUILDING PLC CONTROL PANEL		4PR	24	CAT5e	ARMOURED	<u> </u>	60	NOTE 5	0
COMM-4	 	1	PNL-PLC-100 CONTROL PANEL (MDS RADIO)	TRAY/CNDT				-	COAX	COAX		\vdash	LENGTH AND TYPE AS REQUIRED	0_
00////														0
EFB5030-P1	1	120V	CPNL-100 CONTACTOR PANEL CCT #53	TRAY	EF-B-5030 FUEL GAS SKID EXHAUST FAN		2C	12	XLPE/TECK	600V		25		0
EFB5030-C1	1	120V	CPNL-100 CONTACTOR PANEL TS-1, 33 AND 34	TRAY	EF-B-5030 FUEL GAS SKID EXHAUST FAN T-STAT		2C	14	XLPE/TECK	600V	-	25		<u> </u>
				1					ļ.,,		-	<u></u>	<u></u>	0
EFB6000-P1		120V	CPNL-100 CONTACTOR PANEL CCT #41		EF-B-6000 WATER TREATMENT BUILDING EXHAUST FAN		2C	12	XLPE/TECK	600V		32 32		0
EFB6000-C1	<u> </u>	120V	CPNL-100 CONTACTOR PANEL TS-1, 28 AND 29	TRAY	JB-120 WATER TREATMENT BUILDING		2C	14	XLPE/TECK	V000	-		BY WATER TREATMENT BUILDING VENDOR	0
EFB6000-C1.1		120V	JB-120 WATER TREATMENT BUILDING	CONDUIT	EF-B-6000 WATER TREATMENT BLD EX FAN T-STAT		2C	14	XLPE	600V	1-	5	DI VANIEK IKENIMENI BUILDING VERDOK	<u> </u>
								ļ	14 500000	00017	1 ~	- 00	EP-0103, EP-0104	0
TNSPLANT-C1		24VDC	ATCO UTILITY TRANSFORMER	TRAY	PNL-PLC-100 CONTROL PANEL		6C	14	XLPE/TECK	600V	2	20	EF-0103, EF-0104	-
								10	VI DECTE OF	60014	-	65		0
TK6270-P1	6KW	480V	MCC-100 CONTACTOR(TK-6270 CONTACTOR)		TANK HEATER ON TK-6270 (HTR-TK-6270)		3C	12	XLPE/TECK	600V	+	65		0
TK8270-C1		120V	MCC-100 CONTACTOR(TK-6270 CONTACTOR)	TRAY	THERMOSTAT FOR TANK HEATER ON HTR-TK-6270		2C	14	XLPE/TECK	900V	-	00		-
							<u> </u>	110	VIDEOTO	1000V	-	40	3-1C PER PHASE	0
GEN100-P1		480V	GEN-100 REMOTE GENERATOR		MCC-100 MAIN INCOMING SECTION	,l	9C	4/0	XLPE/TECK		2		YI-01009, EP-0102, EP-0105, EM-100	0
GEN100-C1		24VDC	PNL-PLC-100 CONTROL PANEL	TRAY	GEN-100 GEN SET ALARMS		10C	14	XLPE/TECK	600V	 '	1 4U	1001000, EF-0102, EF-0100, ENF100	
							- 00	 	XLPE/TECK	600V	2	35	TAH-6005, XA-6005	0
B6005-C1		24VDC	PNL-PLC-100 CONTROL PANEL	TRAY	B-6005 EMERGENCY SHOWER ALARMS		6C	14	ALPETIECK	0007	 -	33	1701-00001 707-0000	
							10		XLPE/TECK	600V	+	10	NOTE 2	0
PNL-PRO-C1			PNL-PLC-100 CONTROL PANEL	TRAY	PROMORE PANEL IN MCC ROOM BU-1100		4C	14	ACIC	300V	+	10	NOTE 2	0
PNL-PRO-C2		4-20 mA			PROMORE PANEL IN MCC ROOM BU-1100		PR 3PR	1	ACIC	300V	┼-	136	Note2	0
PNL-PRO-C3		4-20 mA			PROMORE WELLHEAD EQUIPMENT PM-4010		4PR	16	ACIC	300V	+-	302		0
PNL-PRO-C4			PROMORE PANEL IN MCC ROOM BU-1100	TRAY	PROMORE WELLHEAD EQUIPMENT PM-4020		4PR 4PR	16	ACIC	300V	+-	302		0
PNL-PRO-C5		4-20 mA	PROMORE PANEL IN MCC ROOM BU-1100	TRAY	PROMORE WELLHEAD EQUIPMENT PM-4030		4270	10	ACIO	- 3304	1	302	•	
					PAN SIG 400 CONTROL BANKI		30C	14	XLPE/TECK	600V	4	10	NOTE 2	0
CPNL100-C1	+	24VDC	CPNL-100 CONTACTOR PANEL		PNL-PLC-100 CONTROL PANEL		300	14	XLDEATECK		+-) ŠŽ	NOTE 2	0
PER 100 P1	0,5HP	120V	CPNL-100 CONTACTOR PANEL CCT #17		EF-B-1100 INSTRUMENT AIR ROOM EXHAUST FAN		1000	1014	XLPE/TECK		+	В	NOTE 2	0
EFB1100-C1	1	120V	CPNL-100 CONTACTOR PANEL		EF-B-1100 INSTRUMENT AIR RM EX FAN THERMOSTAT		2C	12	XLPE	600V	1	15	NOTE 2	0
CPNL100-P1	280W	120V	CPNL-100 CONTACTOR PANEL CCT #5		MCC BUILDING EXTERIOR LIGHTS	3/4"	3C	12	XLPE	60DV		10	NOTE 2	0
CPNL100-P1A	400011	120V	CPNL-100 CONTACTOR PANEL		EXTERIOR PHOTOCELL YARD LIGHT NO 1	3/4	2C	12	XLPE/TECK		+-	30		0
CPNL100-P2	1000W	120V	CPNL-100 CONTACTOR PANEL CCT #20		YARD LIGHT NO 1		2C	10	XLPE/TECK			45		0
CPNL100-P3	1000W	120V	CPNL-100 CONTACTOR PANEL CCT #22 CPNL-100 CONTACTOR PANEL CCT #24		YARD LIGHT NO 3		2C	10	XLPE/TECK			60		0
CPNL100-P4 CPNL100-P5	1000W	120V	CPNL-100 CONTACTOR PANEL CCT #24		YARD LIGHT NO 4		2C	6	XLPE/TECK			150		0
CPNL100-P8	750W	120V	CPNL-100 CONTACTOR PANEL CCT #28		YARD LIGHT NO 5		2C	6	XLPE/TECK			170		0
CPNL100-P8	500W	120V	CPNL-100 CONTACTOR PANEL CCT #28		YARD LIGHT NO 6	$\overline{}$	2C	8	XLPE/TECK			200		0
CPNL100-P7	750W	120V	CPNL-100 CONTACTOR PANEL CCT #30		YARD LIGHT NO 7		2C	4	XLPE/TECK			250		0
CPNL100-P8	140W	120V	CPNL-100 CONTACTOR PANEL CCT #32	TRAY	B-6000 WATER TREATMENT BLDG EXT. LIGHTS	-	2C	12	XLPE/TECK			30		0
CPNL100-P9	140W	120V	CPNL-100 CONTACTOR PANEL CCT #18		B-1000 OFFICE TRAILER EXTERIOR LIGHTS		2C	12	XLPE/TECK		1	200		0
CPNL100-P10	490W	120V	CPNL-100 CONTACTOR PANEL CCT #16	TRAY	WELLHEAD AND STAIRS LIGHTING JUNCTION BOX		2C	6	XLPE/TECK			250		0
CPNL100-P11.1	140W	120V	WELLHEAD AND STAIRS LIGHTING JUNCTION BOX		WELLHEAD STANCHION LIGHTING 13-09		2C	12	XLPE/TECK			20		0
CPNL100-P11.1	140W	120V	WELLHEAD AND STAIRS LIGHTING JUNCTION BOX		WELLHEAD STANCHION LIGHTING 12-09		2C	12	XLPE/TECK	V008		20		0
CPNL100-P11.3	210W	120V	WELLHEAD AND STAIRS LIGHTING JUNCTION BOX		STAIRS AND PLATFORM STANCHION LIGHTING		2C	12	XLPE/TECK	600V		20		0
O/ NEI00-F 11.0	21044	1204	PIECE DAND GIVING FOUND ROLL HOW	11011	The state of the s									
BATT100-P1	+	120VDC	BATT-100 BATTERY RACK	SURFACE	UPS SYSTEM UPS-100 IN B-1100 MCC BUILDING		2C	6	XLPE	1000V		10	NOTE 3	0
5/1/11/05/1	 	120400	peri con dell'i con	33.11.0L			1							
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NOTES:						1				1				1
1, ESTIMATED CABLE LENGTHS ARE IN MEYERS, FIELD CON	TRACTOR TO CONFID	E CAME HIN LENGT	THE REPORTE ORDERINGS.			4 4 265894 ###	解始度 海牙	8 AF 927	KIE WE	# }			_	1
Z. CABLE SHALL BE SUPPLIED AND RETALLED BY MCC BUR								表示	2 4					
I. CARLE SUPPLED BY UPS VENDOR AND INSTALLED BY MC							CHI CHI	Fig. 18		4			NÜRPHYDII	a particular and a second
A CABLE TO BE ARROUNDED PIDER OFFIC - CORNING PART H		OW FAN KIT FAN-ODS	25-48 AND STIST CONNECTORS			1 1	THE STATE OF THE S	STAN STAN	Steering of the state of the st	tes			IL CORPORATION	1
S. CARLE TO BE ARROUGED CATES - BELDEN PART NO. 1217							F 9 146	医海 章	# 2870 TOR				- " day him had	many H
						ł.				1				

DANN CHOCO APPR

RB PV/RB PV/F

PERMIT STAMP

PERMIT TO PRACTICE VISTA PROJECTS LIMITED

APEGGA PERMIT No. P 04559 ne Association d'Association de Regions August and Deservation d'Associa

RUN

VIA

TRAY STEAM GENERATOR BUILDING UNIT HEATER A

TRAY TNS-EHT-200 EHT TRANSFORMER BY TK-6050
TRAY EHT DISTRIBUTION PANEL DP-EHT-200 BY TK-6050

STEAM GENERATOR BUILDING UNIT HEATER B

FROM

LOAD

HP/LOAD VOLTAGE

480V MCC-100(SECTION F4HL)

480V MCC-100(SECTION F4HR)

480V MCC-100(SECTION R1C)
208V TNS-EHT-200 EHT TRANSFORMER BY TK-6050

CABLE/CONDUIT NO.

HTRB7001A-P1

HTRB7001B-P1

TNSEHT200-P1 DPEHT200-P1

DATE

DWG, NO.

Length NOTE 1

80

30

3

Vista Projects Limited

Murphy Cadotte Pilot CSS

CONDUIT & CABLE SCHEDULE SHEET Z

REMARKS

Rev

0

0

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CONDUCTORS

XLPE/TECK

SIZE INSULATION VOLTAGE SP

600V

1000V 1000V

CONDUIT

SIZE/TYPE TOTAL NO.

3C

4C

CARL PROUDURT NO	L	DAD			RUN		CONDUIT	T	CO	NDUCTORS			Length	ECHADIC	
CABLE/CONDUIT NO.	HP/LOAD	VOLTAGE		FROM	VIA	TO	SIZE/TYPE	TOTAL NO.	SIZE	INSULATION	VOLTAGE	SP	NOTE 1	REMARKS	R
TNSUPS100-P1	5kVA	480V	MCC-100(SECTION	PARI \	TRAY	UPS BY PASS TRANSFORMER TNS-UPS-100	1	2C	10	XLPE/TECK	600V		8	NOTE 2	_
UPS100-P4		120VAC	UPS BY PASS TRAN	NSFORMER TNS-UPS-100	. TRAY	UPS SYSTEM UPS-100 IN B-1100 MCC BUILDING		2C	6	XLPE/TECK	1000V		2	NOTE 2	
UPS100-P1	5kVA		MCC-100(SECTION		TRAY	UPS SYSTEM UPS-100 IN B-1100 MCC BUILDING		3C	10	XLPE/TECK			6	NOTE 2	
UP\$100-P2 UPA1100-C1				100 IN B-1100 MCC BUILDING 100 IN B-1100 MCC BUILDING	TRAY	UPS DISTRIBUTION PANEL DP-UPS-100 PNL-PLC-100 CONTROL PANEL		2C 8C	14	XLPE/TECK XLPE/TECK		-	8	NOTE 2 NOTE 2	-
DPUPS100-P1				PANEL DP-UPS-100 CCT#1	TRAY	PNL-PLC-100 CONTROL PANEL		2C	12	XLPE/TECK	600V		7	NOTE 2	
DPUPS100-P2	250W			PANEL DP-UPS-100 CCT#17	TRAY	BMS TRANSFORMER JUNCTION BOX 18-8 POWER		2C	10	XLPE/TECK		F	40		
DPUPS100-P2.1 DPUPS100-P2.2	65W			R JUNCTION BOX 18-8 POWER R JUNCTION BOX 18-8 POWER	TRAY	BMS CONTROL PANEL BMS-6055 BMS CONTROL PANEL BMS-6065	 	2C 2C	12	XLPE/TECK XLPE/TECK		-	15 15		-
DPUPS100-P2.3	16W	120V UPS	BMS TRANSFORME	R JUNCTION BOX 18-8 POWER	TRAY	FQIT-7010 (NEAR B-7005)		2C	14	XLPE/TECK	V008		20		
DPUPS100-P3 DPUPS100-P4	W008			PANEL DP-UPS-100 CCT#3,5		OFFICE BUILDING UPS POWER JB (JB-P1000)	4	4C	4	XLPE/TECK	1000V	 	260		
DPUPS100-P5	_			I PANEL DP-UPS-100 CCT#12 I PANEL DP-UPS-100 CCT#14	TRAY	FL-8010 FLARE IGNITION PANEL FL-8020 FLARE IGNITION PANEL		2C 2C	10	XLPE/TECK XLPE/TECK	V009 V009	├─	350 350		-
DPUP\$100-P6		120V UPS	UPS DISTRIBUTION	PANEL DP-UPS-100 CCT#4	TRAY	KM-0010 INSTRUMENT AIR DRYER CONTROL PANEL		2C	12	XLPE/TECK	600V		10	NOTE 2	
DPUPS100-P7 DPUPS100-P8	300W			PANEL DP-UPS-100 CCT#2	TRAY	PROMORE PANEL IN MCC ROOM B-1100		2C	12 8	XLPE/TECK	1000V	├	200	NOTE 2	
DPUPS100-P8.1	65W			PANEL DP-UPS-100 CCT#18 R JUNCTION BOX 13-9 POWER	TRAY	BMS TRANSFORMER JUNCTION BOX 13-9 POWER BMS CONTROL PANEL BMS-9015		2C 2C	12	XLPE/TECK	600V	\vdash	15		100
DPUPS100-P8.2	85W	120V UPS	BMS TRANSFORME	R JUNCTION BOX 13-9 POWER	TRAY	BMS CONTROL PANEL BMS-9025		2C	12	XLPE/TECK	V009		15		
DPUPS100-P8.3 DPUPS100-P9	65W 180W			R JUNCTION BOX 13-9 POWER PANEL DP-UPS-100 CCT#6,8	TRAY	BMS CONTROL PANEL BMS-9035		2C	12	XLPE/TECK XLPE/TECK			15 260		
DPUPS100-P9.1	100W			POWER JB-1000 - XFMR FEED		OFFICE BLDG UPS POWER JB-1000 SPARE AND XFMR FIBER OPTIC MEDIA CONVERTER		4C 2C	12	XLPE	600V	\vdash	8		
											1				
TNS100-P1 DP100-P1	50kVA	480V 240V	MCC-100(SECTION	R4DR) ISTRIBUTION TRANSFORMER SUF	TRAY	TNS-100 UTILTIY DISTRIBUTION TRANSFORMER	\\	3C	4 250	XLPE/TECK	1000V	1	3	NOTE 2 NOTE 2	
DP100-P1			UTILITY DISTRIBUT	10N PANEL DP-100 VARIOUS CCTS	SURFACE	UTILITY DISTRIBUTION PANEL DP-100 IN BU-1100 ICPNL-100 CONTACTOR PANEL	- X-11	00 -30C	10	XLPE -	800V	1	3	NOTE 2	
DP100-P2A		120V	UTILITY DISTRIBUT	ION PANEL DP-100 VARIOUS CCTS	SURFACE	CPNL-100 CONTACTOR PANEL	· ·	A ≥ 20C	10	XLPE 📆	₩ 600V	6	3	NOTÉ 2	
DP100-P3 DP100-P3A		120V 120V	UTILITY DISTRIBUT	70N PANEL DP-100 CCT #3	SURFACE	MCC ROOM INTERIOR LIGHT SWITCH		2C	12	XLPE	V000		12	NOTE 2 NOTE 2	
DP100-P4			MCC ROOM INTERIO	TON PANEL DP-100 CCT #11		MCC ROOM INTERIOR LIGHTS INSTRUMENT AIR ROOM LIGHT SWITCH	-	2C 2C	12	XLPE	600V	-	12	NOTE 2	
DP100-P4A		120V	INSTRUMENT AIR R	ROOM LIGHT SWITCH		INSTRUMENT AIR ROOM LIGHTS		2C	12	XLPE	600V		12	NOTE 2	1 1 1 1 1 1 1 1
DP100-P5 DP100-P6		120V 120V		ION PANEL DP-100 CCT#7		MCC ROOM INTERIOR RECEPTACLE		2C	12	XLPE	000V		12	NOTE 2 NOTE 2	
DP100-P7				10N PANEL DP-100 CCT #9 10N PANEL DP-100 CCT #13		INSTRUMENT AIR ROOM INTERIOR RECEPTACLE		2C 2C	12	XLPE XLPE	600V	 	12	NOTE 2	
DP100-P8		120V	UTILITY DISTRIBUT	ION PANEL DP-100 CCT #15		INSTRUMENT AIR ROOM EXTERIOR RECEPTACLE	<u> </u>	2C	12	XLPE	600V		12	NOTE 2	
DP100-P9	20110			10N PANEL DP-100 CCT #19		MCC BUILDING EMERGENCY AND EXIT LIGHTS		2C	12	XLPE	600V		12	NOTE 2	-
DP100-P10 D 2100-P11	0.3 HP	120V		TON PANEL DP-100 CCT#14		P-6280 WATER DRAIN TANK PUMP IN PACKAGE-6000 PNL-DVAG-100 UTIETTY POWER SURPLY		2C	12	XLPE/TECK	600V	-	30	NOTE 2	
DP100-P12	7.2KW	240V	UTILITY DISTRIBUT	ION PANEL DP-100 CCT #43,45	TRAY	B-6005 EMERGENCY SHOWER POWER SUPPLY		3C	6	XLPE/TECK	1000V		30		
DP100-P13 DP100-P14	240\44			10N PANEL DP-100 CCT #40, 42	TRAY	GEN-100 SHORE POWER		3C	6	XLPE/TECK	1000V	<u> </u>	30		
DP100-P14	240W	120V 120V		10N PANEL DP-100 CCT #36 10N PANEL DP-100 CCT #38	TRAY	FUEL GAS BUILDING INTERIOR AND EMERGENCY LIGHTS FUEL GAS BUILDING CATADYNE HEATER IGNITION		2C 2C	12	XLPE/TECK XLPE/TECK	V000	+-	25 25		
					11011	TOLE OF O BOILDING OF THE TIEST ENTON THE		1 20	- 17-						
FL8010-C1 FL8020-C1			PNL-FL8010 REMOT		TRAY	JB-FL8010 BASE MOUNTED FLARE JUNCTION BOX		4C	14	XLPE/TECK	V008	╀—	30		_
HVAC100-P1			PNL-FL8020 REMOT MCC-100(SECTION I		TRAY	JB-FL8020 BASE MOUNTED FLARE JUNCTION BOX HVAC UNIT HVAC-100 IN B-1100		4C 3C	14	XLPE/TECK XLPE/TECK	600V	+	30 8	NOTE 2	-
HVAC101-P1		480V	MCC-100(SECTION	F1ML)	TRAY	HVAC UNIT HVAC-101 IN B-1100		3C	10	XLPE/TECK	600V		8	NOTE 2	72.00.00
¥0000-07 ¥0000-02°		1200	UNIT HEATER HTR	B-1100 MCC ROOM		HAND SWITCH HS-1100		20	147	XLPB	6000		-a-	NOTE 2	
HTRB1101A-P1	15KW		UNIT HEATER HTR- MCC-100(SECTION			REMOTE THERMOSTAT UNIT HEATER HTR-B-1101A I/A ROOM		3C	10	XLPE/TECK	800V	+-	10	NOTE 2	
XXXX-C1	TOTAL	120V	UNIT HEATER HTR-			HAND SWITCH HS-1101A		2C	14	XLPE	600V	\top	3	NOTE 2	- 1
XXXX-C2		120V	UNIT HEATER HTR-			REMOTE THERMOSTAT		2C	14	XLPE	V009		3	NOTE 2	
PNL HVAC-100-C1 HY1100-C1		24VDC		L PNL(TROUBLE, PAIL, STATUS) DOM HVAC-100 (FIRE SHUTDOWN)	TRAY	PNL-PLC-100 CONTROL PANEL PNL-PLC-100 CONTROL PANEL		2C	14	XLPE/TECK XLPE/TECK	V000	-2	5	NOTE 2	
ASH1100A-C1			PNL-PLC-100 CONTI			SMOKE DETECTOR ASH-1100A IN MCC ROOM	1	4C	14	XLPE	600V		6	NOTE 2	
ASH1100B-C1			PNL-PLC-100 CONTI		SURFACE	SMOKE DETECTOR ASH-1100B IN MCC ROOM		4C	14	XLPE	600V		12	NOTE 2	
ASH1100C-C1 ESD1100A-C1			PNL-PLC-100 CONTI PNL-PLC-100 CONTI			SMOKE DETECTOR ASH-1100C IN INSTRUMENT AIR RM IESD BUTTON ESD-1100A EXTERIOR MCC ROOM	- 	4C 2C	14	XLPE	600V	+	18	NOTE 2	
ESD(100B-C1		24VDC	PNL-PLC-100 CONTI	ROL PANEL	SURFACE	ESD BUTTON ESD-1100B EXTERIOR I/A ROOM		2C	14	XLPE	600V		16	NOTE 2	
AH1100-C1			PNL-PLC-100 CONTI		SURFACE	EXTERIOR HORN AH-1100 MCC BUILDING		6C	14	XLPE	600V		16	NOTE 2	
AL1100A-C1 AL1100B-C1			PNL-PLC-100 CONTI PNL-PLC-100 CONTI			EXTERIOR AMBER STROBE AL-1100A MCC BUILDING EXTERIOR BLUE STROBE AL-1100B MCC BUILDING		2C 2C	14	XLPE	600V		16	NOTE 2 NOTE 2	
AL1100C-C1			PNL-PLC-100 CONT			EXTERIOR BLUE STROBE AL-1100B MCC BUILDING EXTERIOR RED STROBE AL-1100C MCC BUILDING	+	2C 2C	14	XLPE	600V	\perp	18	NOTE 2	
IDC1000.04		241/20	DNI DI 0 400 001	DOL DANG!								F.,	100		
JBC1000-C1 JBC1000-C2			PNL-PLC-100 CONTI PNL-PLC-100 CONTI			OFFICE BUILDING CONTROL JB-C1000 OFFICE BUILDING CONTROL JB-C1000		25C	14	XLPE/TECK XLPE/TECK			190	AS BIHL	
HVRCICOCI			MAC 100	1.1.0.354		TEC 40		100	14	XLPE/TECK		士'	100	HAD DUIL	
HVACIONICS			HUAC 101			1240		OC	14	XLDE	LODY				
PES: STINATED CADLE LENGTHS ARE IN METERS. PIELE SAME SHALL BE SEPPLIED AND INSTALLED BY MOC ADLE SUPPLIED BY UP VISIODOR AND INSTALLED B ABLE TO BE AUMOURED FIBER OPTIC - COVING P/ ABLE TO BE AUMOURED CATES - BELDEN PART NO	BUILDING VENDOR MCC BUILDING VENDOR RT NO. 012TUC-T4131D29	ON PANKIT FANLODIS	OG AND STIST CONNECTORS				Address of the state of the sta	With the second			a timo, franchismo, franchismo		OIL C	OCT 2 2 2012	
REPERENCE D	AWAGE		NO. DATE	REVISION		DWN CHCO APPR PERMITSTAMP BY BY BY DECLUT TO APPROVE			ENGINEER'S STAI	89				Vista Projects Umited	
			g 2012-08-17	ISSUED FOR CONSTRUCTION		RB PYTHS PYA PERMIT TO PRACTICE VISTA PROJECTS LIMITED		(8	MAL ENGIA	EES .			Murph	y Cadotte Pilot CSS	
						APEGGA PERMIT No. P 04559		58	P. SW.	(AE)					
						For Autolitism of the notice of Engineers,		10	ATAIL LE	(قال	LSD: LDM BOL		1790	16-08/13-08-085-17 WENI DWIE, NO. 1788-08-081-3	REV
1								100	VS) [(W (7/			1100	ferroring to the state of the s	
						Code (Although Section Section of Although Bridge Section Section)	:	<u>\$</u>		<i>></i> ,	CLIEN	T DWGL, NO.		CONDUST & CARLE SCHEEPINE - SHEET 9	8

DELETED

	10	AD	l	RUN		CONDUIT		CO	NDUCTORS			ength NOTE	REMARKS	Rev
CABLE/CONDUIT NO.	HP/LOAD	VOLTAGE	FROM	VIA	то	SIZE/TYPE	TOTAL NO.	SIZE	INSULATION	VOLTAGE	SP	1	TEMPO GO	
	HEILUAD	VOLIAGE	FROM	V.5.		1	1							
JBP4000-P1	 	120V	UTILITY DISTRIBUTION PANEL DP-100 CCT# 2, 6, 12	TRAY	PROCESS BUILDING POWER JB-P4000	1	8C	10	XLPE/TECK		2	190		0
JBP4000-P1 JBP4000-P2	 	120V	CPNL-100 CONTACTOR PANEL CCT #8, 10	TRAY	PROCESS BUILDING POWER JB-P4000		4C	6	XLPE/TECK	1000V		190		0
JBP4000-P3	+	120V	CPNL-100 CONTACTOR PANEL CCT #4 AND T-STAT	TRAY	PROCESS BUILDING POWER JB-P4000		4C	6	XLPE/TECK	1000V		190		
05) 1000 1 5		1201	01.12.100.001171.01.01.771.02.001.11.00				 		VI DETECK	600V	12	100		0
JBC4000-C1		24VDC	PNL-PLC-100 CONTROL PANEL	TRAY	PROCESS BUILDING CONTROL JB-C4000		30C	14	XLPE/TECK XLPE/TECK	600V		190		0
JBC4000-C2		24VDC	PNL-PLC-100 CONTROL PANEL	TRAY	PROCESS BUILDING CONTROL JB-C4000		8C 16PR	12 18	ACIC		2			0
JBA4000-A1			PNL-PLC-100 CONTROL PANEL	TRAY	PROCESS BUILDING ANALOG JB-A4000	+	8TRI	16	ACIC			190		0
JBA4000-A2			PNL-PLC-100 CONTROL PANEL	TRAY	PROCESS BUILDING ANALOG JB-A4000	+	8PR	16	ACIC			190		0
JBA4000-A3	<u> </u>		PNL-PLC-100 CONTROL PANEL	TRAY	PROCESS BUILDING ANALOG JB-A4000 PROCESS BUILDING ANALOG JB-A4001	+	2TRI	18	ACIC	300V		190		0
JBA4000-A4		4-20 mA	PNL-PLC-100 CONTROL PANEL	TRAY	PROCESS BUILDING ANALOG JB-A4001		1		1					1
IDC4848 C4	ļ	041/00	PNL-PLC-100 CONTROL PANEL	TRAY	PUMPJACK AREA 16-8 CONTROL JB-C4010		40C	14	XLPE/TECK	V000	6	130	· .	0
JBC4010-C1 JBC4010-C1.1	ļ		PUMPJACK AREA 18-8 CONTROL JB-C4010	TRAY	EDY/ZSC/ZSO-4011 NEAR WELLHEAD 16-8	1	6C	14	XLPE/TECK	600V		10		0
JBC4010-C1.1			PUMPJACK AREA 18-8 CONTROL JB-C4010	TRAY	EDY/ZSC/ZSO-4012 NEAR WELLHEAD 16-8		6C	14	XLPE/TECK	V008		10		0
JBC4010-C1.2	 		PUMPJACK AREA 18-8 CONTROL JB-C4010	TRAY	EDY/ZSC/ZSO-4013 NEAR WELLHEAD 16-8		6C	14	XLPE/TECK			10		0
JBC4010-C1.4	+		PUMPJACK AREA 18-8 CONTROL JB-C4010	TRAY	PSHH-4011 NEAR WELLHEAD 18-8		2C	14	XLPE/TECK			10		0
JBC4010-C1.5	 	24VDC	PUMPJACK AREA 16-8 CONTROL JB-C4010	TRAY	PSHH-4019 NEAR WELLHEAD 16-8		2C	14	XLPE/TECK			10		0
JBC4010-C1.6	 	24VDC	PUMPJACK AREA 16-8 CONTROL JB-C4010	TRAY	PYV-4012 NEAR WELLHEAD 16-8		2C	14	XLPE/TECK			10		0
JBC4010-C1.7	1	24VDC	PUMPJACK AREA 18-8 CONTROL JB-C4010	TRAY	PYV-4013 NEAR WELLHEAD 18-8		2C	14	XLPE/TECK	V000	-+	10		0
JBC4010-C1.8			PUMPJACK AREA 18-8 CONTROL JB-C4010	TRAY	PYV-4018 NEAR WELLHEAD 18-8		2C	14	XLPE/TECK	V008	-	10		0
JBC4010-C1.9	I	24VDC	PUMPJACK AREA 16-8 CONTROL JB-C4010	TRAY	PSHH-4017 NEAR WELLHEAD 16-8	-	2C 2C	14	XLPE/TECK	600V		10		0
JBC4010-C1.10		24VDC	PUMPJACK AREA 16-8 CONTROL JB-C4010	TRAY	HOV-4015 NEAR WELLHEAD 16-8	+	2C 2C	14	XLPE/TECK	600V	$\overline{}$	10		0
JBC4010-C1.11		24VDC	PUMPJACK AREA 16-8 CONTROL JB-C4010	TRAY	HOV-4016 NEAR WELLHEAD 16-8		20		1743 63720.0	0000	_			
<u> </u>					INTERPRETATION AND A ACTUAL CO. ID AADAD	+	16PR	16	ACIC	300V	4	130		0
JBA4010-A1			PNL-PLC-100 CONTROL PANEL	TRAY	PUMPJACK AREA 16-8 ANALOG JB-A4010 PY-4013 NEAR WELLHEAD 18-8		1PR	16	ACIC	300V		10		0
JBA4010-A1.1			PUMPJACK AREA 18-8 ANALOG JB-A4010	TRAY	PIT-4013 NEAR WELLHEAD 16-8	+	1PR	16	ACIC	300V		10		0
JBA4010-A1.2	 		PUMPJACK AREA 18-8 ANALOG JB-A4010	TRAY	TIT-4013 NEAR WELLHEAD 16-8	-	1PR	18	ACIC	300V		10		0
JBA4010-A1.3 JBA4010-A1.4	 		PUMPJACK AREA 18-8 ANALOG JB-A4010 PUMPJACK AREA 18-8 ANALOG JB-A4010	TRAY	PT-4010 NEAR WELLHEAD 16-8		1PR	16	ACIC	300V		10		0
JBA4010-A1.5			PUMPJACK AREA 18-8 ANALOG JB-A4010	TRAY	TIT-4012 NEAR WELLHEAD 16-8		1PR	16	ACIC	300V		10		0
JBA4010-A1.6	-		PUMPJACK AREA 18-8 ANALOG JB-A4010	TRAY	PIT-4018 NEAR WELLHEAD 16-8		1PR	16	ACIC	300V		10		0
JBA4010-A1.7			PUMPJACK AREA 18-8 ANALOG JB-A4010	TRAY	PY-4018 NEAR WELLHEAD 16-8		1PR	16	ACIC	300V		10		0
JBA4010-A1.8	-		PUMPJACK AREA 18-8 ANALOG JB-A4010	TRAY	PIT-4012 NEAR WELLHEAD 16-8		1PR	16	ACIC	300V		10		0
JBA4010-A1,9			PUMPJACK AREA 18-8 ANALOG JB-A4010	TRAY	PY-4012 NEAR WELLHEAD 18-8		1PR	16	ACIC	300V 300V		10		0
JBA4010-A1.10		4-20 mA	PUMPJACK AREA 18-8 ANALOG JB-A4010	TRAY	FT-4010 NEAR WELLHEAD 18-8		2PR	16 16	ACIC	300V	- +	10		
JBA4010-A1.11		4-20 mA	PUMPJACK AREA 16-8 ANALOG JB-A4010	TRAY	TIT-4014 NEAR WELLHEAD 16-8	+	1PR	10	ACIO	3000		- 10		0
					THE LACK AREA OF A CONTENS OF THE CASSO	+	40C	14	XLPE/TECK	V000	в	290		0
JBC4020-C1	ļ		PNL-PLC-100 CONTROL PANEL	TRAY	PUMPJACK AREA 13-9 CONTROL JB-C4020	+	6C	14	XLPE/TECK			10		0
JBC4020-C1.1	ļ		PUMPJACK AREA 13-9 CONTROL JB-C4020	TRAY	EDY/ZSC/ZSO-4021 NEAR WELLHEAD 13-9 EDY/ZSC/ZSO-4022 NEAR WELLHEAD 13-9	+	6C	14	XLPE/TECK			10		Q
JBC4020-C1.2			PUMPJACK AREA 13-9 CONTROL JB-C4020 PUMPJACK AREA 13-9 CONTROL JB-C4020	TRAY	EDY/ZSC/ZSO-4023 NEAR WELLHEAD 13-9		6C	14	XLPE/TECK	V000		10		0
JBC4020-C1.3 JBC4020-C1.4			PUMPJACK AREA 13-9 CONTROL JB-C4020	TRAY	PSHH-4021 NEAR WELLHEAD 13-9		2C	14	XLPE/TECK			10		0
JBC4020-C1.4 JBC4020-C1.5	 		PUMPJACK AREA 13-9 CONTROL JB-C4020	TRAY	PSHH-4029 NEAR WELLHEAD 13-9		2C	14	XLPE/TECK			10		0
JBC4020-C1.6			PUMPJACK AREA 13-9 CONTROL JB-C4020	TRAY	PYV-4022 NEAR WELLHEAD 13-9		2C	14	XLPE/TECK		$\overline{}$	10		0
JBC4020-C1.7			PUMPJACK AREA 13-9 CONTROL JB-C4020	TRAY	PYV-4023 NEAR WELLHEAD 13-9		2C	14	XLPE/TECK			10		0
JBC4020-C1.8			PUMPJACK AREA 13-9 CONTROL JB-C4020	TRAY	PYV-4028 NEAR WELLHEAD 13-9		2C	14	XLPE/TECK			10		0
JBC4020-C1.9			PUMPJACK AREA 13-9 CONTROL JB-C4020	TRAY	PSHH-4027 NEAR WELLHEAD 13-9		2C	14	XLPE/TECK			10		0
JBC4020-C1.10		24VDC	PUMPJACK AREA 13-9 CONTROL JB-C4020	TRAY	HOV-4025 NEAR WELLHEAD 13-9		2C	14	XLPE/TECK		 	10		0
JBC4020-C1.11		24VDC	PUMPJACK AREA 13-9 CONTROL JB-C4020	TRAY	HOV-4028 NEAR WELLHEAD 13-9		2C	14	VILE LECK		-	.0		
				<u> </u>	CHARLES OF THE TOTAL TOT	+	16PR	16	ACIC	300V	5	290		0
JBA4020-A1	J		PNL-PLC-100 CONTROL PANEL	TRAY	PUMPJACK AREA 13-9 ANALOG JB-A4020	+	1PR	16	ACIC	300V		10		0
JBA4020-A1,1	+		PUMPJACK AREA 13-9 ANALOG JB-A4020	TRAY	PY-4023 NEAR WELLHEAD 13-9 PTT-4023 NEAR WELLHEAD 13-9	+	1PR	16	ACIC	300V		10		0
JBA4020-A1.2			PUMPJACK AREA 13-9 ANALOG JB-A4020	TRAY	TIT-4023 NEAR WELLHEAD 13-9		1PR	18	ACIC	300V		10		0
JBA4020-A1.3 JBA4020-A1.4	-		PUMPJACK AREA 13-9 ANALOG JB-A4020 PUMPJACK AREA 13-9 ANALOG JB-A4020		PT-4020 NEAR WELLHEAD 13-9	1	1PR	16	ACIC	300V		10		0
JBA4020-A1.4 JBA4020-A1.5			PUMPJACK AREA 13-9 ANALOG JB-A4020		TIT-4022 NEAR WELLHEAD 13-9		1PR	16	ACIC	300V		10		0
JBA4020-A1.6			PUMPJACK AREA 13-9 ANALOG JB-A4020	TRAY	PIT-4028 NEAR WELLHEAD 13-9		1PR	16	ACIC	300V	I	10		0
JBA4020-A1.5	-		PUMPJACK AREA 13-9 ANALOG JB-A4020	TRAY	PY-4028 NEAR WELLHEAD 13-9		1PR	16	ACIC	300V		10	<u> </u>	0
JBA4020-A1.8	1		PUMPJACK AREA 13-9 ANALOG JB-A4020	TRAY	PIT-4022 NEAR WELLHEAD 13-9		1PR	16	ACIC	300V	 	10		1 0
JBA4020-A1.9			PUMPJACK AREA 13-9 ANALOG JB-A4020	TRAY	PY-4022 NEAR WELLHEAD 13-9		1PR	18	ACIC	300V	 	10	 	1 0
JBA4020-A1.10			PUMPJACK AREA 13-9 ANALOG JB-A4020	TRAY	FT-4020 NEAR WELLHEAD 13-9		2PR	16	ACIC	300V	\vdash	10		+-
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roters. I. Bethated Carle Lengths are in meters, field contractor to confini casle run lengths before o 2. Cable Shall 86 Supplied and netalled by MCO (Building Vendor

3, CABLE SUPPLIED BY UPS VERDOR AND INSTALLED BY MCC BUILDING VENDOR 4. CABLE TO BE ANNOUNCE DEPORTED CORRINA PART NO. 121700A OR EQUIVALENT CW RIA 1917 FAN DOS-OF AND STIST CONNECTORS

5. CABLE TO BE ANNOUNCE CATS - BELDEN PART NO. 121700A OR EQUIVALENT CW RIAS CONNECTORS

R	EFERENCE DRAWINGS			REVISION	DWN	CHECD	AFPR	PERMIT STAMP
DWG, NO.	TITLE	NO,	DATE	REYISKA	BY	EY	BA	PERMIT TO PRACTICE VISTA PROJECTS LIMITED
		0	2012-08-17	ISSUED FOR CONSTRUCTION	RB	PV/RB	PV A	VISTA PROJECTS LIMITED
							9.	APEGGA PERMIT No.
					<u> </u>			P 04559
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								Countries and the challenges of American
		·			 			ENGINEER'S AND PERCIT
		1			<u> </u>			STAMP APPLY ONLY TO REV D

MÜRPASB Vista OCT 2 2 201 Murphy Cadotte Pilot CSS CONDUIT & CABLE SCHEDULE - SHEET 4

	LOAD	•	RUN		CONDUIT		CUI	VDUCTORS			ength NOTE	REMARKS
CABLE/CONDUIT NO.	HP/LOAD VOLTAGE	FROM	VIA	то	SIZE/TYPE	TOTAL NO.	SIZE	INSULATION	VOLTAGE	SP	1	
	7.1.1.1.1							LVI SECTOR	600V	-	290	
JBC4030-C1	24VDC	PNL-PLC-100 CONTROL PANEL	TRAY	PUMPJACK AREA 12-9 CONTROL JB-C4030		40C	14	XLPE/TECK	V000	6	10	
JBC4030-C1.1		PUMPJACK AREA 12-9 CONTROL JB-C4030	TRAY	EDY/ZSC/ZSO-4031 NEAR WELLHEAD 12-9		6C	14	XLPE/TECK		 	10	
JBC4030-C1.2		PUMPJACK AREA 12-9 CONTROL JB-C4030	TRAY	EDY/ZSC/ZSO-4032 NEAR WELLHEAD 12-9		6C	14	XLPE/TECK	800V		10	
JBC4030-C1.3		PUMPJACK AREA 12-9 CONTROL JB-C4030	TRAY	EDY/ZSC/ZSO-4033 NEAR WELLHEAD 12-9		6C	14	XLPETECK	600V		10	
JBC4030-C1.4		PUMPJACK AREA 12-9 CONTROL JB-C4030	TRAY	PSHH-4031 NEAR WELLHEAD 12-9		2C	14	XLPE/TECK	V000	 	10	
JBC4030-C1.4 JBC4030-C1.5		PUMPJACK AREA 12-9 CONTROL JB-C4030	TRAY	PSHH-4039 NEAR WELLHEAD 12-9		2C	14	XLPE/TECK	000V			
JBC4030-C1.5		PUMPJACK AREA 12-9 CONTROL JB-C4030	TRAY	PYV-4032 NEAR WELLHEAD 12-9		2C	14	XLPE/TECK	600V	1	10	
JBC4030-C1.7		PUMPJACK AREA 12-9 CONTROL JB-C4030	TRAY	PYV-4033 NEAR WELLHEAD 12-9		2C	14	XLPE/TECK	600V	-	10	
		PUMPJACK AREA 12-9 CONTROL JB-C4030	TRAY	PYV-4038 NEAR WELLHEAD 12-9		2C	14	XLPE/TECK	600V	├	10	
JBC4030-C1.8		PUMPJACK AREA 12-9 CONTROL JB-C4030	TRAY	PSHH-4037 NEAR WELLHEAD 12-9		2C	14	XLPE/TECK	600V	-	10	
JBC4030-C1.9		PUMPJACK AREA 12-9 CONTROL JB-C4030	TRAY	HOV-4035 NEAR WELLHEAD 12-9		2C	14	XLPE/TECK	V008	\vdash	10	
JBC4030-C1.10		PUMPJACK AREA 12-9 CONTROL JB-C4030	TRAY	HOV-4036 NEAR WELLHEAD 12-9		2C	14	XLPE/TECK	600V		10	
JBC4030-C1.11	24VUC	PUNIPJACK AREA 12-9 CONTROL 3B-C4000	1141)	1107 400 112 11 112						-		
1041000 44	100-1	DNI DI C 400 CONTEOL DANIEL	TRAY	PUMPJACK AREA 12-9 ANANLOG JB-A4030		16PR	16	ACIC	300V	5	290	
JBA4030-A1		PNL-PLC-100 CONTROL PANEL	TRAY	PY-4033 NEAR WELLHEAD 12-9		1PR	16	ACIC	300V	\vdash	10	
JBA4030-A1.1		PUMPJACK AREA 12-9 ANANLOG JB-A4030	TRAY	PIT-4033 NEAR WELLHEAD 12-9		1PR	16	ACIC	300V	1	10	
JBA4030-A1.2		PUMPJACK AREA 12-9 ANANLOG JB-A4030	TRAY	TIT-4033 NEAR WELLHEAD 12-9		1PR	16	ACIC	300V		10	
JBA4030-A1.3		PUMPJACK AREA 12-9 ANANLOG JB-A4030	TRAY	PT-4030 NEAR WELLHEAD 12-9		1PR	16	ACIC	300V	\perp	10	
JBA4030-A1.4		PUMPJACK AREA 12-9 ANANLOG JB-A4030	TRAY	TIT-4032 NEAR WELLHEAD 12-9		1PR	16	ACIC	300V	1	10	
JBA4030-A1.5		PUMPJACK AREA 12-9 ANANLOG JB-A4030	TRAY	PIT-4038 NEAR WELLHEAD 12-9		1PR	16	ACIC	300V		10	
JBA4030-A1.6		PUMPJACK AREA 12-9 ANANLOG JB-A4030	TRAY	PY-4038 NEAR WELLHEAD 12-9		1PR	16	ACIC	300V		10	
JBA4030-A1.7		PUMPJACK AREA 12-9 ANANLOG JB-A4030	TRAY	PIT-4032 NEAR WELLHEAD 12-9		1PR	16	ACIC	300V	1	10	
JEA4030-A1.8		PUMPJACK AREA 12-9 ANANLOG JB-A4030	TRAY	PY-4032 NEAR WELLHEAD 12-9		1PR	10	ACIC	300V		10	
JBA4030-A1.9		PUMPJACK AREA 12-9 ANANLOG JB-A4030	TRAY	FT-4030 NEAR WELLHEAD 12-9		2PR	16	ACIC	300V		10	
JBA4030-A1.10	4-20 mA	PUMPJACK AREA 12-9 ANANLOG JB-A4030	INAT	F 1-1000 NEAR WELLIES IN THE				T				
		PULL DI O LEO CONTROL DANIEL	TRAY	EXCHANGER AREA CONTROL/ANALOG JB-C/A4050		10C	14	XLPE/TECK	600V	8	210	
JBC/A4050-C1		PNL-PLC-100 CONTROL PANEL		LSHH-402D (ON VESSEL TK-4020)		2C	14	XLPETECK	600V		10	
JBC/A4050-C1.1		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY			2C	14	XLPE/TECK	600V	T	20	
JBC/A4050-C1.2		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	PSHH-4034 (NEAR TK-4020)		2C	14	XLPE/TECK	600V	\top	20	
JBC/A4050-C1.3		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	PSHH-4024 (NEAR E-4050)		2C	14	XLPE/TECK	600V		20	
JBC/A4050-C1.4		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	PSHH-4014 (NEAR E-4060)		16PR	16	ACIC	300V	4	210	
JBC/A4050-A1		PNL-PLC-100 CONTROL PANEL	TRAY	EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	_	1PR	16	ACIC	300V	1	18	
JBC/A4050-A1.1		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	PDIT-4011 (NEAR EXCHANGER E-4050)		1PR	16	ACIC	300V	1	18	
JBC/A4050-A1.2		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	TY-4015 (NEAR EXCHANGER E-4050)		1PR	18	ACIC	300V	1	18	
JBC/A4050-A1.3		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	TIT-4015 (NEAR EXCHANGER E-4050)		2PR	16	ACIC	300V	1	18	
JBC/A4050-A1.4		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	FIT-4050 (NEAR EXCHANGER E-4050)	_	1PR	16	ACIC	300V	1	18	
JBC/A4050-A1.5		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	PIT-4016 (NEAR EXCHANGER E-4050)		1PR	16	ACIC	300V	1	18	
JBC/A4050-A1.6		EXCHANGER AREA CONTROL/ANALOG JB-C/A4060	TRAY	PY-4016 (NEAR EXCHANGER E-4050)		2PR	16	ACIC	300V	1 1	18	
JBC/A4050-A1.7		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	FIT-4043 (NEAR EXCHANGER E-4060)		1PR	16	ACIC	300V	1	18	
JBC/A4050-A1.8		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	TY-4040 (NEAR EXCHANGER E-4060)		1PR	16	ACIC	300V	1	18	
JBC/A4050-A1.9		EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	TIT-4040 (NEAR EXCHNAGER E-4060)			16	ACIC	300V	1	18	
JBC/A4050-A1.10	4-20 mA	EXCHANGER AREA CONTROL/ANALOG JB-C/A4050	TRAY	TIT-4016 (NEAR EXCHANGER E- 4050)		1PR	10	7010	- 5004	+		
						400	44	XLPE/TECK	(600V	8	185	
JBC/A5010-C1		PNL-PLC-100 CONTROL PANEL	TRAY	AIR COOLER AREA CONTROL/ANALOG JB-C/A5010		10C	14	XLPE/TECK	VG00	+	10	
JBC/A5010-C1.1		AIR COOLER AREA CONTROL/ANALOG JB-C/A5010	TRAY	VSHH-5010 (ON AIR COOLER AC-5010)		2C	14		300V	8	185	
JBC/A5010-A1		PNL-PLC-100 CONTROL PANEL	TRAY	AIR COOLER AREA CONTROL/ANALOG JB-C/A5010		16PR	_ 16	ACIC	300V	 	15	
JBC/A5010-A1.1		AIR COOLER AREA CONTROL/ANALOG JB-C/A5010	TRAY	TIT-5012 (ON AIR COOLER AC-5010)		1PR	16	ACIC	300V		15	
JBC/A5010-A1.2		AIR COOLER AREA CONTROL/ANALOG JB-C/A5010	TRAY	TY-5012A (NEAR AIR COOLER AC-5010)		1PR	16	ACIC		╅╼╾╉	15	
JBC/A5010-A1.3		AIR COOLER AREA CONTROL/ANALOG JB-C/A5010	TRAY	TIT-5010 (ON AIR COOLER AC-5010)		1PR	16	ACIC	300V	+	15	
JBC/A5010-A1.4		AIR COOLER AREA CONTROL/ANALOG JB-C/A5010	TRAY	FIT-5014 (SIG AND PWR NEAR AC-5010)		2PR	16	ACIC	300V	+	15	
JBC/A5010-A1.5		AIR COOLER AREA CONTROL/ANALOG JB-C/A5010	TRAY	FIT-5011 (SIG AND PWR NEAR AC-5010)		2PR	16	ACIC	300V	+	15	
JBC/A5010-A1.6		AIR COOLER AREA CONTROL/ANALOG JB-C/A5010	TRAY	FIT-5013 (SIG AND PWR NEAR AC-5010)		2PR	16	ACIC	300V			
JBC/A5010-A1,7		AIR COOLER AREA CONTROL/ANALOG JB-C/A5010	TRAY	PIT-5010 (NEAR AIR COOLER AC-5010)		1PR	16	ACIC	300V	+	15	
agoiner jorni,	7-25 (117)	THE PERSON NAMED OF THE PERSON					L	1		+	en	
JBC/A5020-C1	24/100	PNL-PLC-100 CONTROL PANEL	TRAY	AIR COOLER AREA CONTROL/ANALOG JB-C/A5020		10C	14	XLPE/TECK		8	60	
JBC/A5020-C1.1		AIR COOLER AREA CONTROL/ANALOG JB-C/A5020	TRAY	VSHH-5020 (ON AIR COOLER AC-5020)		2C	14	XLPE/TECK		+	10	
JBC/A5020-C1.1		PNL-PLC-100 CONTROL PANEL	TRAY	AIR COOLER AREA CONTROL/ANALOG JB-C/A5020		12PR	18	ACIC	300V	4	60	
JBC/A5020-A1.1		AIR COOLER AREA CONTROL/ANALOG JB-C/A5020		TIT-5022 (ON AIR COOLER AC-5020)		1PR	16	ACIC	300V	+	10	
JBC/A5020-A1.1		IAIR COOLER AREA CONTROL/ANALOG JB-C/A5020		TY-5022A (NEAR AIR COOLER AC-5020)		1PR	16	ACIC	300V	+	10	
JBC/A5020-A1.3		IAIR COOLER AREA CONTROL/ANALOG JB-C/A5020		TIT-5020 (ON AIR COOLER AC-5020)		1PR	16	ACIC	300V	+	10	
JBC/A5020-A1.4		AIR COOLER AREA CONTROL/AVALOG JB-C/A5020		PY-5020 (ON AIR COOLER AC-5020)		1PR	18	ACIC	300V		10	
		IAIR COOLER AREA CONTROL/ANALOG JB-C/A5020		TY-5020 (ON AIR COOLER AC-5020)		1PR	10	ACIC	300V	\perp	10	
JBC/A5020-A1.5		IAIR COOLER AREA CONTROL/ANALOG JB-C/A5020	TRAY	PT-5020 (NEAR AIR COOLER AC-5020)		1PR	16	ACIC	300V	\bot	10	
JBC/A5020-A1.6		IAIR COOLER AREA CONTROLIANALOG JB-C/A5020	TRAY	PT-7010 (NEAR AC-5020)		1PR	16	ACIC	300V	\perp	10	
JBC/A5020-A1.7		IAIR COOLER AREA CONTROL/ANALOG JB-C/A5020	TRAY	TIT-7036 (NEAR STEAM GEN BLDG B-7000)		1PR	16	ACIC	300V		10	
JBC/A5020-A1.8	4-20 MA	MIN GUOLEN AREA GUINTROLIANALUG JE-CIASUZU	11001	THE TOOK WHAT OF ME AND OF TOOK								
		DAIL DEG 400 CONTROL DANIEL	TRAY	FUEL GAS AREA CONTROL/ANALOG JB-C/A5030		10C	14	XLPE/TECH			20	
100/45000 64										1 4	00	
JBC/A5030-C1 JBC/A5030-A1		PNL-PLC-100 CONTROL PANEL PNL-PLC-100 CONTROL PANEL	TRAY	FUEL GAS AREA CONTROL/ANALOG JB-C/A5030		16PR	16	ACIC	300V	4	20 10	

NOTES:

1. ESTIMATED CABLE LENGTHS ARE MI METERS. FIELD CONTRACTOR TO CONFIDI CABLE RUN LENGTHS BAPORE ORDERING.

2. CABLE SUPPLIED BY LIPS VENDOR AND INSTALLED BY MCC BULLDING VENDOR

3. CABLE SUPPLIED BY LIPS VENDOR AND INSTALLED BY MCC BULLDING VENDOR

4. CABLE TO BE ARMOUNDED PRIER OFTIC - CORRING PART INC. 912TUC-14131021 CW FAK INT FAN-ODS-05 AND STIST CONNECTORS

5. CABLE TO BE ARMOUNDED CATSO - DELICEN PART INC. 121700A OR SQUIVALENT CWI RL-4S CORNECTORS

	EFERENCE DRAWINGS				DAN	CHKD	APPR	PERMIT STAMP
DWG, NO.	TITLE	NO.	DATE	REVISION	BY	BY	BY	PERMIT TO PRACTICE
		8	2012-08-17	ISSUED FOR CONSTRUCTION	RS	PV/RB	PV A	VISTA PROJECTS LIMITED
							•	APEGGA PERMIT No.
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LSD:		16-09/13-01	1-015-17 V		-	
JOB NO.	1790	DWG, NO.		1720-85-861-5	REV	
CLIENT DWG. NO.		CONTR	ITA CAR	III SCHEDULE - SHEET 5	1 . 1	
Scale:	N.T.S.					

March Marc	ADI CIGOLIDUT VO	LOAD		RUN		CONDUIT	L		DUCTORS			Length NOTE	REMARKS
	ABLE/CONDUIT NO.	HP/LOAD VOLTAGE	FROM	VIA	то	SIZE/TYPE	TOTAL NO.	SIZE	INSULATION	VOLTAGE	SP	_1_	
September 1,000										20014		20	
WARD	JBC/A5030-A2	4-20 mA	PNL-PLC-100 CONTROL PANEL	TRAY							2		
	JBP5030-P1	120VAC									-		
1.5 1.5	JBP5030-P2	120VAC	UTILITY DISTRIBUTION PANEL DP-100 CCT# 36, 38	TRAY	FUEL GAS LET DOWN SKID POWER JB-P5030		80	10	ALPETIEUR	OUUV		20	
1.5 1.5							900	10	ACIC	3007	4	140	
### 15 A SOLIC WITE WILL AND SASSES TOWN THE PROPERTY THE PR											-7		
1985 1987 1997									ACIC				
Company Comp						 							
March Marc	JBA6000-A1.3	4-20 mA	SOURCE WATER WELL ANALOG JB-A6000	TRAY	FIT-6000 (SIG AND PWR NEAR P-6000)	+	-211	- 10	7,0,0	4524		-	
March Marc				7044	WATER TANK AREA CONTROL (ANALOG IR C/ARASA	+	120	14	XI PE/TECK	600V	4	4D	
										600V	2	18	
### ACCORDANCE 1891 M. P. CONTONING PARK 1892 M. CONTONING PARK M. CONTON										600V		18	
### ASSESSMENT 1,000						1		18	ACIC		В		<u> </u>
							1PR	18					
March 120						1	1PR	16	ACIC	300V_		18	
MOST	00070000-711.2	4-20 HP1	WATER TARRAGE CONTROL TO BE SEE LESS	1									
BROWN STANDON STANDON ST	JB005-P1	120V UPS	UPS DISTRIBUTION PANEL DP-UPS-100 CCT#11	TRAY	STEAM GENERATION BUILDING POWER JB-P005			8					
BORDER 1990. 199					STEAM GEN BUILDING POWER JB-P005			8			2		
1800-12 1800-02 1800				TRAY		1							
BIRD STAN OF CHILD STREET PARK THAY STAN GRIEB BLOWN POWER, APPLICATION STAN GRIEB BLOWN POWER, APPLICATION POWER, AP				TRAY							<u> </u>		
SECTION SECT	JB005-P3	120VAC	UTILITY DISTRIBUTION PANEL DP-100 CCT#34,51	TRAY							-	90	EM 7040 PM 7040 VI 7040 EM-7010 PM-7010 YI-
1807 1	JB005-C1	24VDC	MCC-100 SECTION 8								-		EMPTO40, INF 7040, 11-1040, EMPTO10, INF 7010, 11
1967 A.1		24VDC	PNL-PLC-100 CONTROL PANEL										
BPYOR P													
Interview Transport Tran	JB007-A2	4-20 mA	PNL-PLC-100 CONTROL PANEL	TRAY	STEAM GEN BLDG CONTROL/ANALOG JB-007	+	4155	10	ACIC	3007	 ~	- 00	
Interview Transport Tran					The state of the s	+	100	12	XI DEVIECK	VDO	4	50	
BELATION C1.1 24 PACE 1907 19						+-							
SECUNDS CT SAVIO CHARGE PLANS CONTRICTAMANO B CANDOS TRAY SHARKAR PROBLEMS CONTRICTAMANO B CANDOS TRAY SHARKAR TEACHER SAVIO CHARGE PLANS CONTRICTAMANO B CANDOS TRAY SHARKAR TEACHER SAVIO CHARGE PLANS CONTRICTAMANO B CANDOS TRAY SHARKAR TEACHER SAVIO CHARGE PLANS CONTRICTAMANO B CANDOS TRAY SHARKAR TEACHER SAVIO CHARGE PLANS CONTRICTAMANO B CANDOS TRAY SHARKAR TEACHER SAVIO SAV						+							
SECATION S.C. 2400 CRARGE FILINES CONTROLLAND, CS. J. S.C. ATOSS TRAY CLARGE FLANE CONTROLLAND, CS. J.C. ATOSS TRAY CLARGE FLANE CON						+							
SCANDOCAL ADMIN PROPERTY													
Companies Comp										300V	5	50	
						 			ACIC	300V		18	
SECATOSS-A1 4 A20 mA CHARGE PLAMPS CONTROLANALOG JS CATATOS TRAY LIF-9600 (ON SOFT WATER TARK TK-6990) 1PR 60 ACC SOC 18						1	1PR	18	ACIC				
SIGCATOSS-ALS						1		16					
SECATIOSS ALS 4.20 mA CHARGE FRAMPS CONTROLIANALOG JB CIA7005 TRAY LIFAZO (ON TANK TREAZY) LIFAZO (ON TANK TRE							1PR	16					
BCARBOO_C1							1PR	16					
SECA8500-C1					CHARGE PUMPS CONTROL/ANALOG JB-C/A7005		4TRI	16	ACIC	300V	2	50	
BIC/AB000_C1 24/DC FROD AREA CONTROLANALOG JB C/AB000 TRAY XA-BOR (NH F-18/32) 2C 14 XL-PETECK 600V 120									L		<u> </u>	0.0	
BEC/AB000-C11	JBC/A8000-C1	24VDC	PNL-PLC-100 CONTROL PANEL	TRAY	FKOD AREA CONTROL/ANALOG JB-C/A8000						1		
BEC/AB000-C13 24VDC FKOD AREA CONTROL/ANALOG JB-C/AB000 TRAY LSHH-B021 (ON FKOD VESSEL V-8020) 2C 14 XLPETECK 800V 10		24VDC	FKOD AREA CONTROL/ANALOG JB-C/A8000	TRAY									
JBC/JA8000-C1 24VDC FROD AREA CONTROLANALOG JB-C/JA8000 TRAY SHEADING (IN FROD YESSEL V-8010) 2°C 14 XLPETTECK 500V 10	JBC/A8000-C1.2		FKOD AREA CONTROL/ANALOG JB-C/A8000										
BEC/AB000-A1 420 mA PR. PLC-100 CONTROL PAMEL TRAY KTOD AREA CONTROLLANALOG JB-C/AB000 12PR 18 ACIC 300V 4 245	JBC/A8000-C1.3	.24VDC	FKOD AREA CONTROL/ANALOG JB-C/A8000										
JBC/A8000-A1.1						-					4		
150C/18000-0.12						-					-		
BEC/AB000-A1.2						-							
BEC/AB000-A1.4 4-20 mA FKOD AREA CONTROL/ANALOG JB-C/AB000 TRAY LIT-8010 (NEAR PKOD VESSEL V-8010) 1PR 18 ACIC 300V 10											 		
JBC/A8000-A1.5						+					 		
JBC/A8000-A1.5						 							
JBC/A9000-C1						+							
BEC/A9000-C1.1 24VDC EMULSION TANK CONTROL/ANALOG JB-C/A9000 TRAY LSHH-9021 (ON TANK TK-9010) 2C 14 XLPE/TECK 800V 15	JBC/A8000-A1.6	4-20 mA	PROD AREA CON I ROLIANALOG JE-CIASUSU	IRAT	LITTURE (NEAR FROD VEGGEL V-0020)		 		1	1			
BEC/A9000-C1.1 24VDC EMULSION TANK CONTROL/ANALOG JB-C/A9000 TRAY LSHH-9021 (ON TANK TK-9010) 2C 14 XLPE/TECK 800V 15	IDC/ACOON C4	24/100	IDNI DI C 100 CONTROL PANEL	TDAV	EMULSION TANK CONTROL/ANALOG JB-C/A9000	1	30C	14	XLPE/TECK	600V	6	160	
BC/A9000-C1.2 24VDC EMULSION TANK CONTROLANALOG JB-C/A9000 TRAY LSHI-9021 (ON TANK TK-9020) 2C 14 XLPE/TECK 600V 15						_				600V			
BC/A9000-C1.3								14	XLPE/TECK	000V			
BC/A9000-C1.4 24VDC EMULSION TANK CONTROL/ANALOG JB-C/A9000 TRAY XY/XAJ-9015 (ON BMS PACKAGE PK-9015) 6C 14 XLPE/TECK 600V 2 15 JBC/A9000-C1.5 24VDC EMULSION TANK CONTROL/ANALOG JB-C/A9000 TRAY XY/XAJ-9025 (ON BMS PACKAGE PK-9025) 6C 14 XLPE/TECK 600V 2 15 JBC/A9000-C1.6 24VDC EMULSION TANK CONTROL/ANALOG JB-C/A9000 TRAY XY/XAJ-9035 (ON BMS PACKAGE PK-9025) 6C 14 XLPE/TECK 600V 2 15 JBC/A9000-A1 4-20 mA PNL-PLC-100 CONTROL/ANALOG JB-C/A9000 TRAY XY/XAJ-9035 (ON BMS PACKAGE PK-9025) C 4 XLPE/TECK 600V 2 15 JBC/A9000-A1 4-20 mA EMULSION TANK CONTROL/ANALOG JB-C/A9000 TRAY TIT-9010 (ON TANK CONTROL/ANALOG JB-C/A9000 TRAY TIT-9010 (ON TANK TK-9010) TPR 16 ACIC 300V 15 JBC/A9000-A1 4-20 mA EMULSION TANK CONTROL/ANALOG JB-C/A9000 TRAY TIT-9010 (ON TANK TK-9010) TRAY TIT-9020 (ON TANK TK-9020) TRAY TIT-9020 (ON TANK TK-9020) TRAY TIT-9030 (ON TANK TK-9020) TRAY TIT-9030 (ON TANK TK-9030) TRAY TIT-9030 (ON TANK TK-90													
BC/A9000-C1.5 24VDC EMILSION TANK CONTROL/ANALOG JB-C/A9000 TRAY XY/XA/-9025 (ON BMS PACKAGE PK-9025) BC 14 XLPE/TECK 600V 2 15 JBC/A9000-C1.6 24VDC EMILSION TANK CONTROL/ANALOG JB-C/A9000 TRAY XY/XA/-9035 (ON BMS PACKAGE PK-9035) BC 14 XLPE/TECK 600V 2 15 JBC/A9000-A1 4-2D mA PNL-PLC-100 CONTROL/ANALOG JB-C/A9000 TRAY TRAY EMILSION TANK CONTROL/ANALOG JB-C/A9000 BPR 16 ACIC 300V 2 160 JBC/A9000-A1.1 4-2D mA EMILSION TANK CONTROL/ANALOG JB-C/A9000 TRAY TT-9010 (ON TANK TK-9010) TRAY TT-9010 (ON TANK TK-9010) TRAY TT-9020 (ON TANK TK-9020) TRAY													
BC/A9000-C1.6 24VDC EMULSION TANK CONTROL/ANALOG JB-C/A9000 TRAY XY/XA/-9035 (ON BMS PACKAGE PK-9035) 6C 14 XLPE/TECK 600V 2 15													
JBC/A9000-A1				TRAY	XY/XA/-9035 (ON BMS PACKAGE PK-9035)								
JBC/A9000-A1.1											2		
JBC/A9000-A1.2		4-20 mA	EMULSION TANK CONTROL/ANALOG JB-C/A9000								₩		
BC/A9000-A1.3		4-20 mA	EMULSION TANK CONTROL/ANALOG JB-C/A9000								1-		
JBC/A9000-A1.5 4-20 mA EMULSION TANK CONTROL/ANALOG JB-C/A9000 TRAY TIT-9030 (ON TANK TK-9030) 1PR 16 ACIC 300V 15 JBC/A9000-A1.5 4-20 mA EMULSION TANK CONTROL/ANALOG JB-C/A9000 TRAY TIT-9030 (ON TANK TK-9030) 1PR 16 ACIC 300V 15											₩		
38C/A9000-A1.5 4-20 MA (EMULSION TANK CONTROLLANALOG JB-C/A9000 1RAY 111-9030 (ON TANK TK-9030)	JBC/A9000-A1.4	4-20 mA	EMULSION TANK CONTROL/ANALOG JB-C/A9000	TRAY	LT-9020 (ON TANK TK-9020)						+		
JBC/A9000-A1.6 4-20 mA EMÜLSION TANK CONTROL/ANALOG JB-C/A9000 TRAY LT-9030 (ON TANK TK-9030) 1PR 16 ACIC 300V 15	JBC/A9000-A1.5										-		
	JBC/A9000-A1.6	4-20 mA	EMULSION TANK CONTROL/ANALOG JB-C/A9000	TRAY	LT-9030 (ON TANK TK-9030)		1PR	16	AUIC	3000	+-	15	
						 	ļ		 	+		+	

1. ESTIMATED CABLE LENGTHS ARE IN METERS. FIELD CONTRACTOR TO CONFIRM CABLE RUN LENGTHS BES

2. CABLE SHALL BE SUPPLED AND INSTALLED BY MCC BUILDING VENDOR 9. CABLE SUPPLIED BY UPS VENDOR, AND INSTALLED BY MCC BUILDING VENDOR

4. CARLE TO BE AVAICURED FRER OFTIC - CORDING PART NO, DIZTUC-T415TUZD CAN FAN INT FAN-COZS-08 AND STIST CONNECTORS 9. CARLE TO BE AVAICURED CATS: - BELDEN PART NO. 121700A OR BOUNALENT CAN RJ-46 CONNECTORS

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R	EACRENCE DRAWINGS	L.,	DATE	REVISION	DWN	CHED	APPR	PERIST STAMP	ENGINEER'S STAMP
DWG, NO.	TrpLB	1 ~~	DA/12	Decidence	ΒY	BY	ay	PERMIT TO PRACTICE	61.60
		. 0	2812-08-17	ESSUED FOR CONSTRUCTION	RB	PVRS	PV A	VISTA PROJECTS LIMITED	ANL ENGINEER
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					\vdash			P 04559	(E) (12) (A)
					_			the Angrophic of Figure 1929 Digitaria.	(E/1904 1973)
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Murphy Cadotte Pilot CSS

SD:	16-03/13-03-085-17 WSM								
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DEFINITION 100000000000000000000000000000000000					001/01/17	THE FIRE AND THE CONTROLLED VARIOUS HTD CCTS	63mm	42C	В	XLPE	600V		1.5		0
Deptition Dept			120/208VAC	DP-EHT-200 DISTRIBUTION PANEL VARIOUS CCTS	CONDUIT	PNL-EHT-200 EHT CONTROLLER VARIOUS HTR COTS			8		600V		1.5		0
Deptition-19					CONDUIT	PNL-EHT-200 EHT CONTROLLER VARIOUS HIR CCTS			В	XLPE	600V		1.5		0
DP-ENT-200-FF 100W 120/AC 120/A		1			CONDUIT	PNL-EHT-200 EHT CONTROLLER VARIOUS HTR COTS	Compa		12		600V		25		0
Deptimode Column Deptimo		100W	120VAC	DP-EHT-200 DISTRIBUTION PANEL CCT # 69	TRAY	B-7005 CHARGE PUMP SKID CATADYNE HEATER IGNITION	-				600V				0
PRINCIPAL 104W 120WG PRILEHT-200 FIRE ALARM TRAY PRILET-100 GUNTOLE HIR RIS TRAY PRILE	DPEHT200-P5	100W	120VAC	DP-EHT-200 DISTRIBUTION PANEL CCT #71										HTA-100	0
PUBBOOSS-1-CT 104W 120WC PNL-BHT-200 BHT CONTROLLER HTR #1 1 TRAY PLB-5-0000-1 FELD JUNCTION BOX 17TR 16	PNLEHT200-C1		24VDC	PNL-EHT-200 TRIP ALARM	TRAY	PNL-PLC-100 CONTROL PANEL	 	-20	17	ALI LITEOR	1 - 000.		1		
PUBBOOSS-1-CT 104W 120WC PNL-BHT-200 BHT CONTROLLER HTR #1 1 TRAY PLB-5-0000-1 FELD JUNCTION BOX 17TR 16					<u> </u>		ļ 	1 20	<u> </u>	AL BELLECK	V009		70		0
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RTDV8010-1-C1		1644W	208VAC				+						60		
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PJBHR0001-1-P1	RTDHR0007-1-C1						+								
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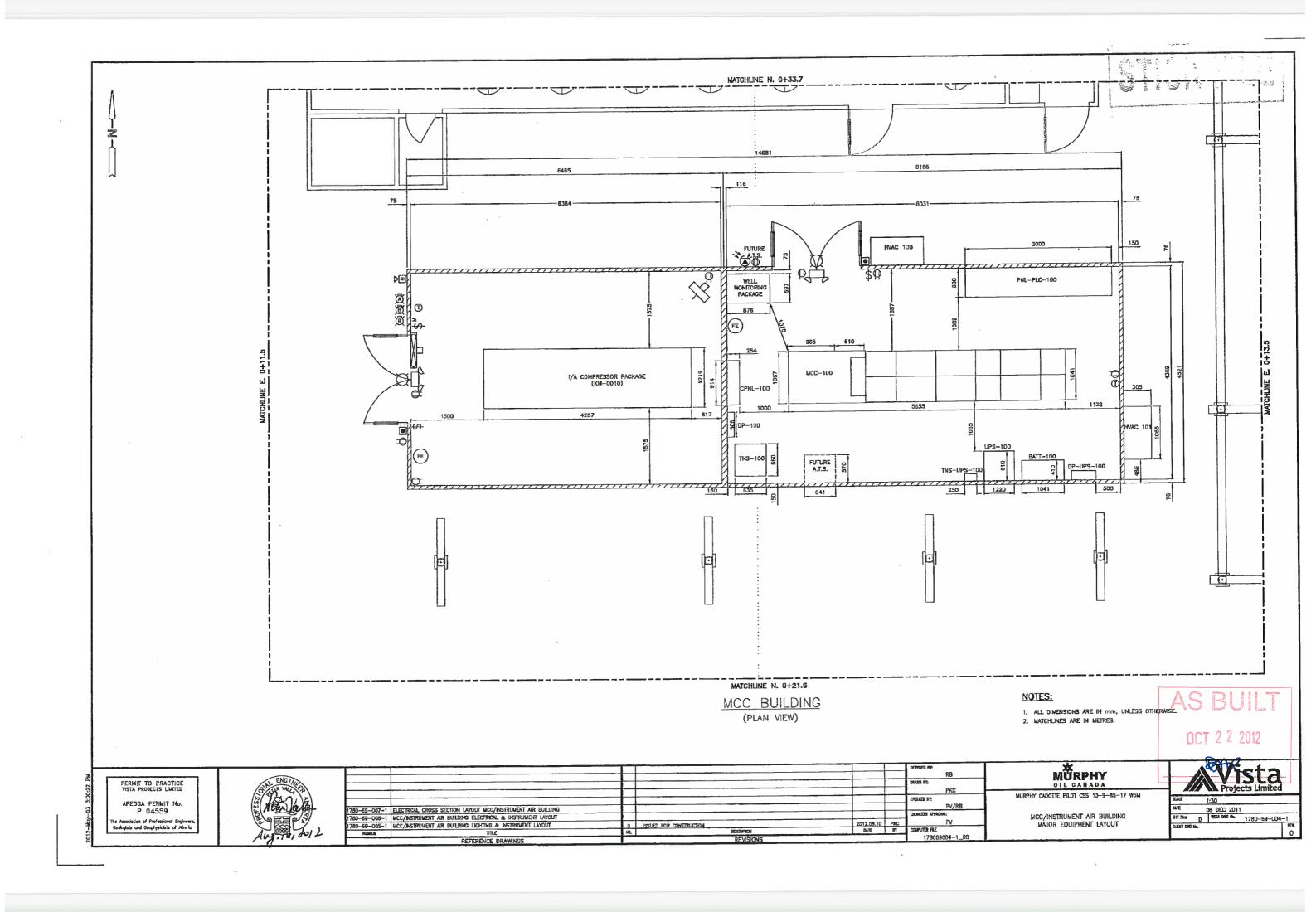
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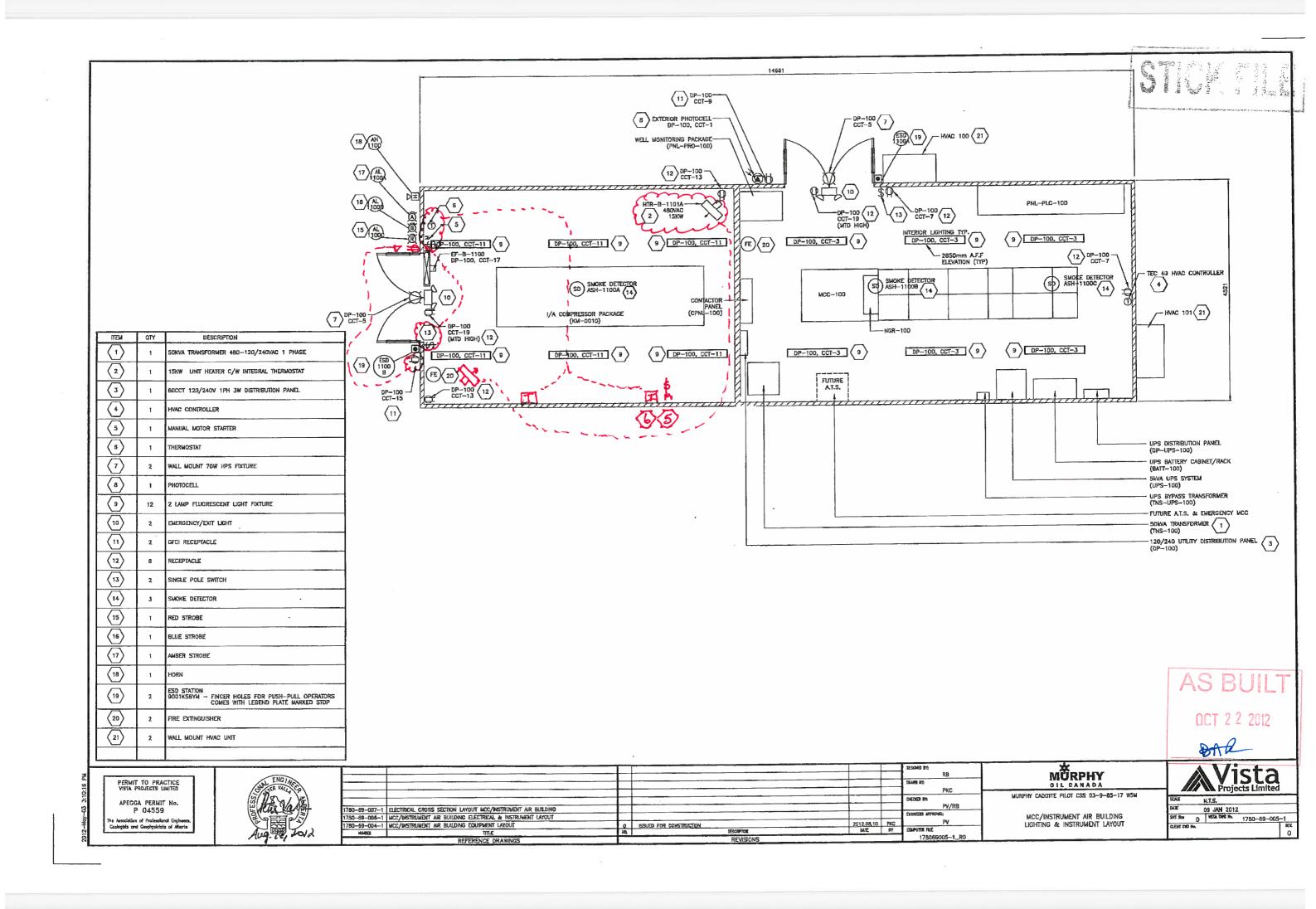


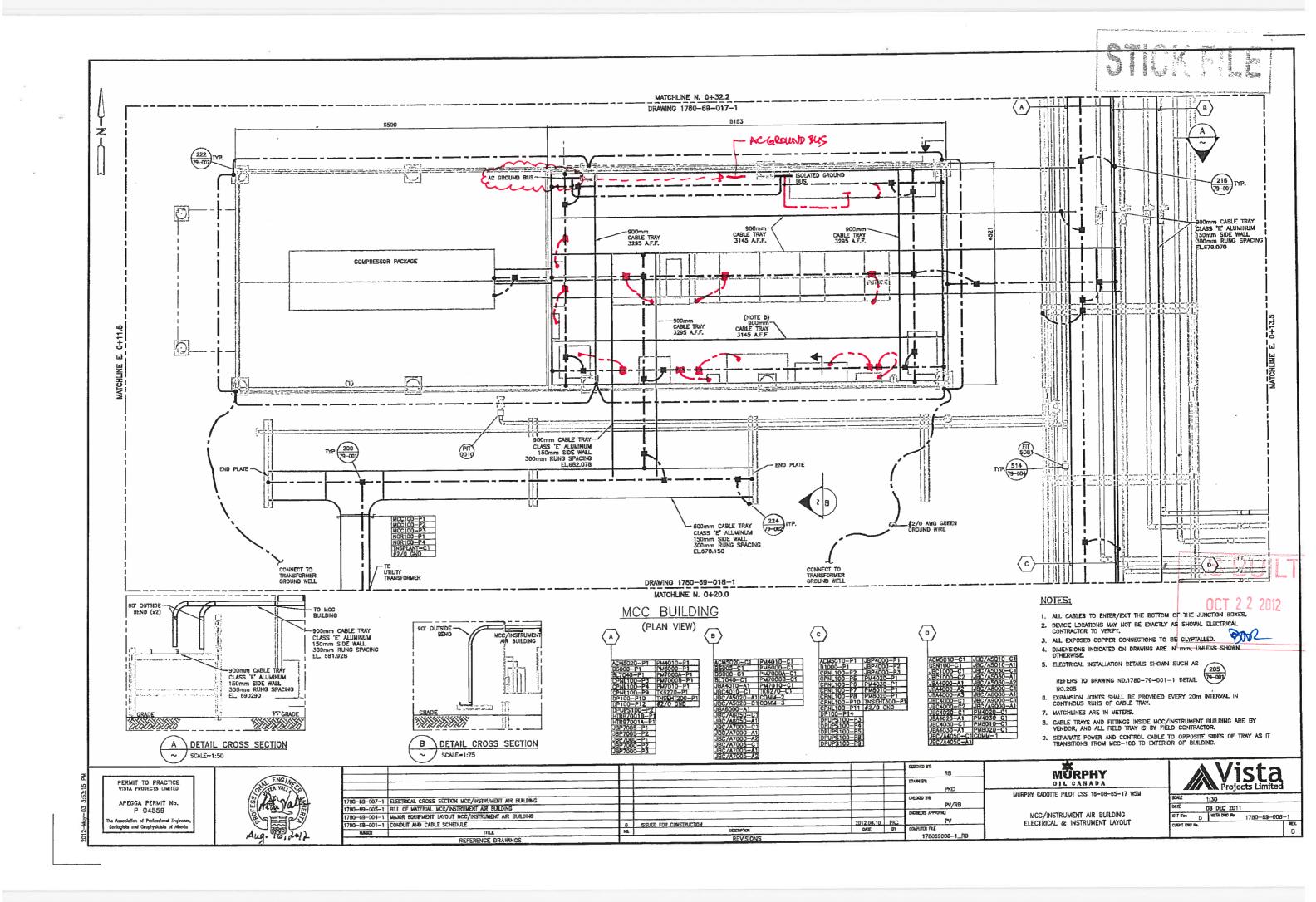


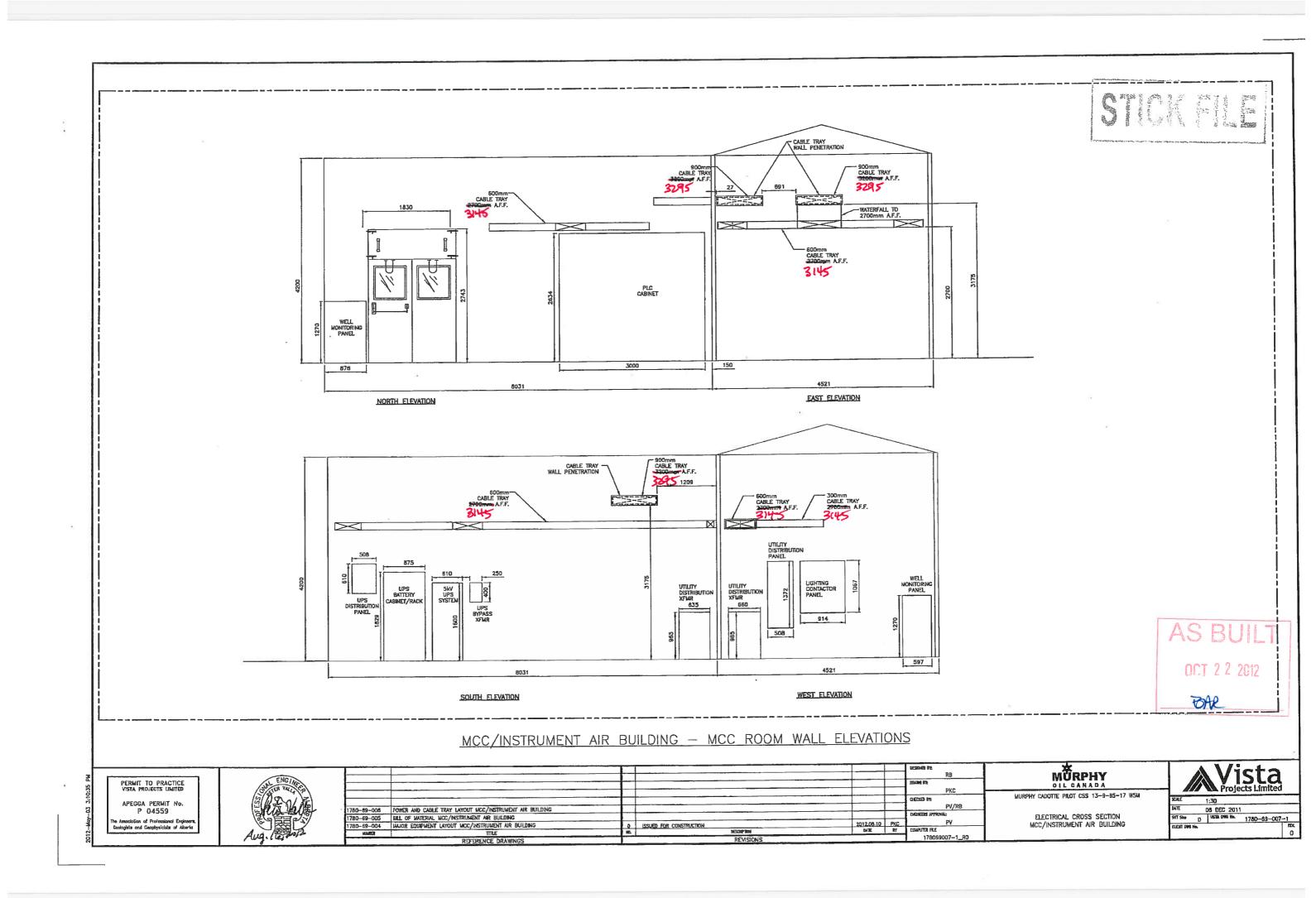
Murphy Cadotte Pilot CSS

1.8D:	16-08/13-08-065-17 WSM								
JOB NO.	1790	OWO. NO.	1700-00-001-7	P.EV					
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OTHERWISE.

PERMIT TO PRACTICE VISTA PROJECTS LIMITED APEGGA PERMIT No. P 04559

1780-69-004-1 WAIGE EQUIPMENT LAYOUT MCC/INSTRUMENT AIR BUILDING
1780-62-003-1 SINGLE LINE DIAGRAM MCC-100
1780-62-002-1 SINGLE LINE DIAGRAM MCC-100
1780-62-001-1 SINGLE LINE DIAGRAM MCC-100
MARKER 17TLE DECKED BY: 0 ISSUED FOR CONSTRUCTION
NO. 178069040-1_RO REFERENCE DRAWINGS

MULPHY CADOTTE PILOT CSS 15-08-85-17 W5M MCC/INSTRUMENT AIR BUILDING MCC-100 FRONT ELEVATION LAYOUT

MÜRPHY

OIL CANADA

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DUE 01 MAY 2012

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REAR ELEVATION MOTOR CONTROL CENTER (MCC-100)

OCT 2 2 2012

NOTES:

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APEGGA PERMIT No. P 04559 Association of Professional Engineers alogists and Geophysicists of Alberta

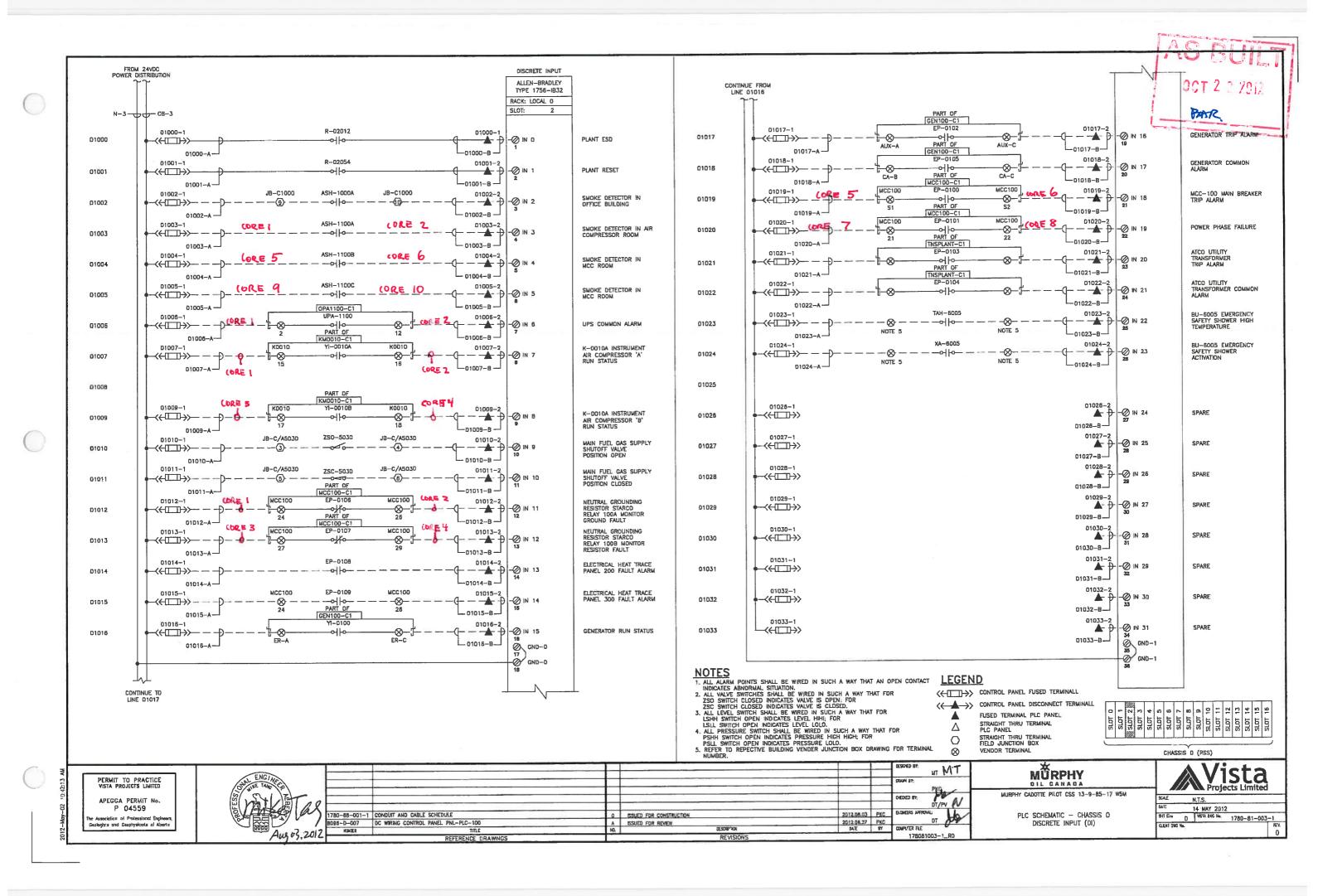


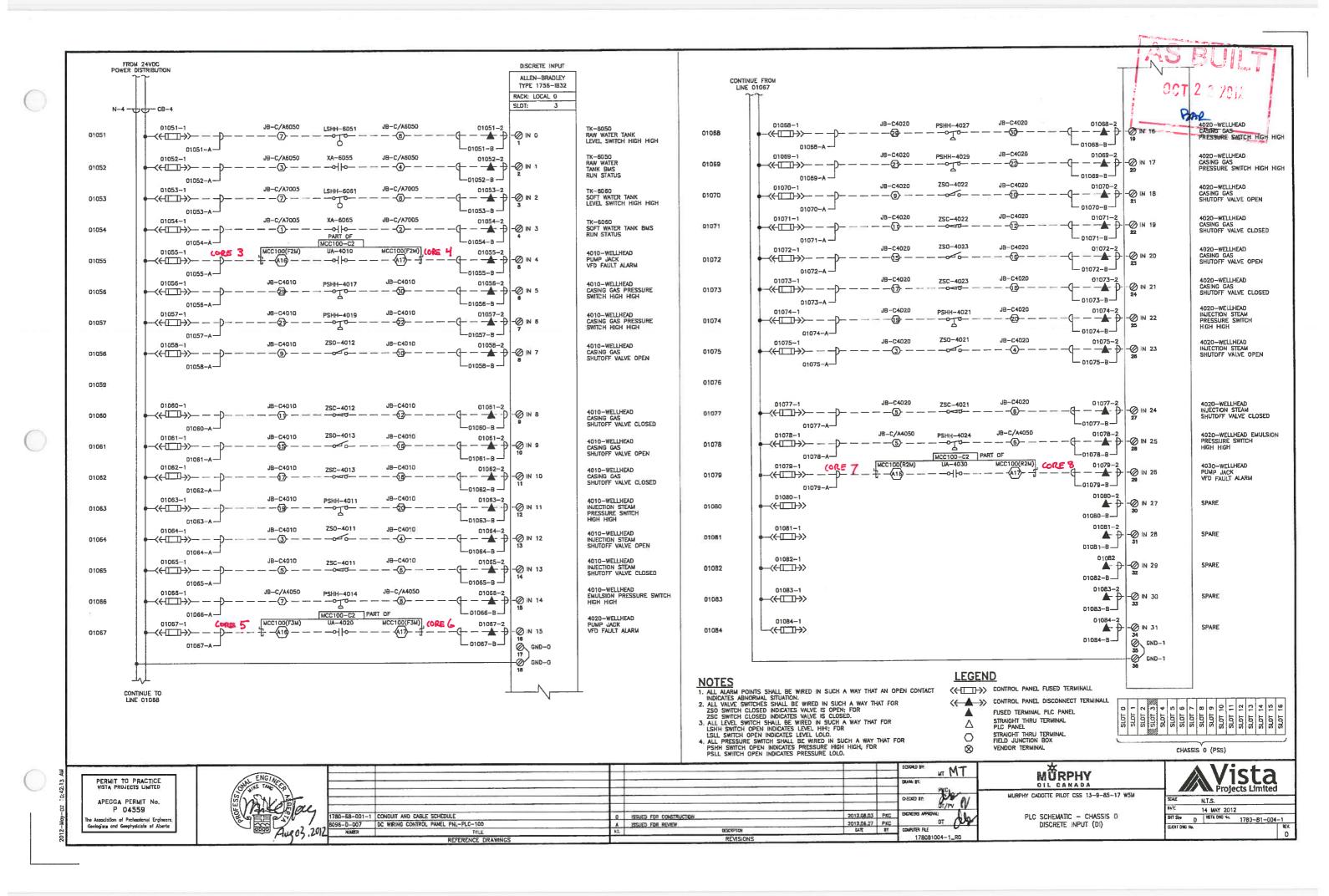
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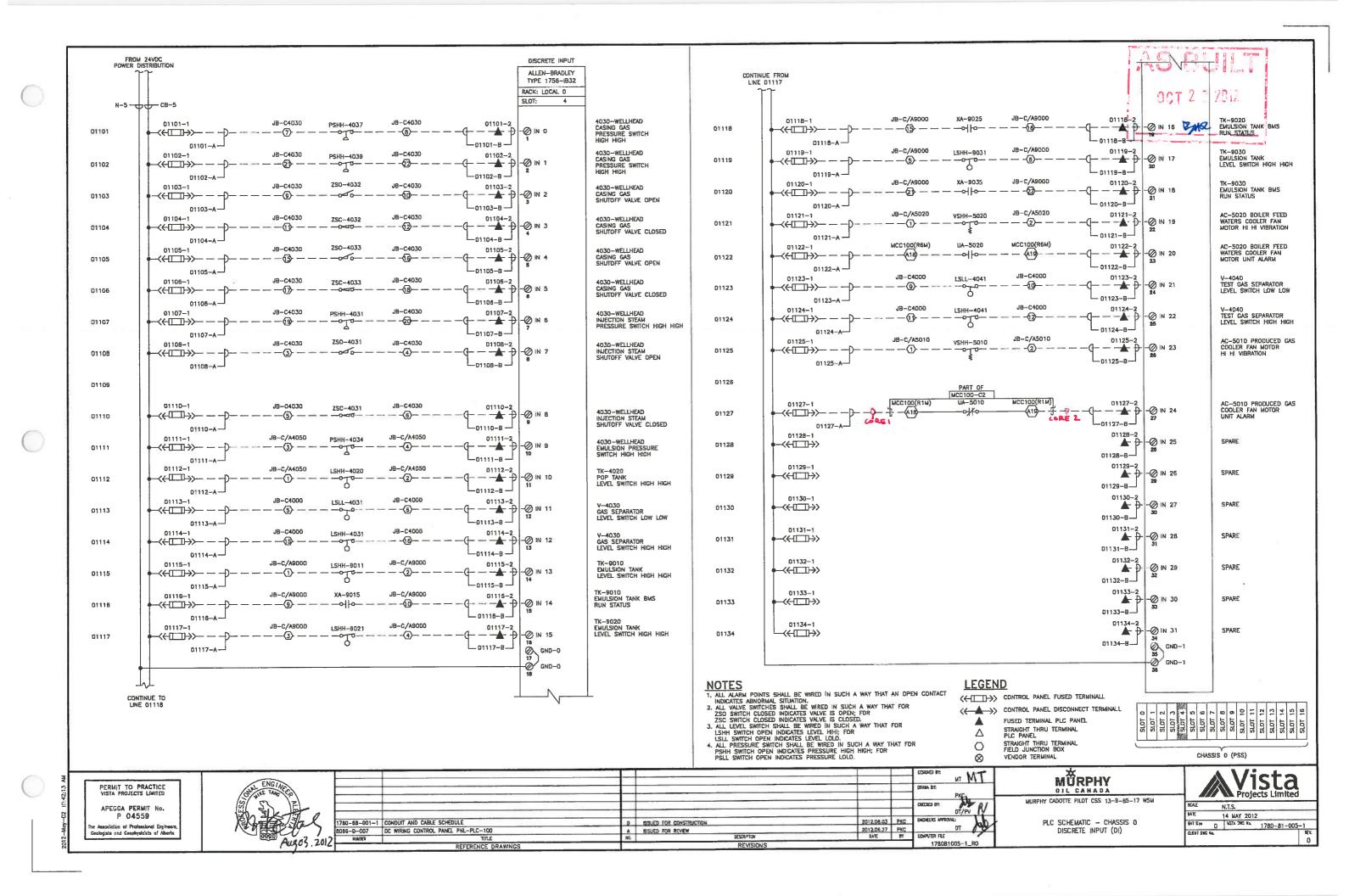
MURPHY
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MULPHY CADOTTE PILOT CSS 16-08-85-17 WSM MCC/INSTRUMENT AIR BUILDING
MCC-100 REAR ELEVATION
DETAIL

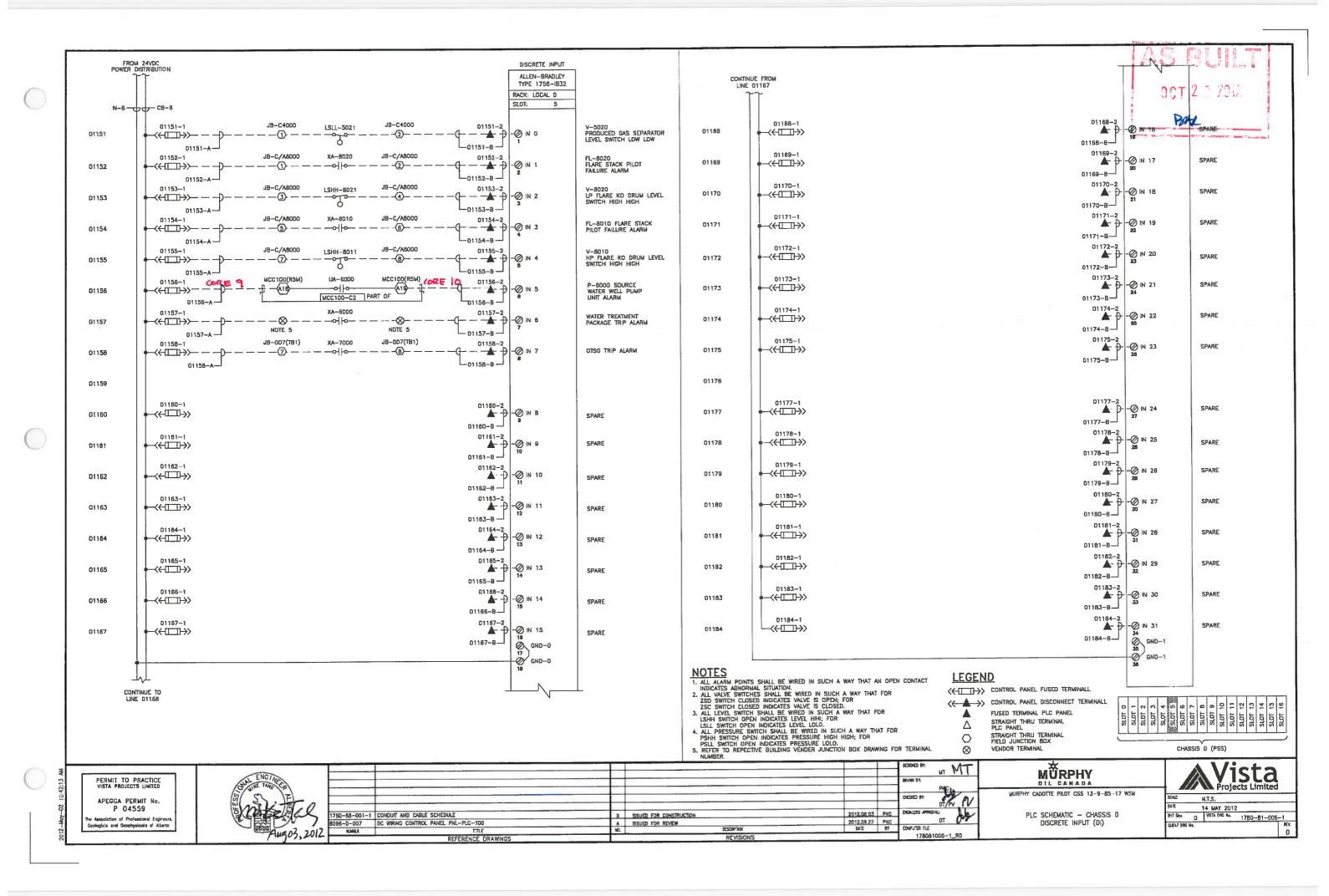
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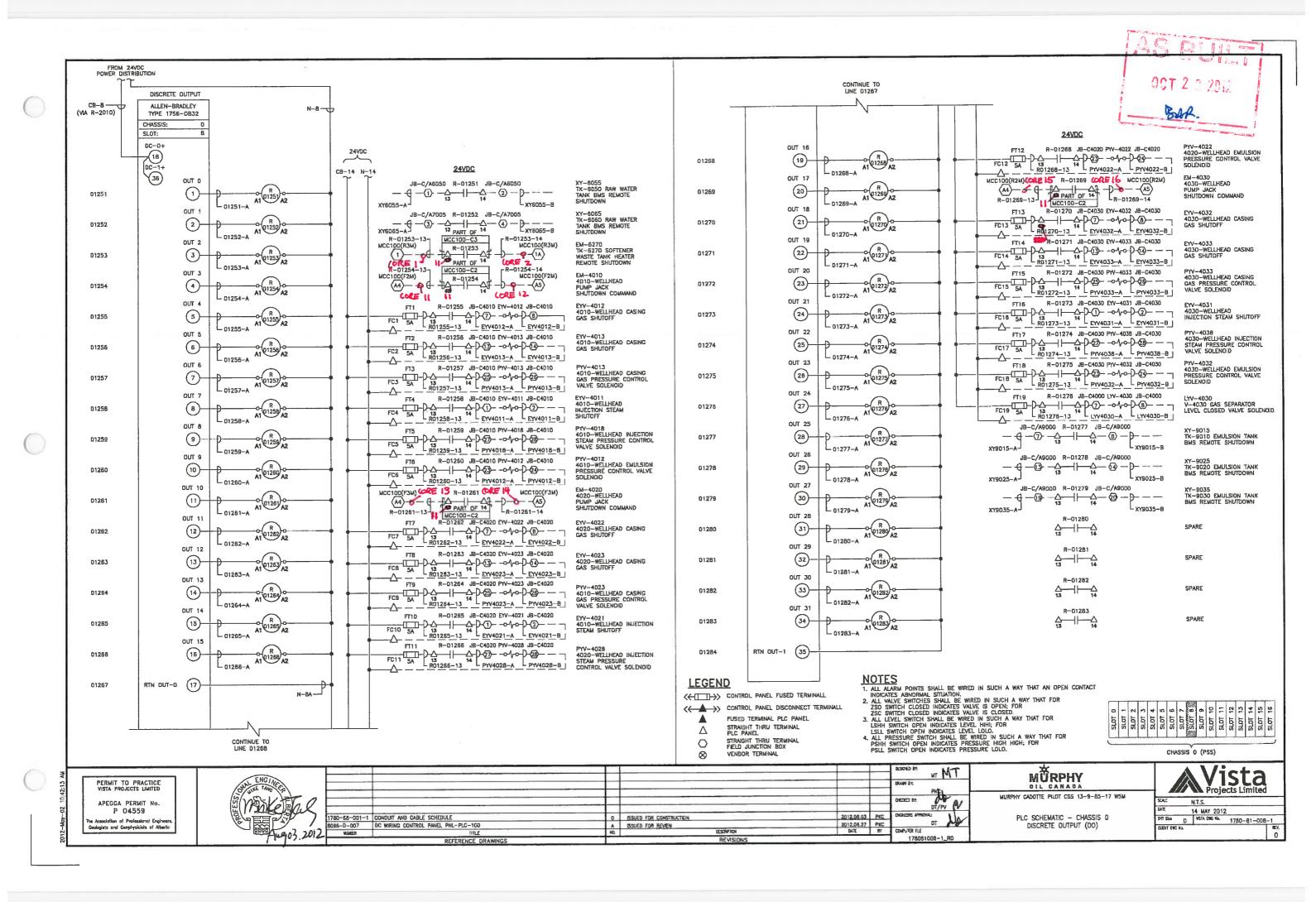
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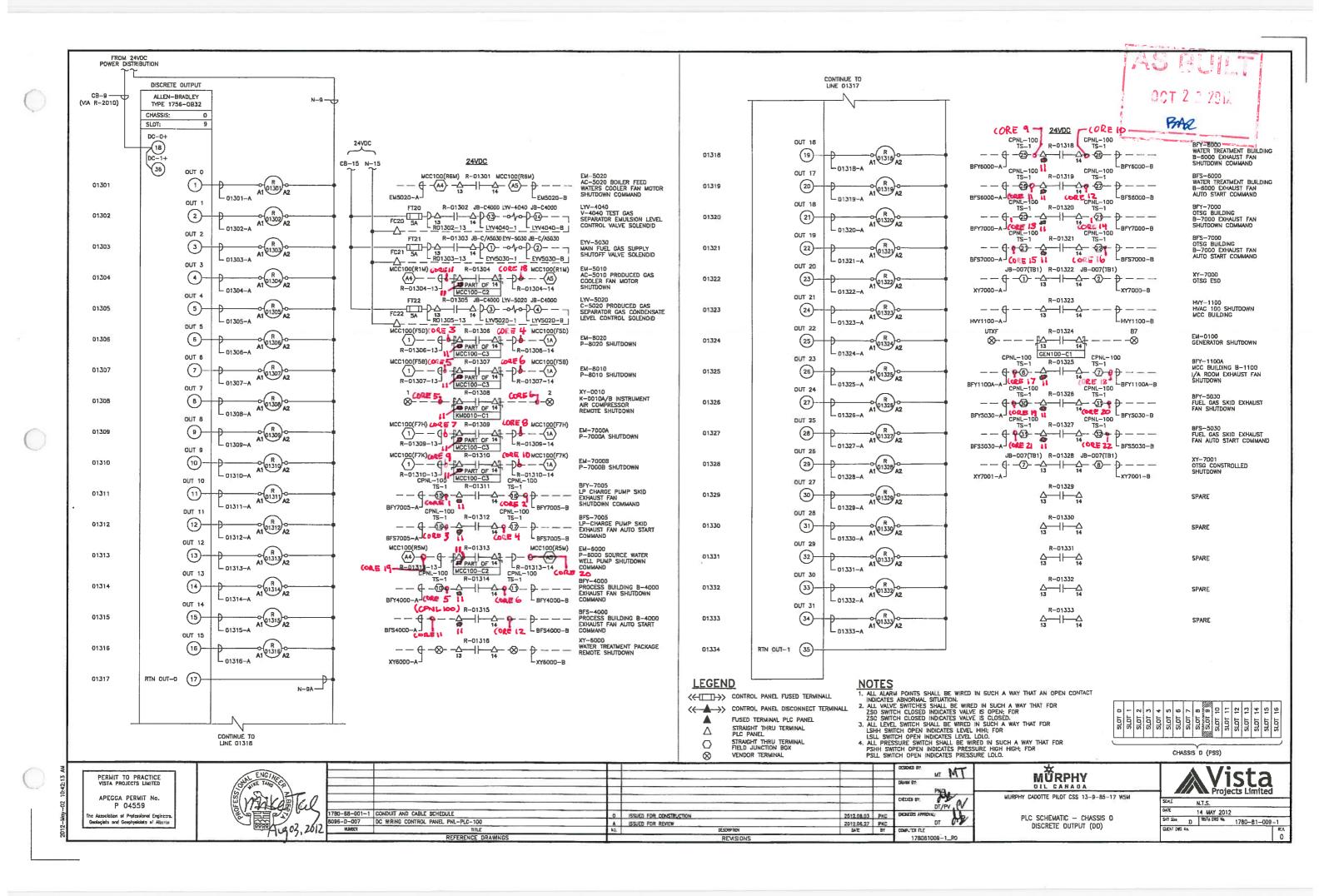


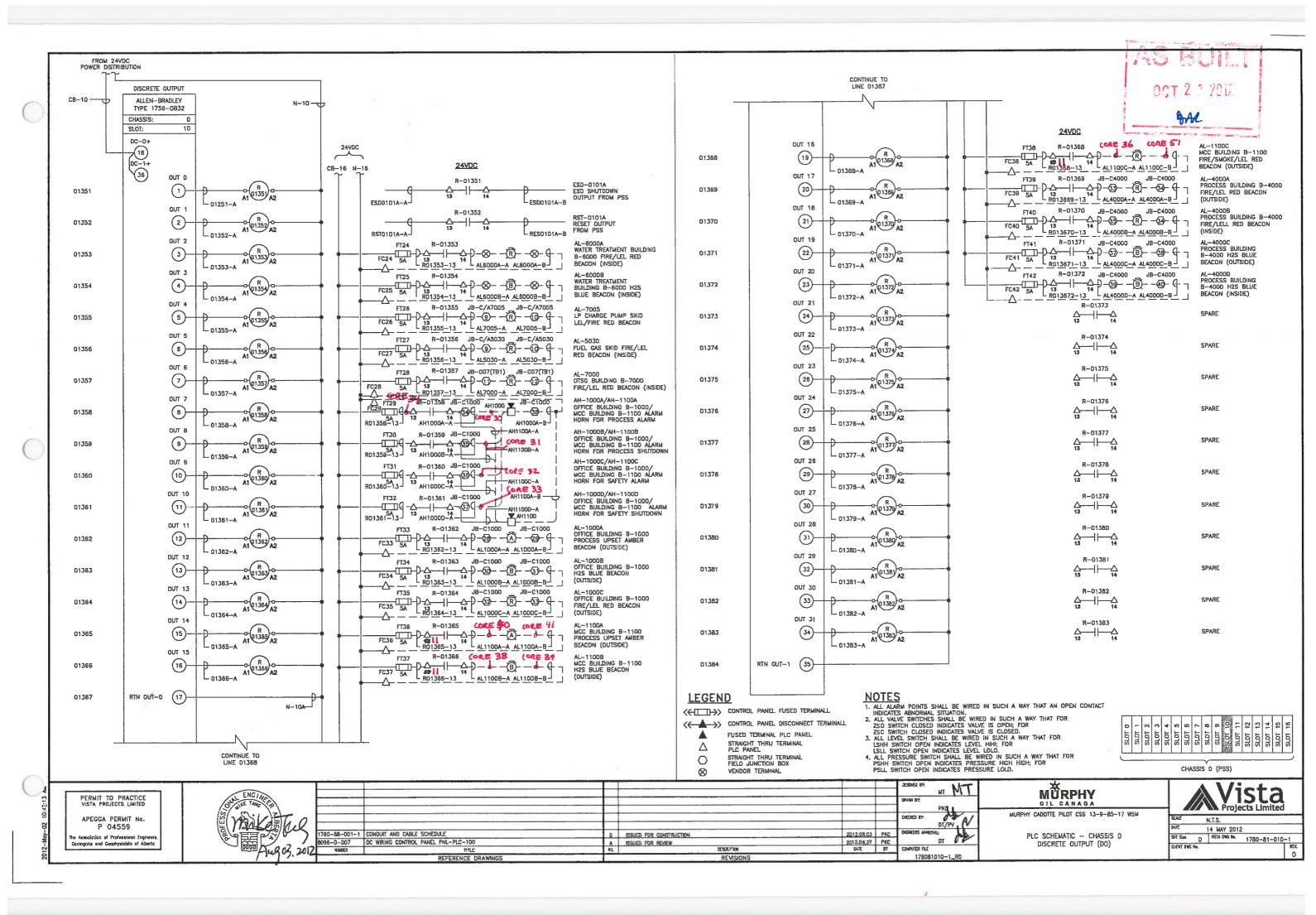


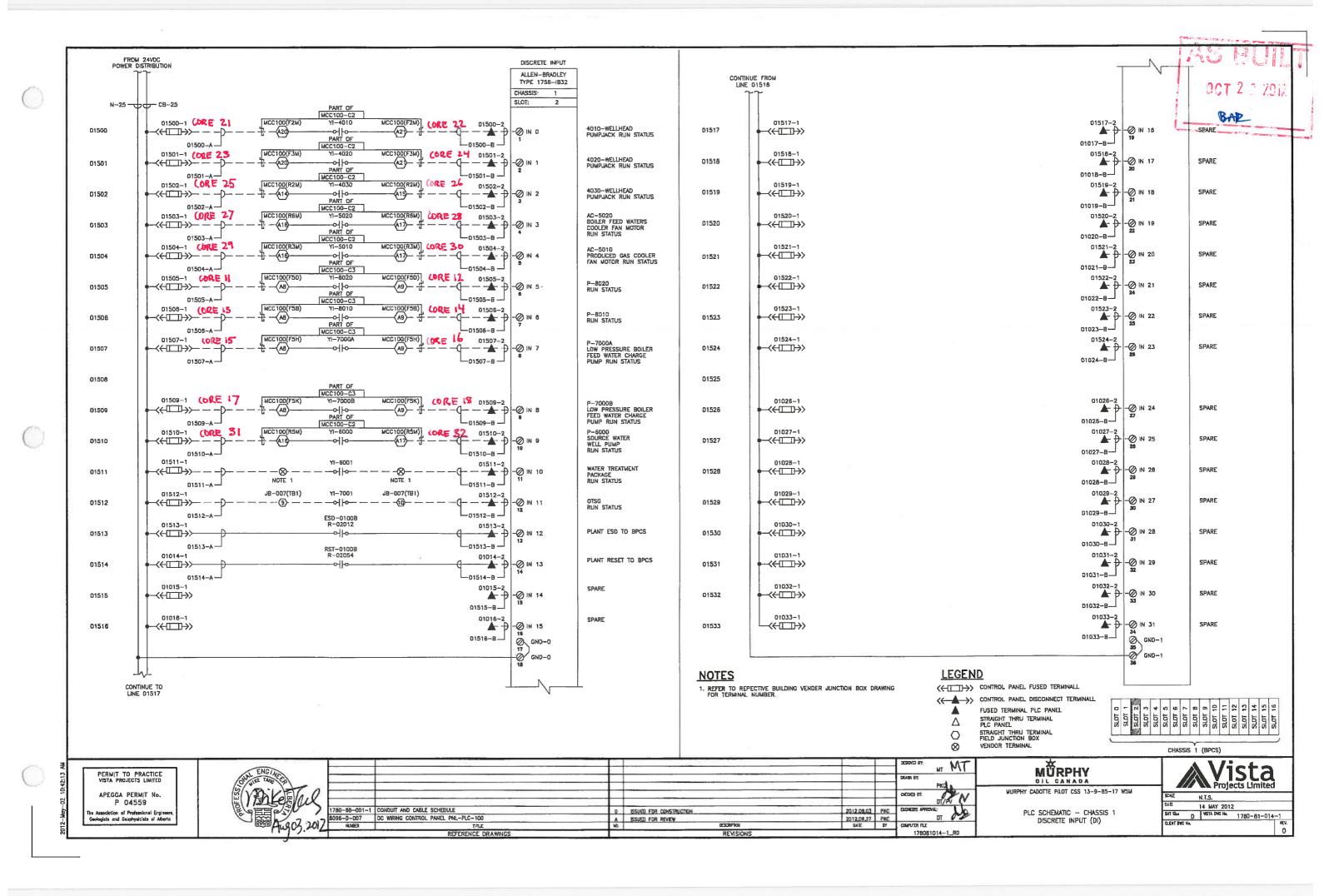


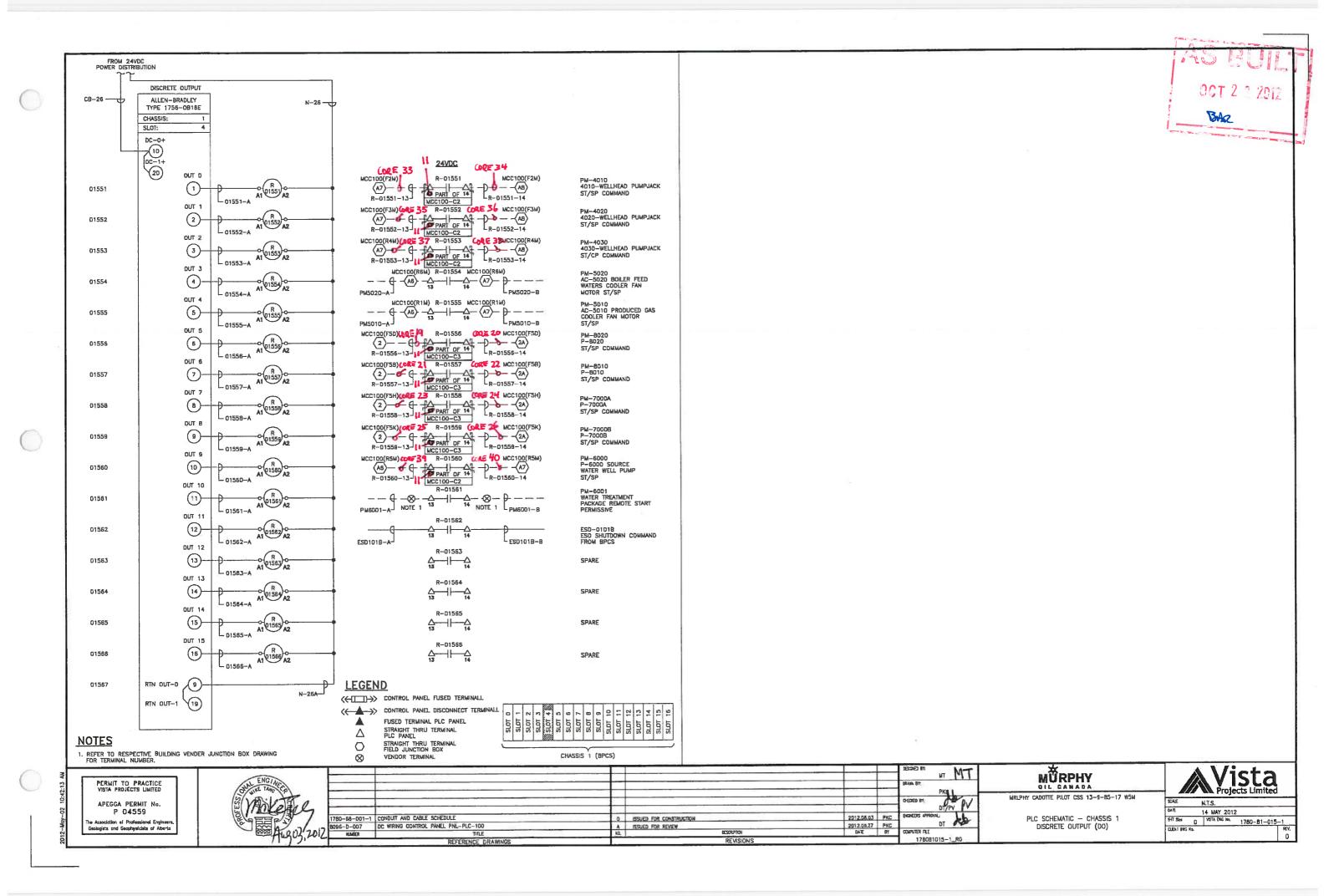


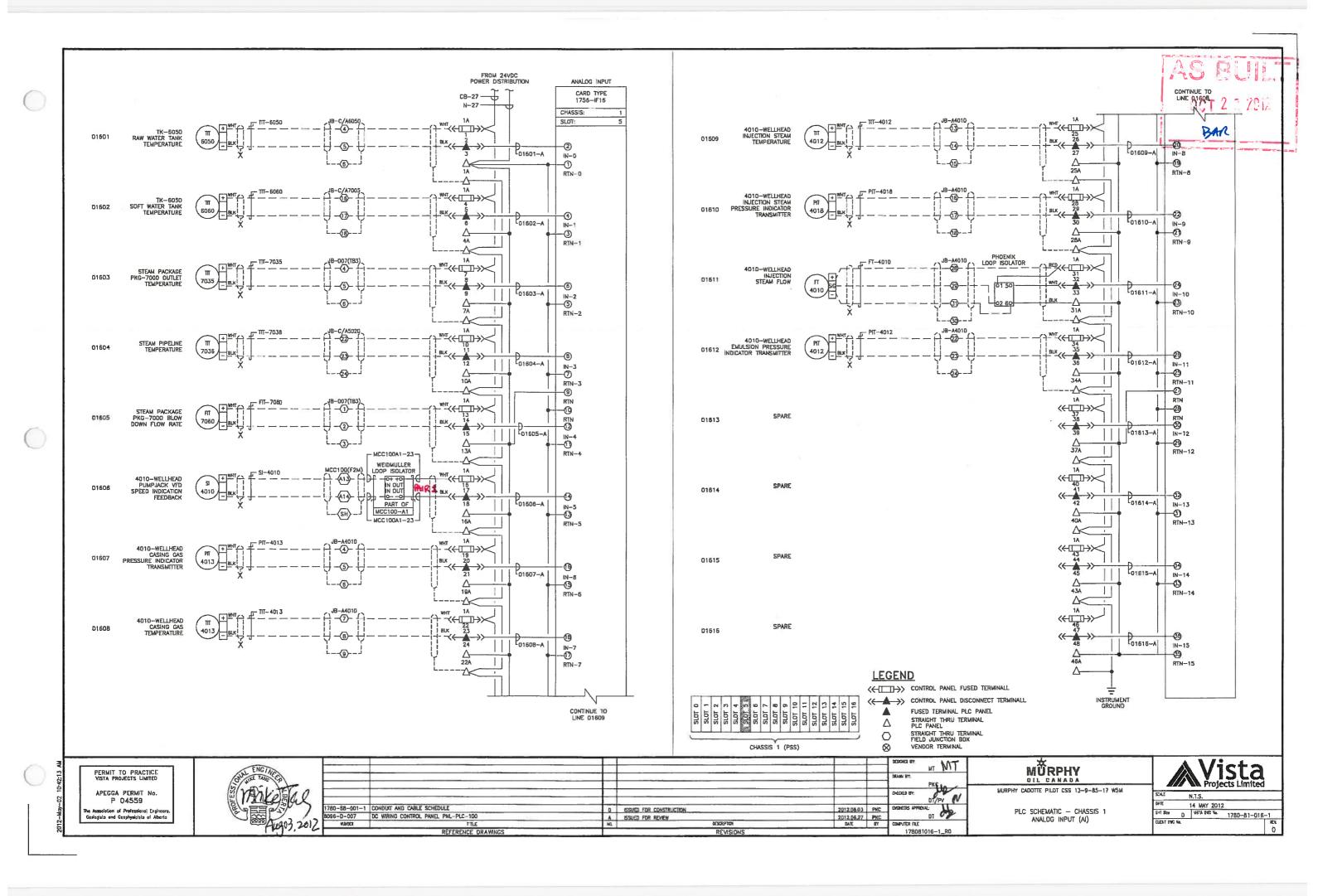


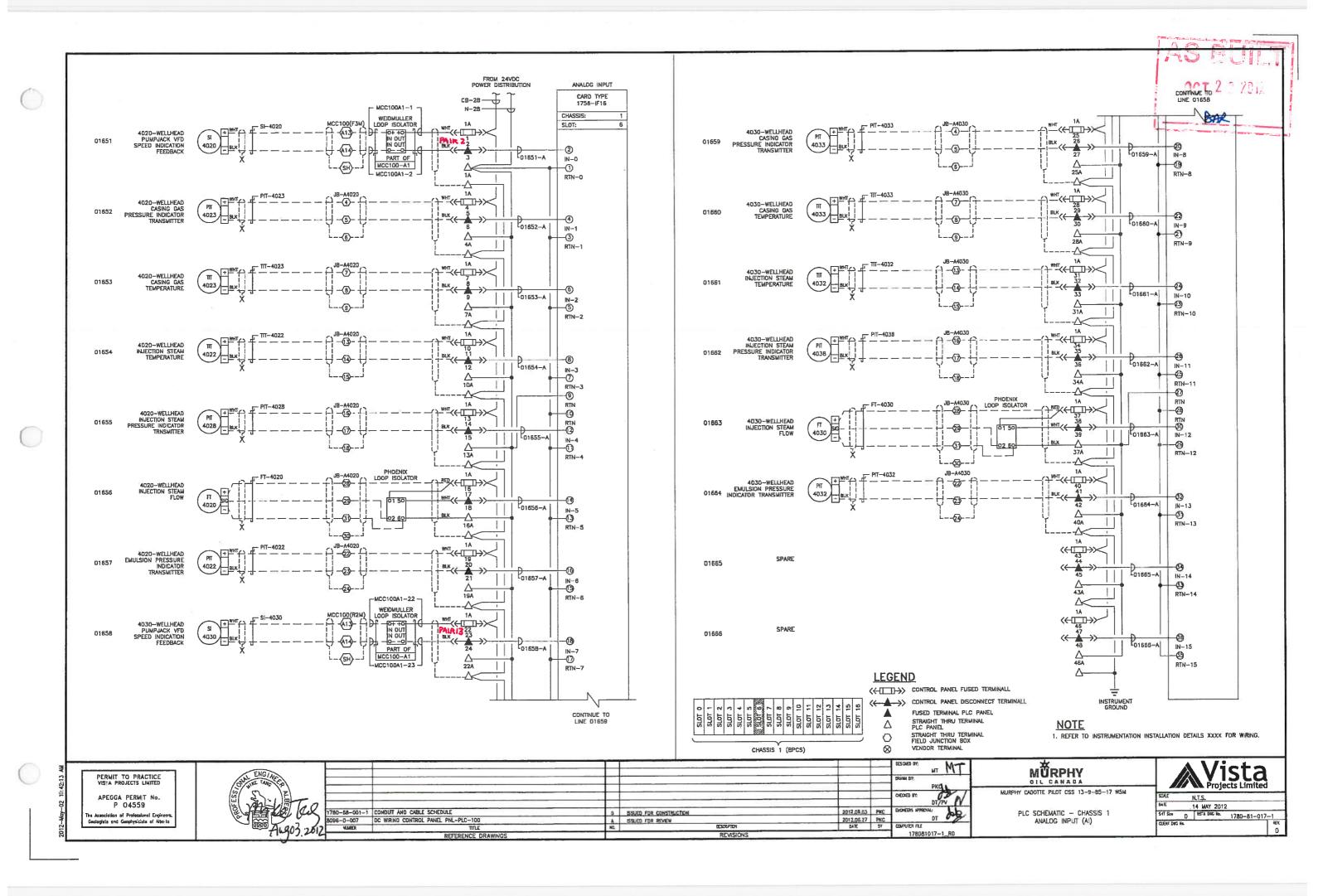


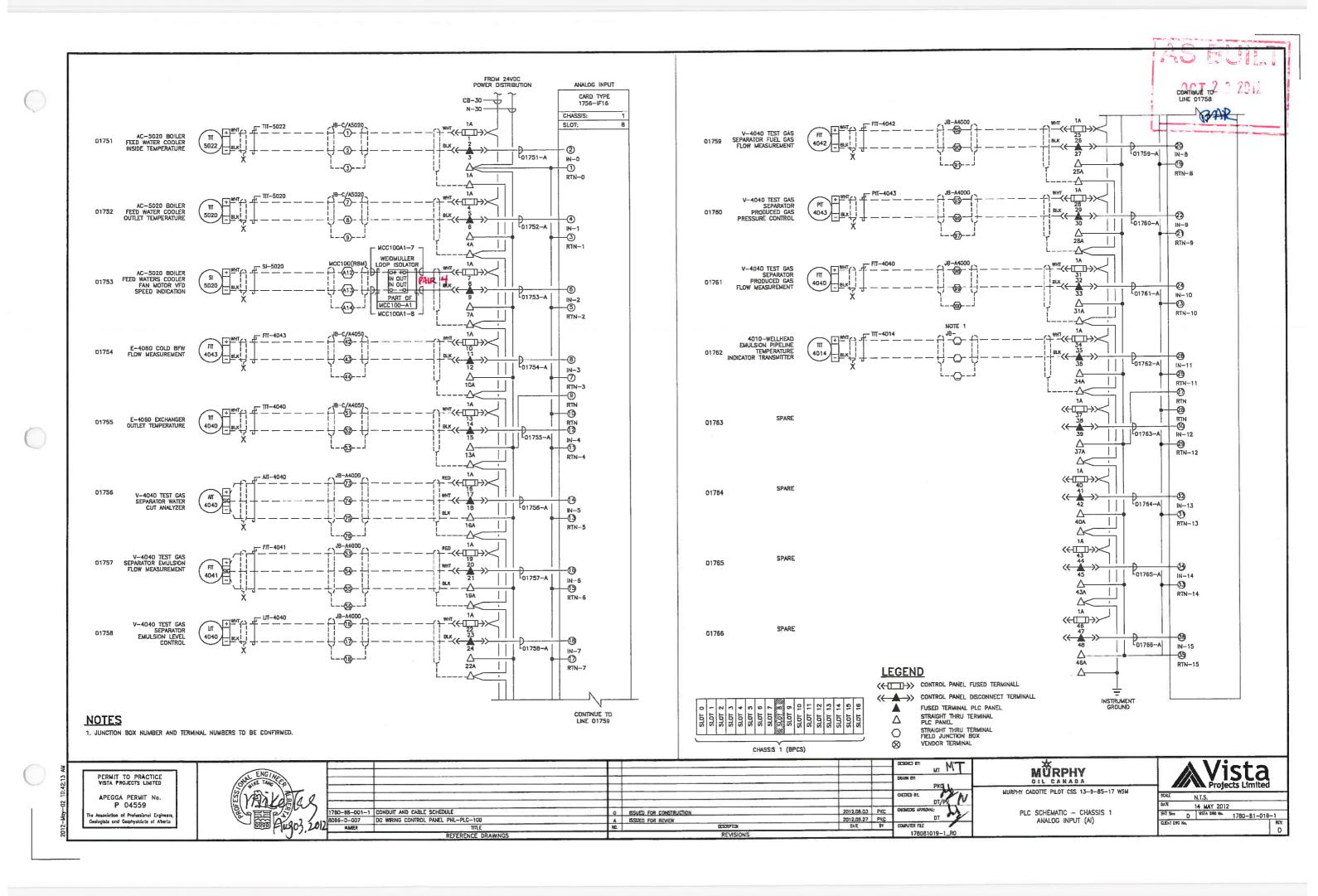


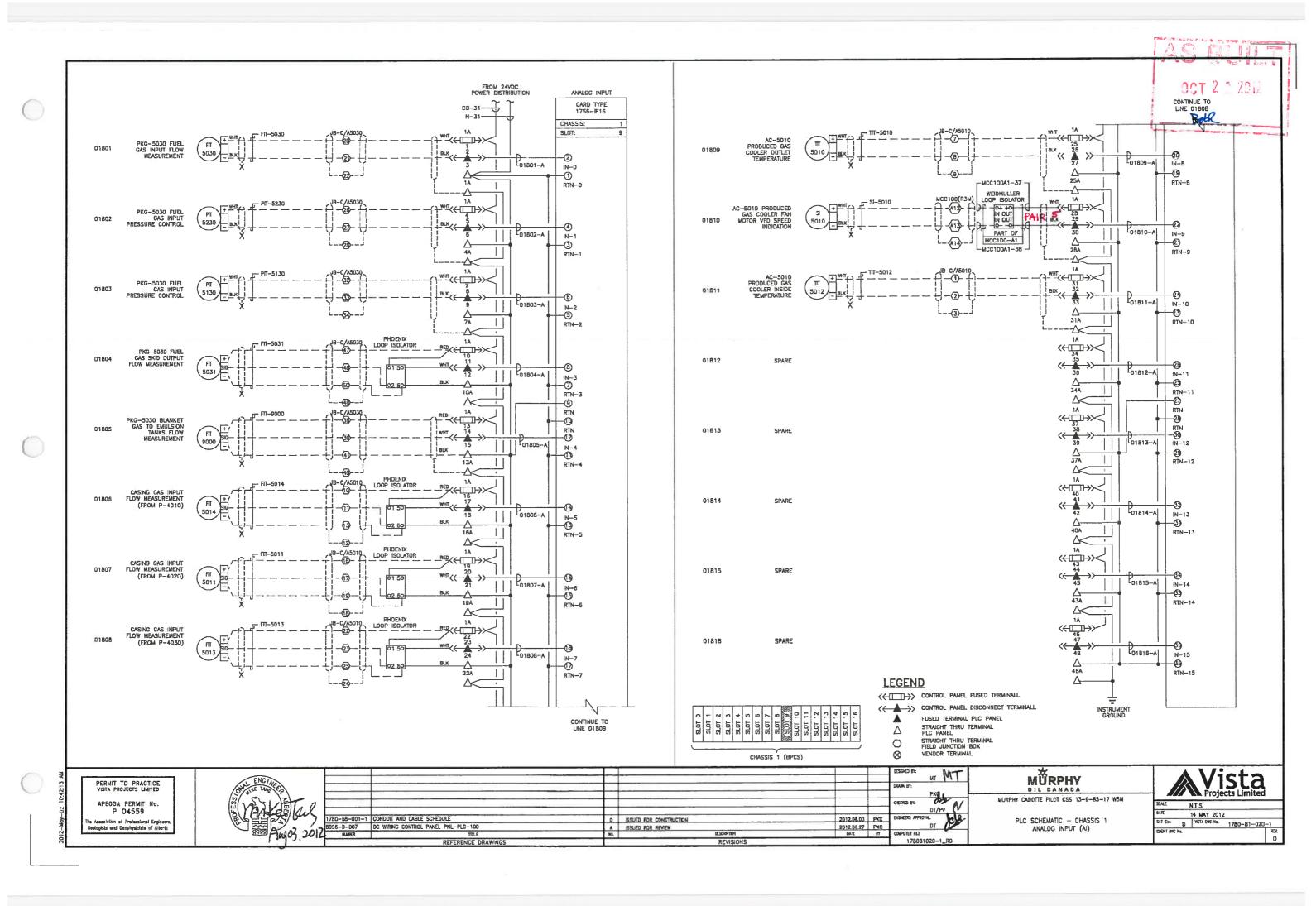


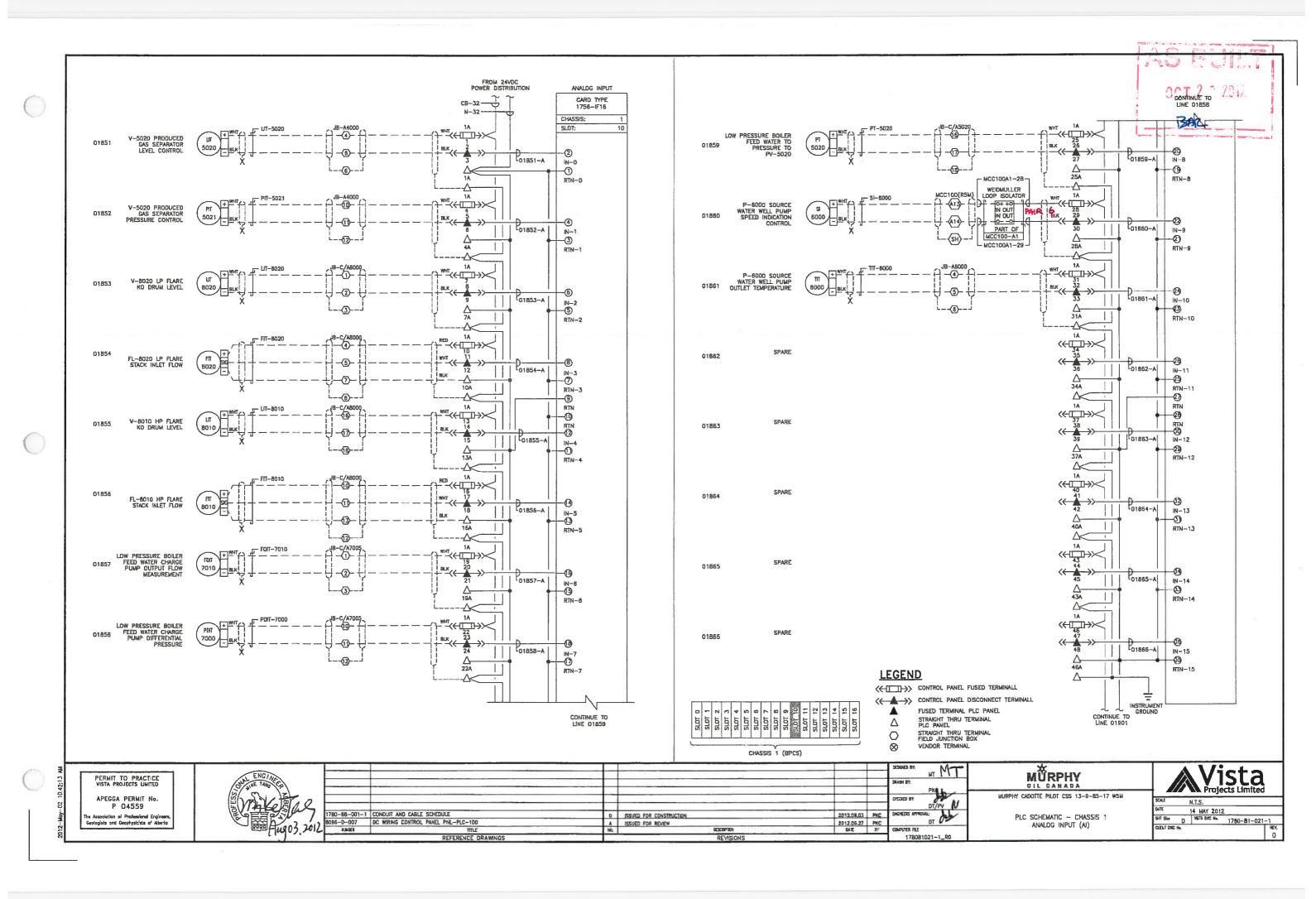


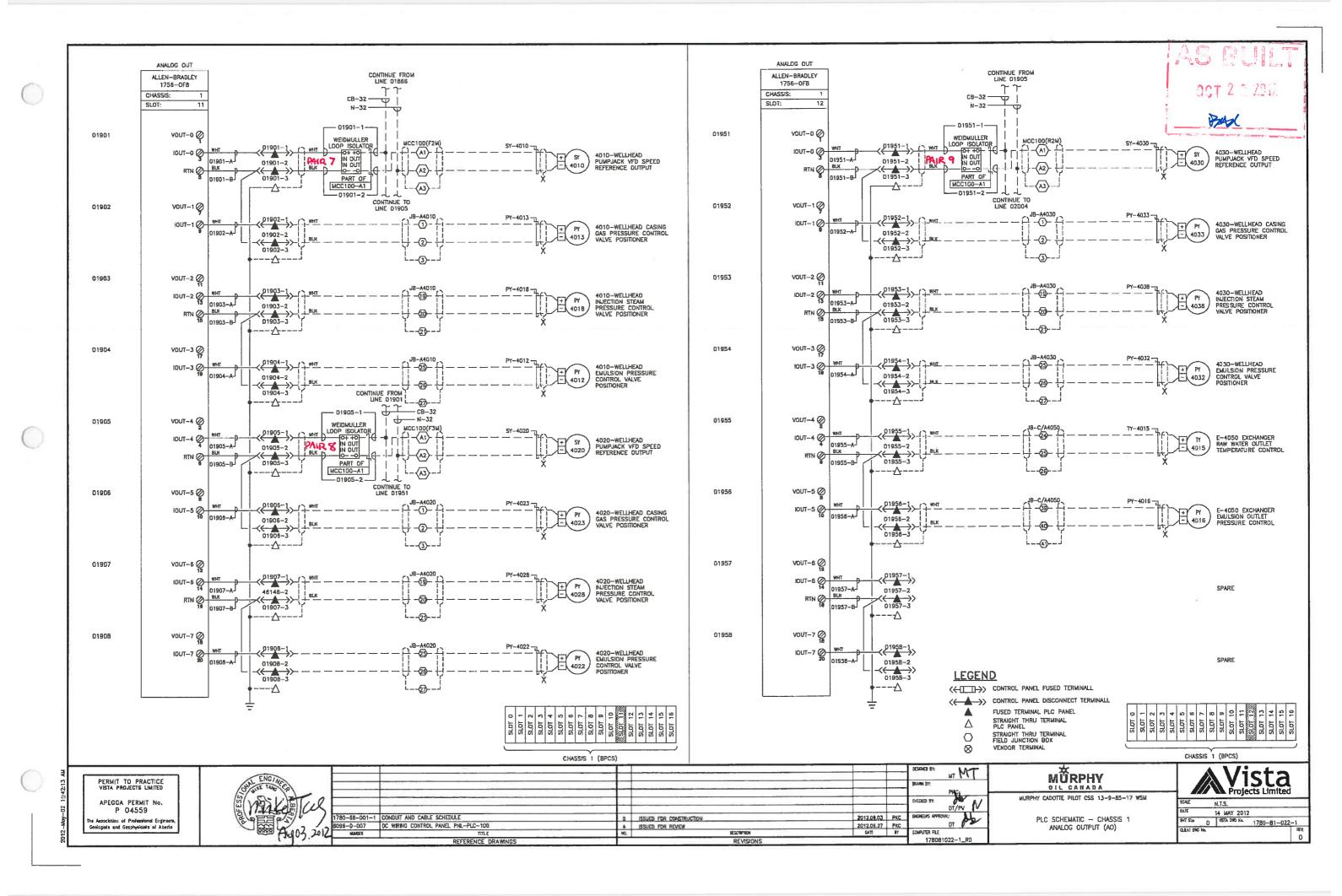


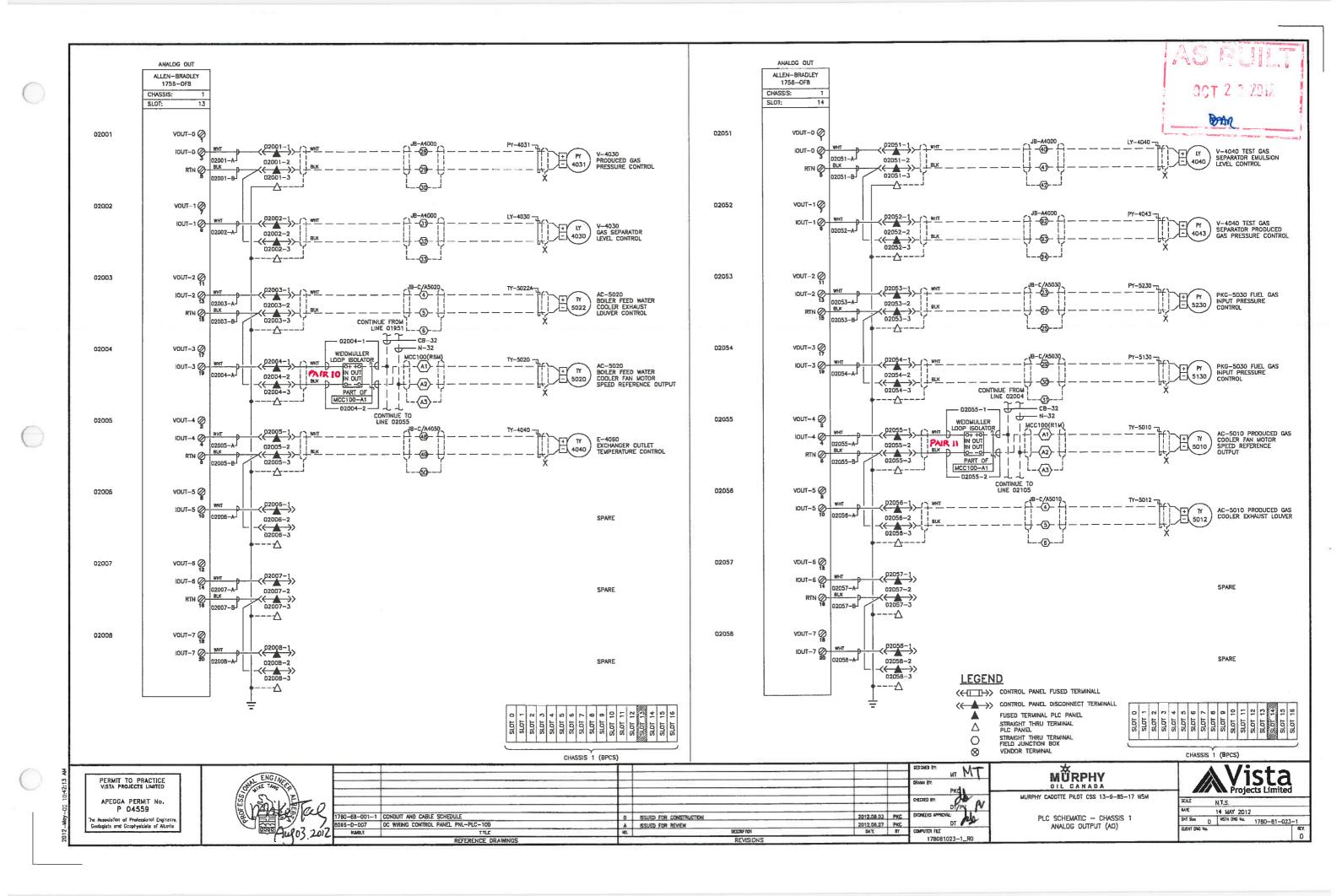


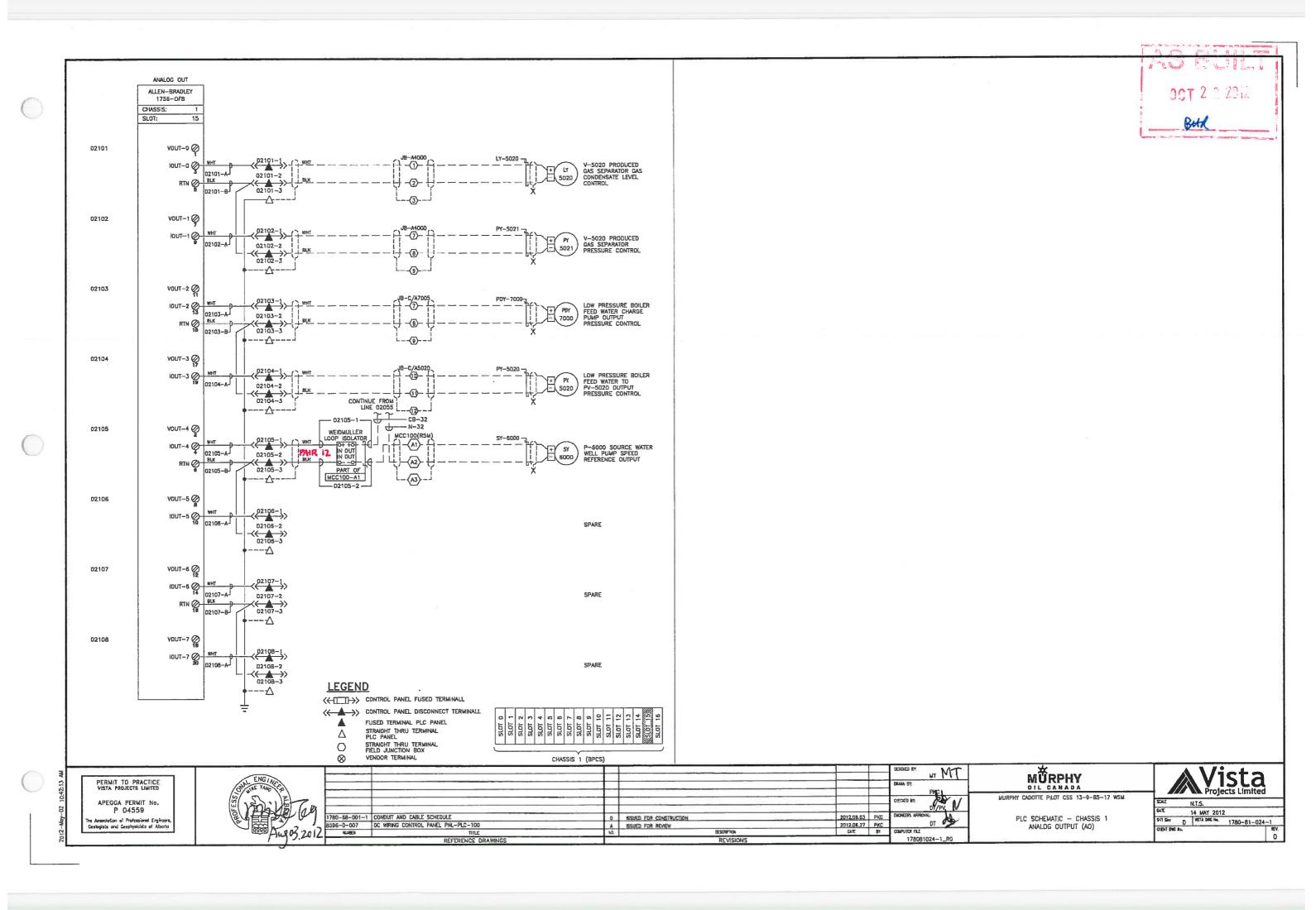


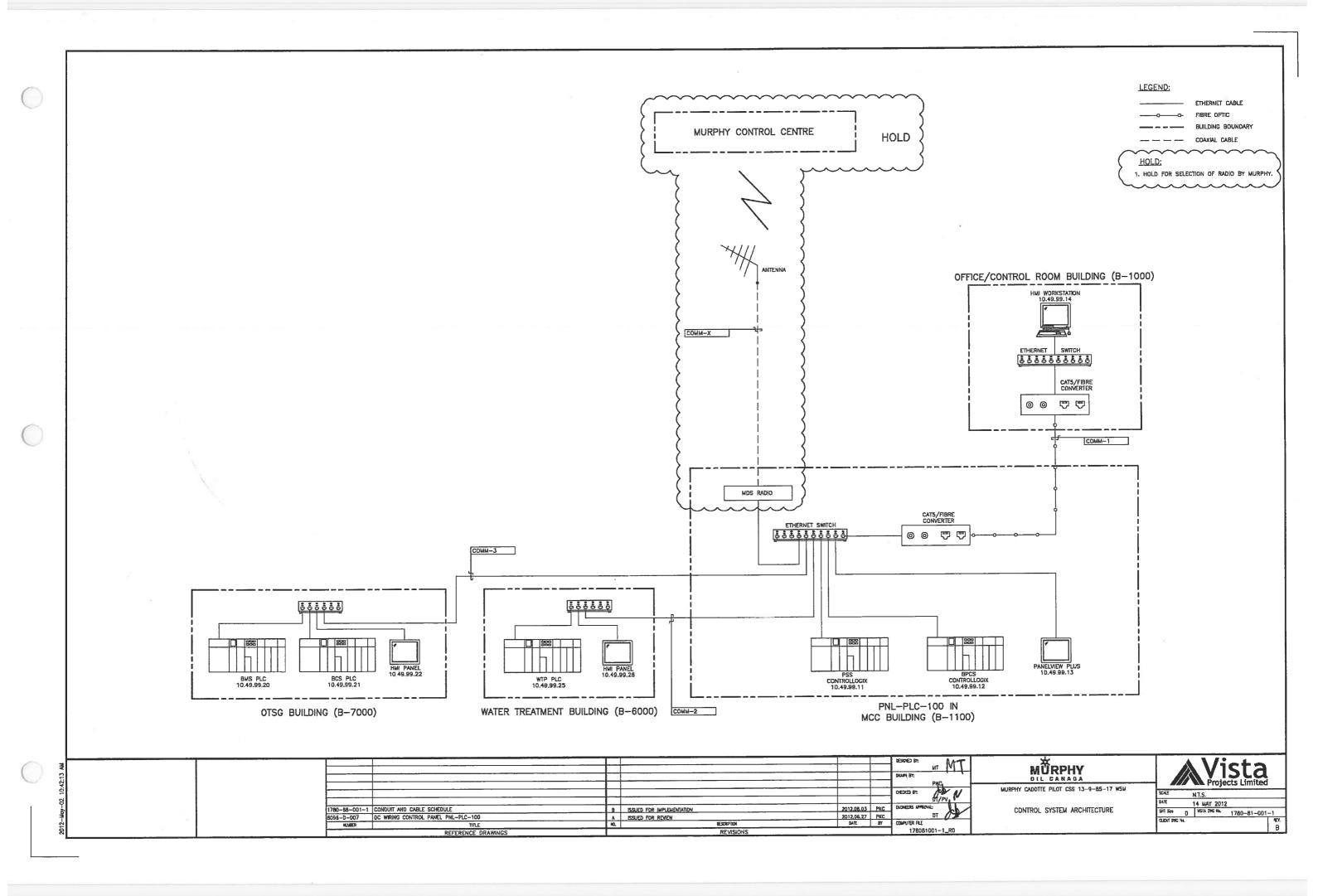


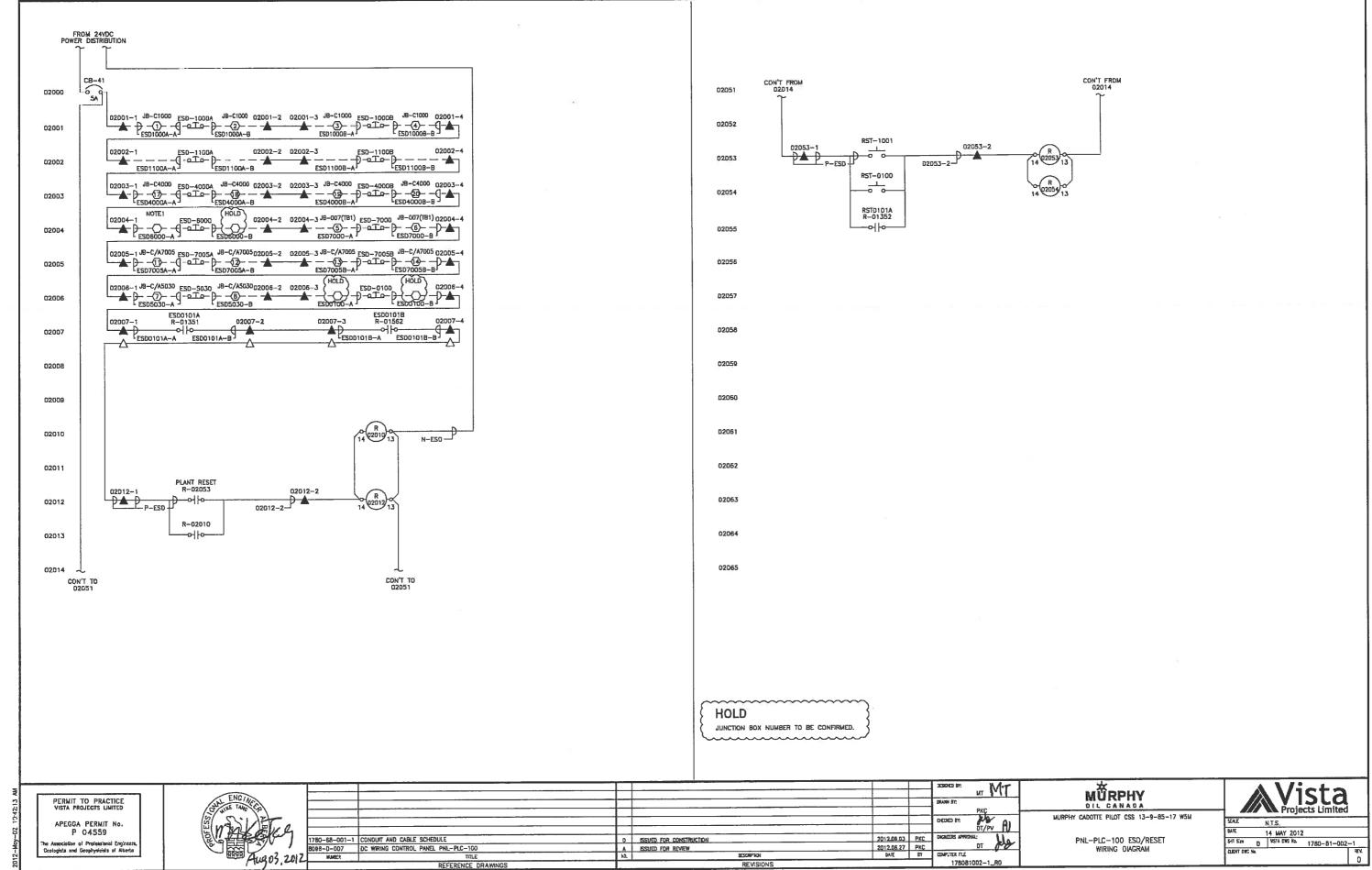












0 ISSUED FOR CONSTRUCTION
A ISSUED FOR REVIEW

REFERENCE DRAWINGS

DESCRIPTION

2012.08.03 PKC

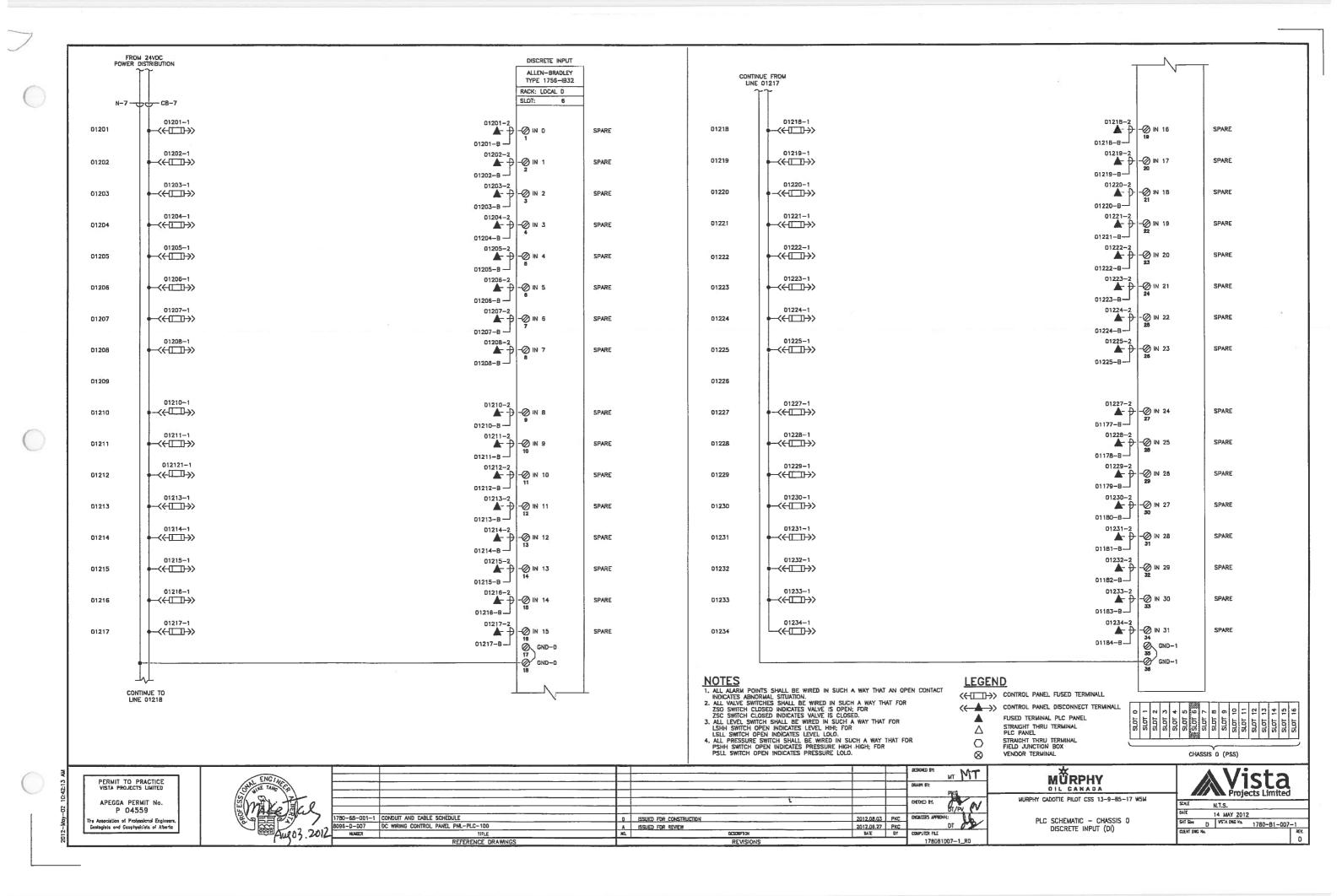
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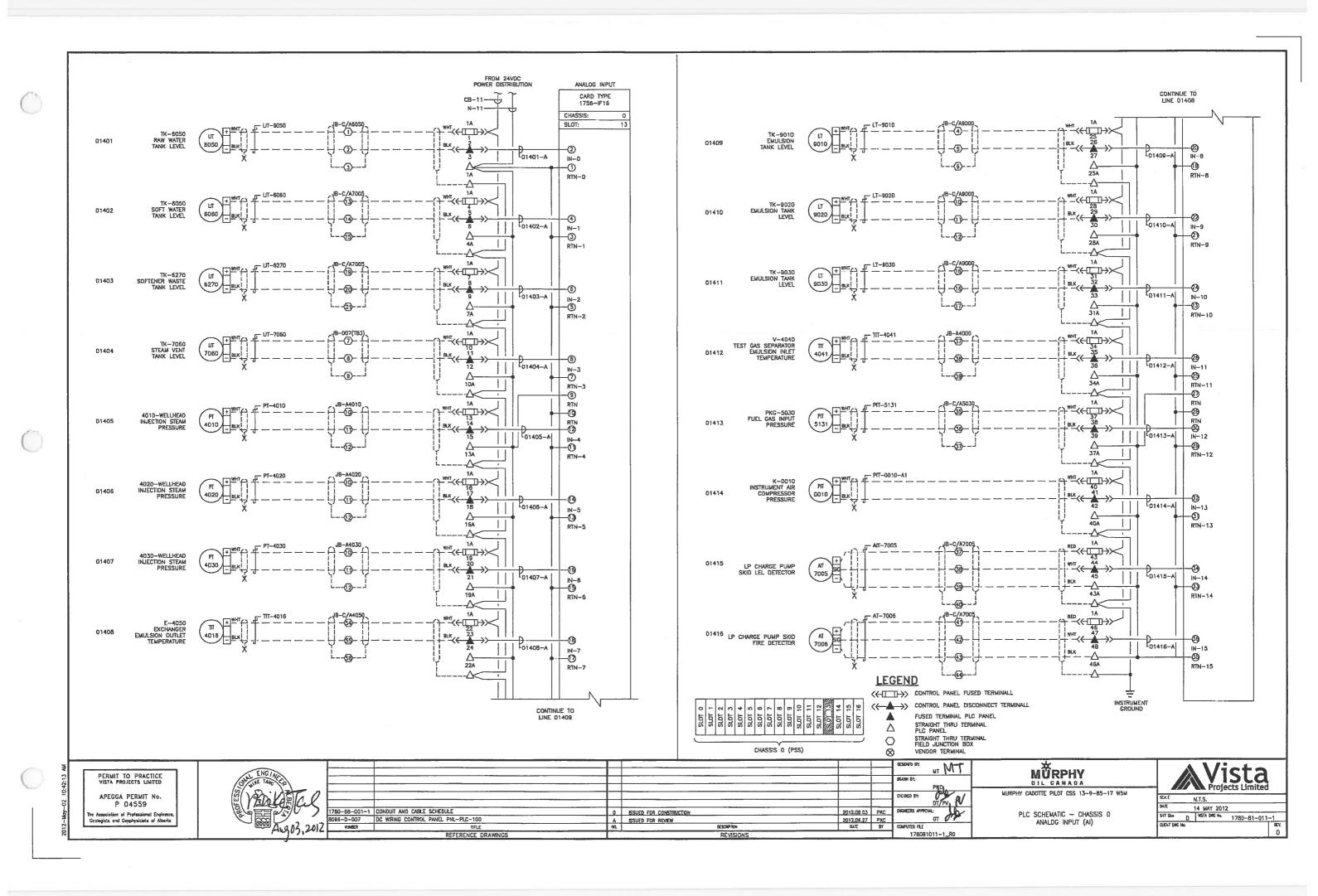
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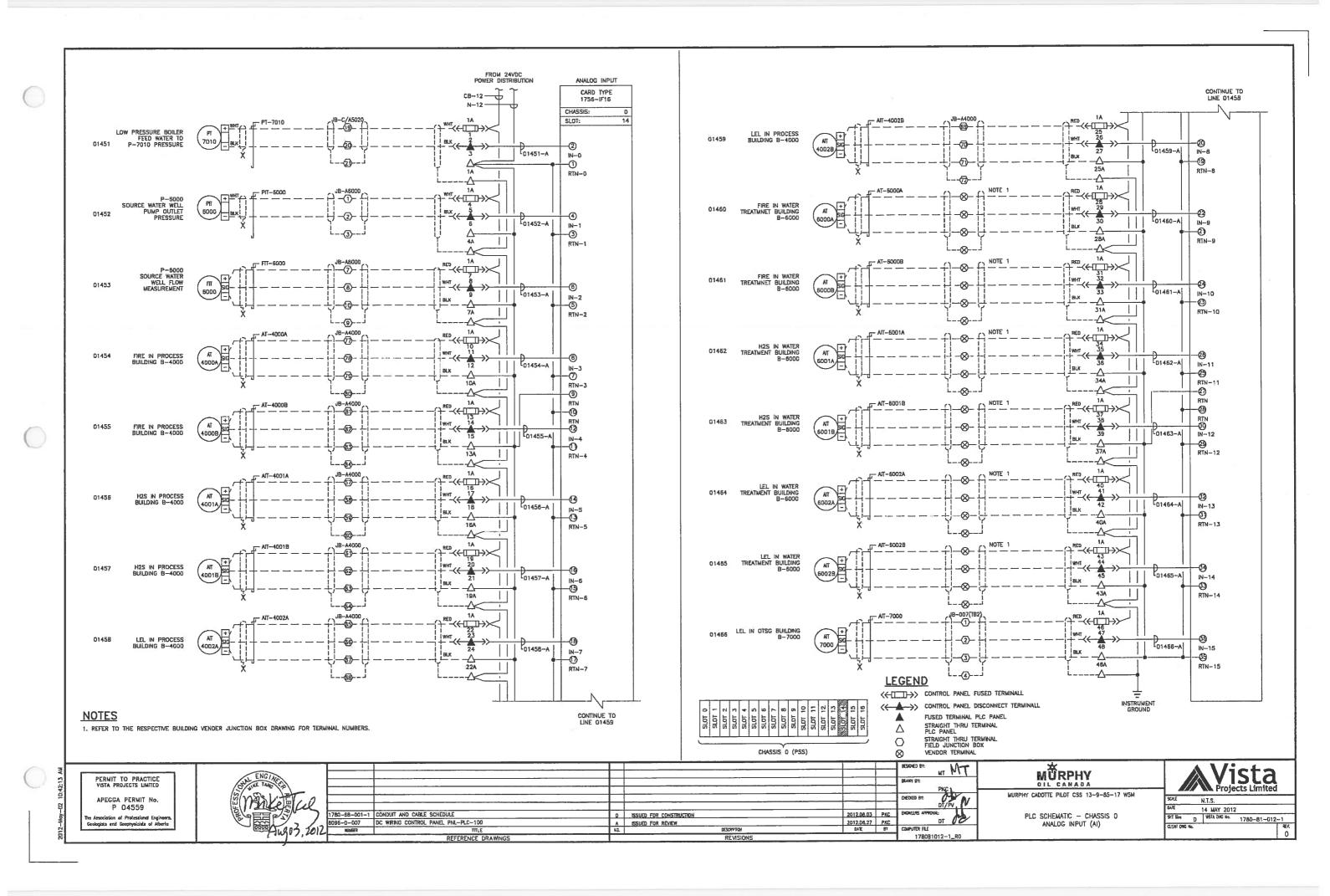
PNL-PLC-100 ESD/RESET

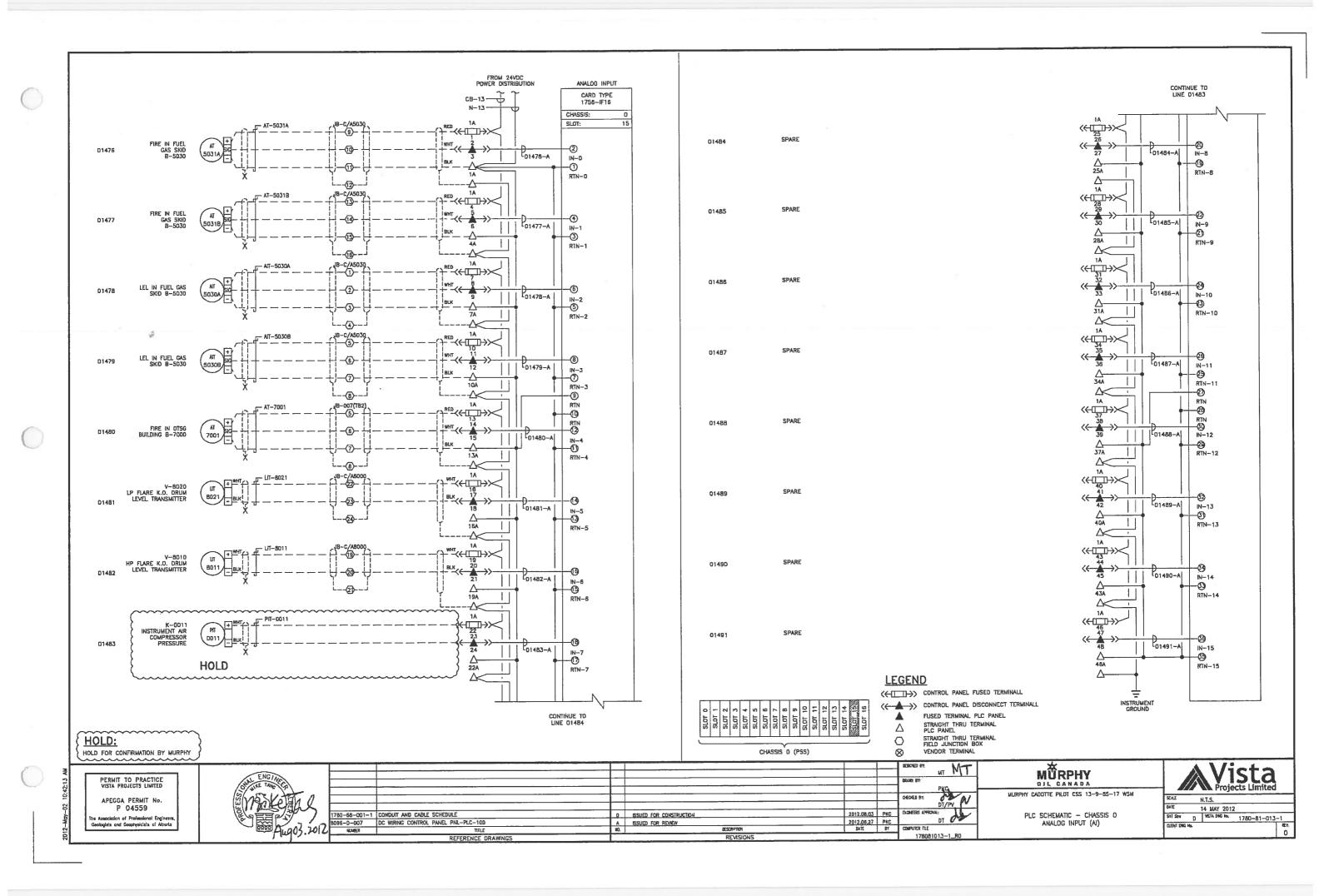
WIRING DIAGRAM

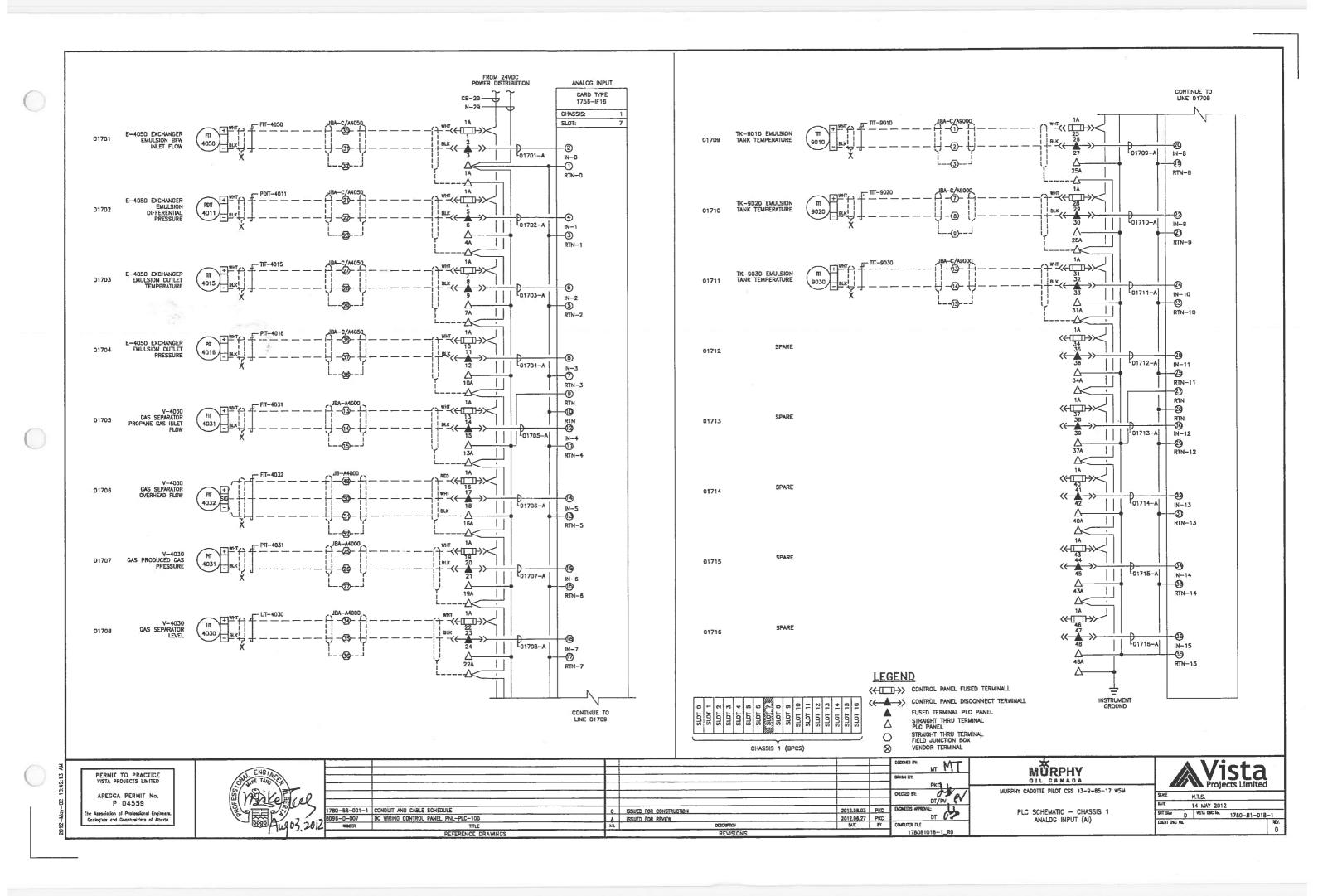
P 04559











Clarification

"All rights, title and interests, including copyright ownership, to all information and materials that may be provided by ABB Inc. ("ABB") shall remain the property of ABB.

Terms:

Our price is based on progress invoicing due "Net 30 days", and is calculated on percent complete of project. We have based our pricing with anticipation of work being performed in the second quarter of 2012. Due to fluctuation of copper our cable and wire pricing is to be revised at time of order based on most current market pricing.

Sincerely, ABB BER-MAC

Christa Boutin
Estimator
T 403-357-3733
C
christa.l.boutin@ca.abb.com

Copied to:

File

Attachments:

ABB Inc.-Terms and Conditions of Sale-BerMac.pdf

Area Office: Red Deer T 403-357-3733

F

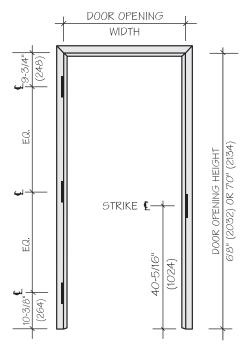
Warwick Primary source of standard 20GA Doors

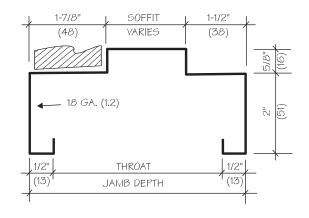
50 % of 3'-0" x 7'-0" x 20GA Honey comb core lock seam Blank doors



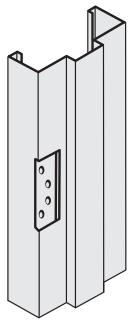
^{*}Contact Product Services for full details

K SERIES STANDARD FRAMES

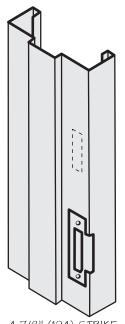




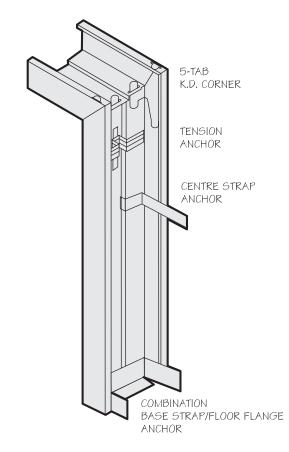
MODEL	THROAT	JAMB DEPTH	SOFFIT
350K	3-1/2" (89)	4-1/2" (114)	1-1/8" (28)
462K	4-5/8" (118)	5-5/8" (143)	2-1/4" (57)
487K	4-7/8" (124)	5-7/8" (149)	2-1/2" (64)
525K	5-1/4" (133)	6-1/4" (159)	2-7/8" (73)
675K	6-3/4" (172)	7-3/4" (197)	4-3/8" (111)



4-1/2" (114) HINGE PREPARATION— 10 GA. (3.4) REINF. WITH DUST BOX



4-7/8" (124) STRIKE
PREPARATION
[ANSI A115.1]
14 GA. (2.0) REINF.
WITH DUST BOX.
MULTI-CENTRE
DEADBOLT KNOCKOUT
WITH DUST BOX.



PROJECT:

DATE:

SH: OF

LH SWING KEY RH

PRINTED IN CANADA

CertainTeed E

Specification Sheet

Fibre Glass Building Insulation

1. PRODUCT NAME

CertainTeed Fibre Glass Building Insulation

2. MANUFACTURER

CertainTeed Corporation P.O. Box 860 Valley Forge, PA, USA 19482-0105 Phone: 800-233-8990

610-341-7000 Fax: 610-341-7994

Fax-On-Demand: 800-947-0057 Website: www.certainteed.com

3. PRODUCT DESCRIPTION

Basic Use: Fibre glass building insulation is intended for use in either residential or commercial construction as thermal and acoustical insulation in ceilings, walls and floors.

The product is unfaced and designed for use in standard wood stud and steel frame assemblies.

Benefits: Installing fibre glass building insulation is an easy, cost effective method to help conserve energy in residential and commercial new construction, remodeling, and

reinsulation projects. In addition to its thermal properties, fibre glass building insulation also provides excellent acoustical performance. It is compression packaged for ease of handling, and its broad availability of R-values and sizes ensures the right product for the job.

Composition and Materials: The product is composed of yellow, uniformly textured, inorganic glass fibres.

Sizes: Available standard sizes are listed in the table below. Contact CertainTeed for non-standard sizes.

Limitations: Insulation shall not be installed over or within 75 mm (3 in.) of recessed light fixtures, unless the fixture is identified for contact with insulation, Type IC.

Because of potential skin irritation, unfaced building insulation should not be used in an exposed installation.

All building insulation should be kept dry. Wet fibre glass insulation will lose its effectiveness until it dries. Fibre glass will often dry naturally and regain its original R-value.



UNFACED

However, under conditions where the insulation will not dry thoroughly it should be removed and allowed to dry or be replaced.

4. TECHNICAL DATA

Applicable Standards:

National Building Code 1995
 Article 9.25.2.2
 CAN/ULC-S702-1997
 CCMC Evaluation Listing
 No. 13020-L
 CSA A101-M1993
 CAN/CGSB-51.11-92

Fire Resistance:

CAN/ULC-S102-1998
 Flame Spread: 5
 Smoke Developed: 0
 CAN4-S114-1980
 Noncombustibility-Pass
 ULC-S129-1995
 Smolder Resistance-Pass

Quality Assurance: Many of CertainTeed's manufacturing plants are registered to ISO 9001-2000 standards.

	Available Sizes													
R-V	alue	Thick	cness	wid	lth	Length								
R	RSI	in.	mm	in.	mm	in.	mm							
12	2.1	3 1/2	89	15, 23	381, 584	47	1194							
				16, 24	406, 610	48	1219							
13	2.3	3 1/2	89	15, 23	381, 584	47	1194							
14	2.4	3 1/2	89	15, 23	381, 584	47	1194							
20	3.5	6	152	15, 23	381, 584	47	1194							
				16, 24	406, 610	48	1219							
22	3.9	5 1/2	140	15, 14.75	315	47	1194							
24	4.2	6	152	15, 23	381, 584	47	1194							
28	4.9	8 1/2	216	16, 24	406, 610	48	1219							
31	5.4	9 1/2	241	16, 24	406, 610	48	1219							
35	6.1	10 1/2	267	16, 24	406, 610	48	1219							
40	7.0	11 1/4	286	16, 24	406, 610	48	1219							

5. INSTALLATION

The standard practice for installing fibre glass batts in wood studs is to friction fit batts into stud cavities. When batts completely fill stud cavities, they are constrained by studs at their edges and by wall facings front and rear.

- When fibre glass batts are installed in ceiling or floor joists, they must be supported by a ceiling finish material or another material such as wire.
- Where vapour control is required, the vapour retarder shall be installed per the 1995 National Building Code, Section 9.25.

6. AVAILABILITY AND COST

For availability and cost, contact your local distributor, or call CertainTeed Sales Support Group at 800-233-8990.

7. WARRANTY

Refer to CertainTeed's Lifetime Limited Insulation Warranty for Fibre Glass Building Insulation (30-21-1321).

8. MAINTENANCE

No maintenance required.

9. TECHNICAL SERVICES

Technical assistance can be obtained by calling CertainTeed at 800-233-8990.







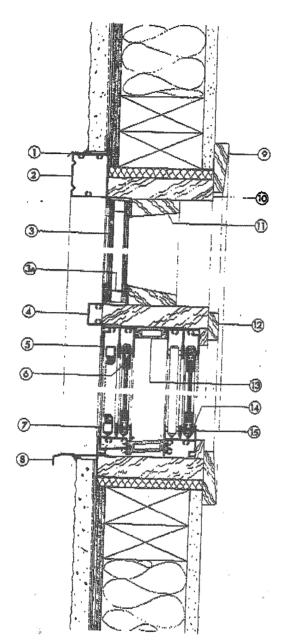


ASK ABOUT OUR OTHER CERTAINTEED PRODUCTS AND SYSTEMS:

EXTERIOR: ROOFING • SIDING • WINDOWS • FENCE • RAILING • TRIM • DECKING • FOUNDATIONS • PIPE INTERIOR: INSULATION • GYPSUM • CEILINGS

CertainTeed Corporation P.O. Box 860 Valley Forge, PA 19482 Professional: 800-233-8990 Consumer: 800-782-8777 www.certainteed.com





Sealed Units With Slider below

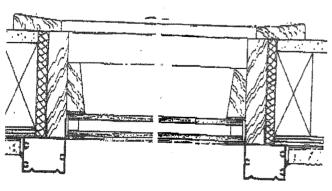
- 1. Weather Flashing by Others
- Extruded Aluminum Do Ible Seaded Casing (Baked enamel finish an 3il.)
 Sealed Unit (3A) Sea ad Unit Frame
- Extruded Aluminum Ho izontal Multion Casing Thermo Sider Top Track:

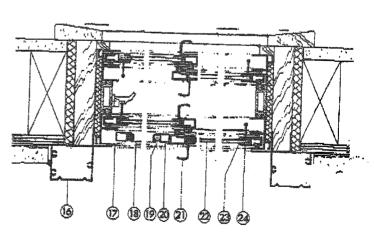
- Thermo Slider Sash
- Thermo Slider Bottom T ack
- Extruded Aluminum Sill Drip Cap
- Inside Wood Casing Susplied by Others
 Wooden Top Frame for Scaled Unit
- 11. Wooden Stops
- Wooder stops
 Wood Casing Inside Sur plied by Others
 Vinyl Themo Break (Thermo Slider)
 Double Pile Westher Str pping
 Inside Bottom Track The mo Slider

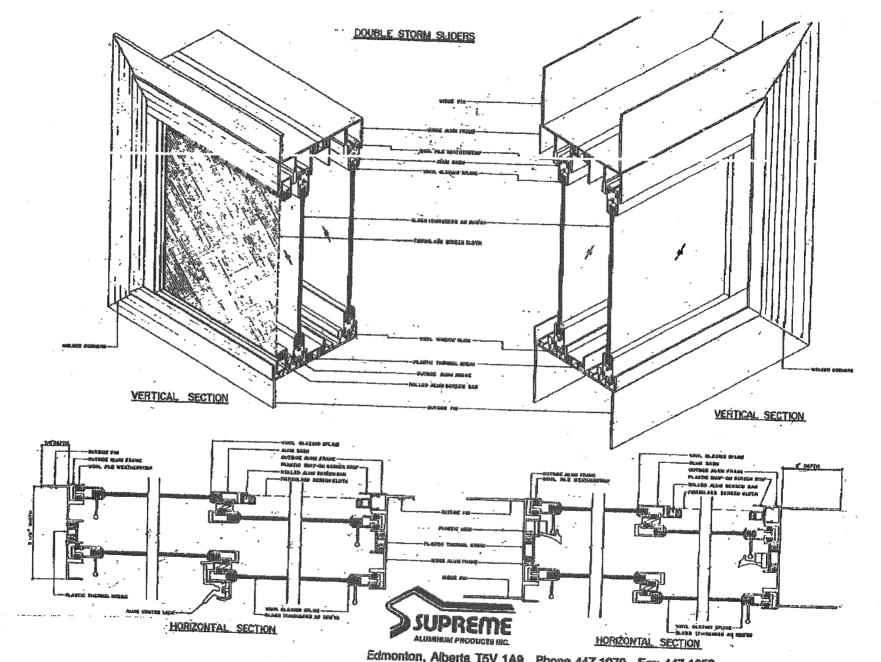
- Thermo Casing Side Por ion 14,
- Outside Track Thermo Sider 17.
- 18. Fibreglass Screen Cloth
- 19. Vinyl Screen Spline
- 20. Aluminum Screen Bar
- Extruded Aluminum Tubular Meeting Rail
- Glass as per CMHC Spex s. 22.
- 23. Vinyl Glazing
- Extruded Aluminum Tubs lar Lift Rail with Double Weather Strippin;



Phone 447-1070 Fax 447-1859







Edmonton, Alberta T5V 1A9 Phone 447-1070 Fax 447-1659

<u>UHE-01</u> <u>ELECTRIC</u> <u>UNIT HEATER</u>

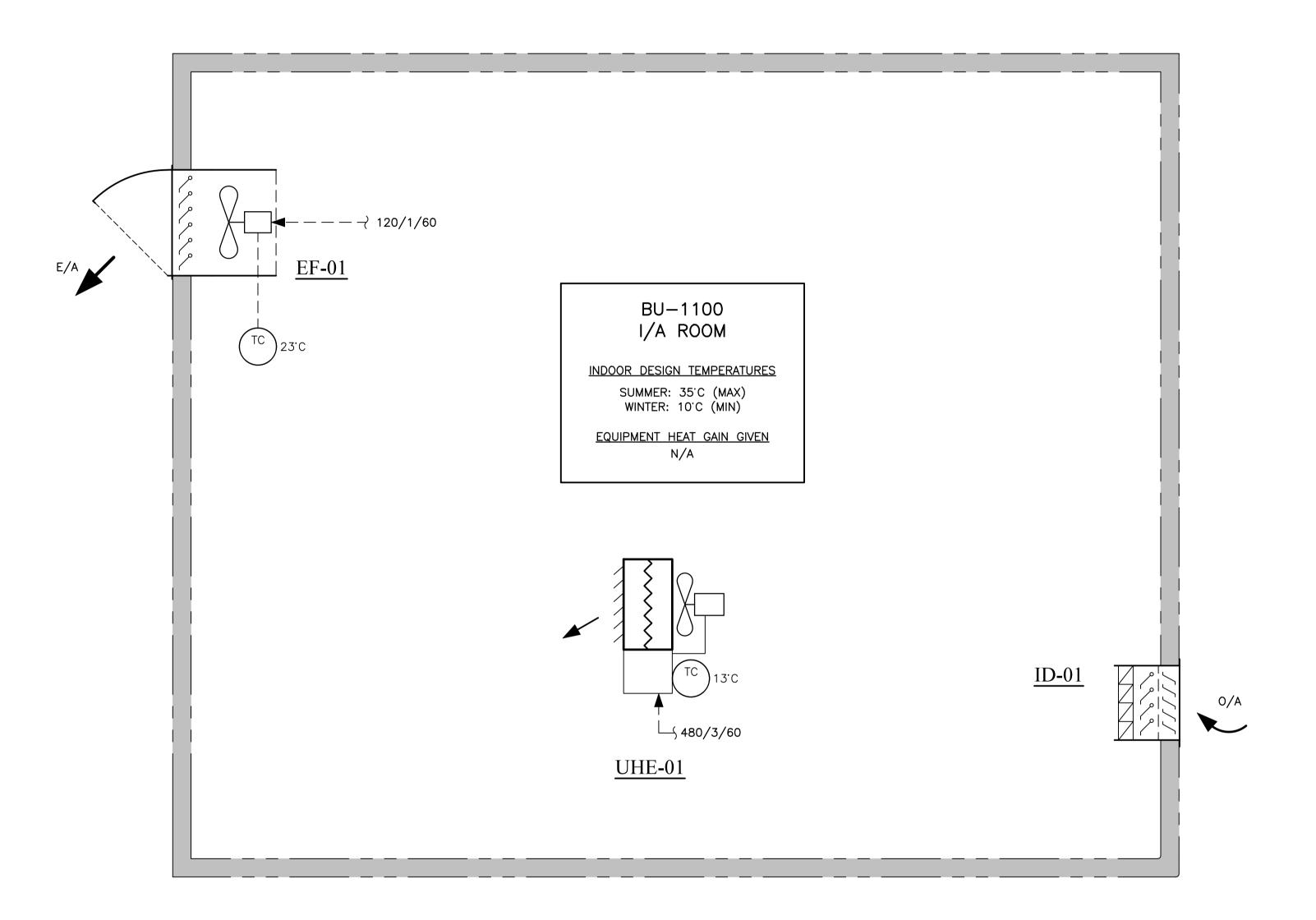
OUELLET MODEL OAS 15kW HEATING CAPACITY 480/3/60 c/w WALL BRACKET AND BUILT-IN THERMOSTAT

EF-01 EXHAUST FAN

ENERTECH MODEL ET12-1GP 236L/s [500CFM] 120/1/60 c/w SHUTTER, BACKGUARD AND T'STAT

ID-01 INTAKE DAMPERS

WESTVENT MODEL XF-445W
FIXED EXTERIOR INTAKE LOUVRE
610x610 [24x24]
c/w BACKDRAFT DAMPER
BDX-3C3-LB BIRDSCREEN AND
CARTRIDGE FILTER



HEATING & VENTILATION - SEQUENCE OF OPERATION

1.0 H&V SYSTEM - DESIGN OVERVIEW

- 1.1 ROOM CONSISTS OF ONE ELECTRIC UNIT HEATER, ONE EXHAUST FAN AND ONE INTAKE DAMPER.
- 1.2 HEATING IS BY THE UNIT HEATER AND IS CONTROLLED BY ITS BUILT—IN THERMOSTAT.
- 1.3 COOLING IS BY OUTDOOR AIR CONTROLLED BY THE EXHAUST FAN'S THERMOSTAT.
- 1.4 DESIGN INDOOR TEMP/PRESSURE LIMITS:
- MAX TEMP: 30°CMIN TEMP: 10°C
- MIN TEMP: 10°CBLDG PRESSURE: NEGATIVE WHEN
- EXHAUST FAN IS RUNNING

 1.5 RUN TIME SCHEDULES, INITIAL SET POINTS
 ETC. SHALL BE EVALUATED DURING

FINAL DESIGN REQUIREMENTS/INTENT.

COMMISSIONING AND ADJUSTED TO MEET THE

2.0 H&V SYSTEM - VENTILATION AND COOLING

- 2.1 ROOM IS MECHANICALLY VENTILATED WHEN ROOM TEMPERATURE REACHES ITS COOLING
- SET POINT.

 2.2 COOLING VENTILATION OF <u>EF-01</u> IS CYCLED ON/OFF BASED ON THE THERMOSTAT SET
- 2.3 ALL VENTILATION IS DRAWN INTO THE ROOM THROUGH <u>ID-01</u>.

3.0 H&V SYSTEM - HEATING OPERATION

- 3.1 WHEN THE ROOM TEMP FALLS BELOW THE HEATING SET POINT THE UNIT HEATER
- STARTS.

 3.2 ONCE THE ROOM TEMP REACHES SET POINT THE UNIT HEATER SHUTS DOWN.

LEGEND

(**devices not by EnerTech UNO)

PROP FAN W/ MOTOR

BACKDRAFT DAMPER

DAMPER

FILTERS

~~~~

ELECTRIC HEATING
ELEMENT

DAMPER ACTUATOR

DISCONNECT SWITCH

ACH AIR CHANGE PER HOUR

S/A SUPPLY AIR R/A RETURN AIR

O/A OUTSIDE AIR
E/A EXHAUST AIR

EM ECONOMIZER MODULE

ES ENTHALPY SENSOR TE TEMP SENSOR

TC TEMP CONTROLLER

---- FIELD WIRING
----- FACTORY WIRING

— - - — BLDG OUTLINE— SL — REFRIG SUCTION LINE— LL — REFRIG LIQUID LINE

———— AIR FLOW

\*\* NOT PROVIDED BY ENERTECH

. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE PROJECT DRAWINGS AND SPECS. REFER TO THE APPLICABLE EQUIPMENT DATASHEETS FOR FURTHER

NOTES

2. AREA CLASS.: NON-CLASSIFIED

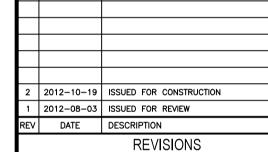
DETAILS.

3. THIS DRAWING IDENTIFIES
"SCOPE OF WORK" FOR
ENERTECH SUPPLY. ONLY THE
CONTROL DEVICES DESCRIBED
HERE OR ON EQUIPMENT
DATASHEETS ARE BY ENERTECH
UNLESS NOTED OTHERWISE.
EQUIPMENT INSTALLATION BY
BUILDING VENDOR.

DISCONNECT SWITCHES ARE NOT SUPPLIED BY ENERTECH UNLESS OTHERWISE NOTED.

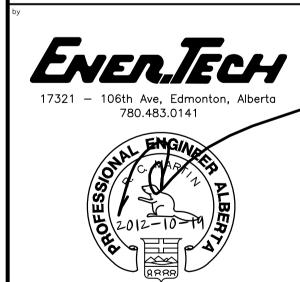
5. ALL FIELD WIRING BY ELECTRICAL CONTRACT.

6. WEATHER HOODS ARE PROVIDED AS SHOWN. EXHAUST HOODS SHALL BE 45' AND INTAKE HOODS SHALL BE 90'. ALL HOODS SHALL BE c/w 25mm BIRD SCREEN AND SUPPLIED BY BUILDING VENDOR.





INDUSTRIESLTD



PERMIT TO PRACTICE

Signature

2012-10-19

PERMIT NUMBER: P 2487

The Association of Professional Engineers, Geologists and Geophysicists of Alberta

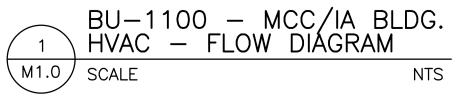
Murphy Oil Canada - Cadotte Cyclic Steam Stimulation (CSS) Pilot Project

near Peace River/Slave Lake, AB. LSD: 13-09-085-17 W5M

BU-1100 - MCC/IA BUILDING
IA COMP ROOM H&V FLOW DIAGRAM

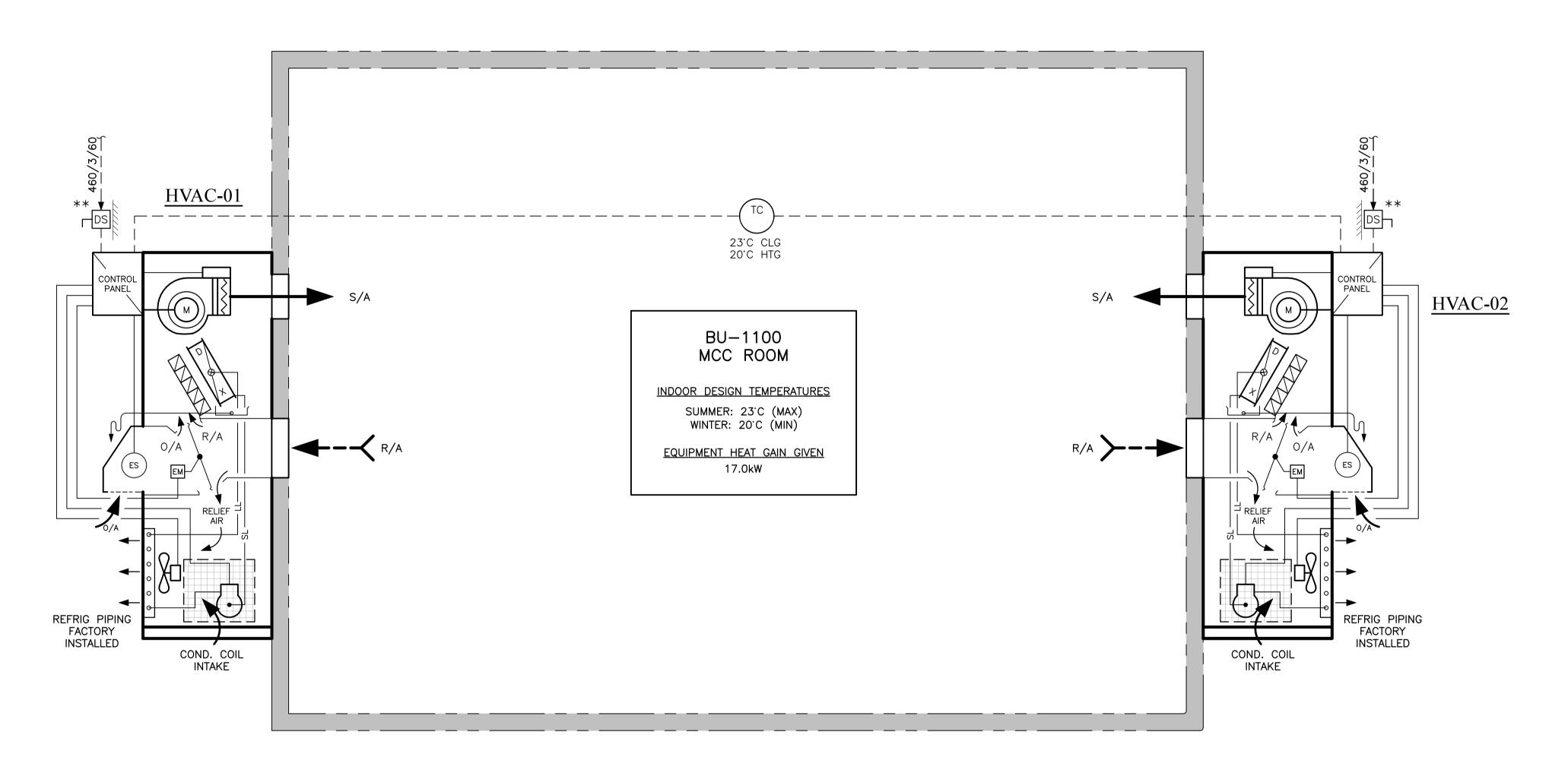
drawn by Checked by AS approved by MS sheet size A1 AS SHOWN

M1.0



### HVAC-01/02 WALL MOUNTED HVAC UNIT

BARD MODEL W48A1-C15EPXXXJ 732L/s @ 20Pa ESP 10% 73L/s MIN O/A 0.37kW INDOOR BLOWER MOTOR 0.25kW OUTDOOR FAN MOTOR 460/3/60, MCA=27A NOMINAL 4TON COOLING CAPACITY AT 35°C AMBIENT 13.8kW TOTAL, 10.8kW SENSIBLE R410A REFRIGERANT 15kW ELECTRIC HEATING COIL EACH UNIT IS SELF CONTAINED AND OPERATED BY THE ROOM MOUNTED TEC-40 CONTROLLER. c/w SUPPLY/RETURN GRILLES, FIRE SHUTDOWN CONTACT AND COMMON TROUBLE ALARM.



### HVAC - SEQUENCE OF OPERATION

### 1.0 HVAC SYSTEM - DESIGN OVERVIEW

- 1.1 ROOM CONSISTS OF TWO HVAC UNITS AND ONE TEMP CONTROLLER. 1.2 THE TEMP CONTROLLER, OPERATES THE HVAC UNITS IN A STAGED ARRANGEMENT
- BASED ON THE SPACE TEMP. 1.3 DESIGN INDOOR TEMP/PRESSURE LIMITS: MAX TEMP: 23°C
  - MIN TEMP: 20°C
  - BLDG PRESSURE: POSITIVE (UNMONITORED)
- 1.4 RUN TIME SCHEDULES, INITIAL SETPOINTS ETC. SHALL BE EVALUATED DURING COMMISSIONING AND ADJUSTED TO MEET THE FINAL DESIGN REQUIREMENTS/INTENT.

### 2.0 HVAC SYSTEM - VENTILATION

2.1 VENTILATION OCCURS ONLY WHEN UNIT(s) ARE RUNNING. EACH UNIT PROVIDES 1.5ACH

### 3.0 HVAC SYSTEM - 'FREE COOLING' OPERATION

- 3.1 HVAC UNITS ARE EACH EQUIPPED WITH AN ECONOMIZER TO PROVIDE FREE COOLING WHEN THE CONDITIONS ARE RIGHT. THIS IS CONTROLLED WITHIN EACH UNIT BASED ON THE OUTDOOR AIR ENTHALPY AND THE INDOOR SPACE TEMP.
- 3.2 ONCE THE HVAC UNITS CAN NO LONGER HOLD THE COOLING SET POINT BY FREE COOLING THEY WILL AUTOMATICALLY SWITCH OVER TO MECHANICAL COOLING. SEE 4.0.

### 4.0 HVAC SYSTEM - 'MECHANICAL COOLING'

- 4.1 WHEN THE HVAC UNITS CAN NO LONGER HOLD THE COOLING SET POINT WITH FREE COOLING PER 3.0, MECHANICAL COOLING IS INITIATED. THIS IS CONTROLLED BY THE J MODULE OF THE HVAC UNITS.
- 4.2 WHEN MECHANICAL COOLING IS ENERGIZED THE ECONOMIZER DAMPER RETURNS TO ITS MIN O/A POSITION AND THE DX COOLING SYSTEM IS STARTED.
- 4.3 IF THE COOLING SET POINT IS NOT MET WITHIN 10 MINUTES, THE CONTROLLER CALLS FOR THE DX COOLING FROM THE SECONDARY UNIT.
- 4.4 ONCE COOLING SET POINT IS MET, THE DX COOLING FROM EACH UNIT IS CYCLED OFF.
- 4.5 WHILE THE DX COOLING IS OFF AND THE O/A TEMP IS >10°C, THE ECONOMIZER DAMPER WILL BE IN ITS MIN O/A POSITION TO CONTINUE TO VENTILATE THE BUILDING. IF THE BUILDING TEMP RISES ABOVE SET POINT THE MECHANICAL COOLING CYCLE
- BEGINS AGAIN FROM 4.3. 4.6 MECHANICAL COOLING IS LOCKED OUT WHEN THE O/A TEMP IS ≤10°C.

### 5.0 HVAC SYSTEM - 'HEATING' OPERATION

- 5.1 EACH HVAC UNIT IS EQUIPPED WITH AN ELECTRIC HEATER SIZED TO COVER THE VENTILATION AND THE ROOM LOSSES TO MAINTAIN THE ROOM AT ITS MINIMUM TEMPERATURE OF 20°C.
- 5.2 THE UNIT'S HEATERS ARE CONTROLLED INTERNALLY BY THEIR CONTROLLER.
- 5.3 WHEN THE ROOM TEMP DROPS BELOW THE HEATING SET POINT, THE LEAD UNIT ENERGIZES THE HEATING. THE ECONOMIZER DAMPERS WILL ALREADY BE IN THEIR MINIMUM O/A POSITION AS THEY COME OFF THEIR 'FREE COOLING' CYCLE DESCRIBED IN 3.0.
- 5.4 IF THE HEATING SET POINT IS NOT MET WITHIN 5 MINUTES, HEATING FROM THE SECOND UNIT IS ENERGIZED.

BEGINS AGAIN FROM 5.3.

5.5 ONCE HEATING SET POINT IS MET, THE HEATERS IN EACH UNIT ARE CYCLED OFF. 5.6 IF THE ROOM TEMP FALLS BELOW THE HEATING SET POINT THE HEATING CYCLE

### 6.0 HVAC SYSTEM - EMERGENCY SHUTDOWN

- 6.1 ON A REMOTE EMERGENCY SHUT DOWN
- SIGNAL FROM OTHERS STOPS HVAC UNITS. UNITS ARE PERMITTED TO OPERATE ONCE SHUTDOWN CONTACT IS CLOSED AGAIN.

### **LEGEND**

(\*\*devices not by EnerTech UNO)



MOTOR



DX EVAPORATOR COOLING COIL



CONDENSING COIL



DAMPER



CONDENSER FAN



COMPRESSOR

ELEMENT



DAMPER ACTUATOR

DISCONNECT SWITCH

ACH AIR CHANGE PER HOUR S/A SUPPLY AIR

RETURN AIR OUTSIDE AIR RC/A RECIRCULATED AIR

EXHAUST AIR ECONOMIZER MODULE ENTHALPY SENSOR ES TEMP SENSOR

TEMP CONTROLLER

NOT PROVIDED

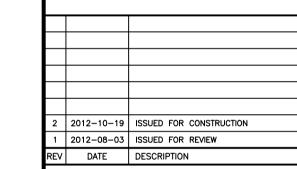
BY ENERTECH

---- FIELD WIRING — FACTORY WIRING

— - - — BLDG OUTLINE ----SL--- REFRIG SUCTION LINE — LL — REFRIG LIQUID LINE

AIR FLOW

AS SHOWN. EXHAUST HOODS SHALL BE 45' AND INTAKE ELECTRIC HEATING HOODS SHALL BE 90'. ALL HOODS SHALL BE c/w 25mm BIRD SCREEN AND SUPPLIED BY BUILDING VENDOR.





NOTES

THIS DRAWING TO BE READ IN

CONJUNCTION WITH THE PROJECT DRAWINGS AND

SPECS. REFER TO THE APPLICABLE EQUIPMENT

DETAILS.

DATASHEETS FOR FURTHER

2. AREA CLASS.: UNCLASSIFIED

"SCOPE OF WORK" FOR

HERE OR ON EQUIPMENT

BUILDING VENDOR.

SYSTEM AND VFD

ELECTRICAL.

UNLESS NOTED OTHERWISE.

DISCONNECT SWITCHES ARE NOT SUPPLIED BY ENERTECH UNLESS OTHERWISE NOTED.

ALL FIELD WIRING OF HVAC

RECIRC/EXHAUST DUCT BY

6. WEATHER HOODS ARE PROVIDED

EQUIPMENT INSTALLATION BY

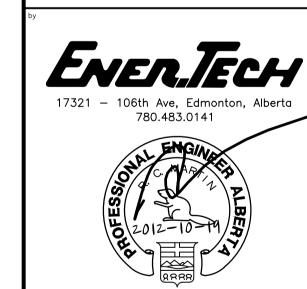
ENERTECH SUPPLY. ONLY THE

CONTROL DEVICES DESCRIBED

DATASHEETS ARE BY ENERTECH

3. THIS DRAWING IDENTIFIES





2012-10-19 PERMIT NUMBER: P 2487 The Association of Professional Engineers Geologists and Geophysicists of Alberta

Murphy Oil Canada - Cadotte Cyclic Steam Stimulation (CSS) Pilot Project

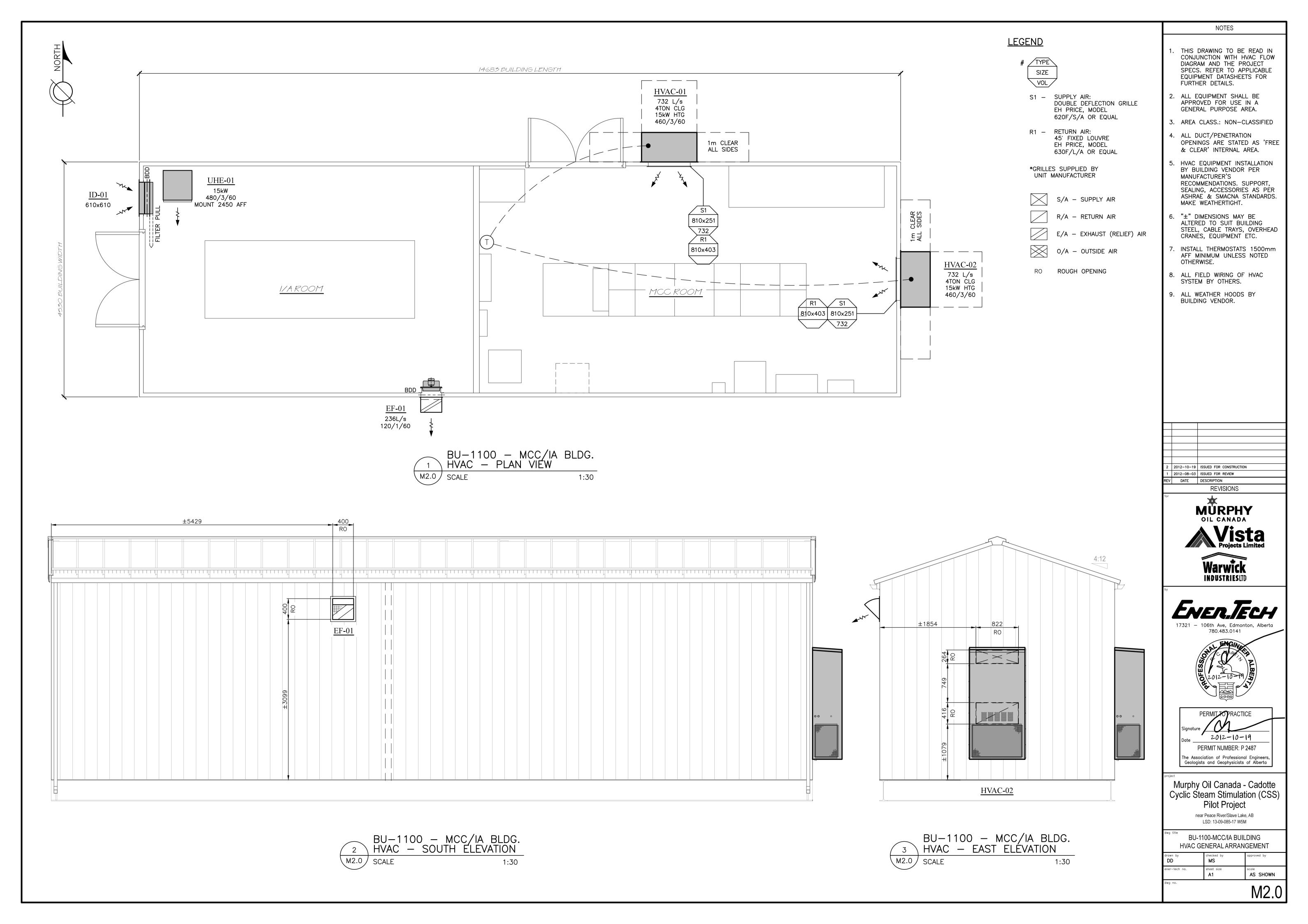
near Peace River/Slave Lake, AB. LSD: 13-09-085-17 W5M

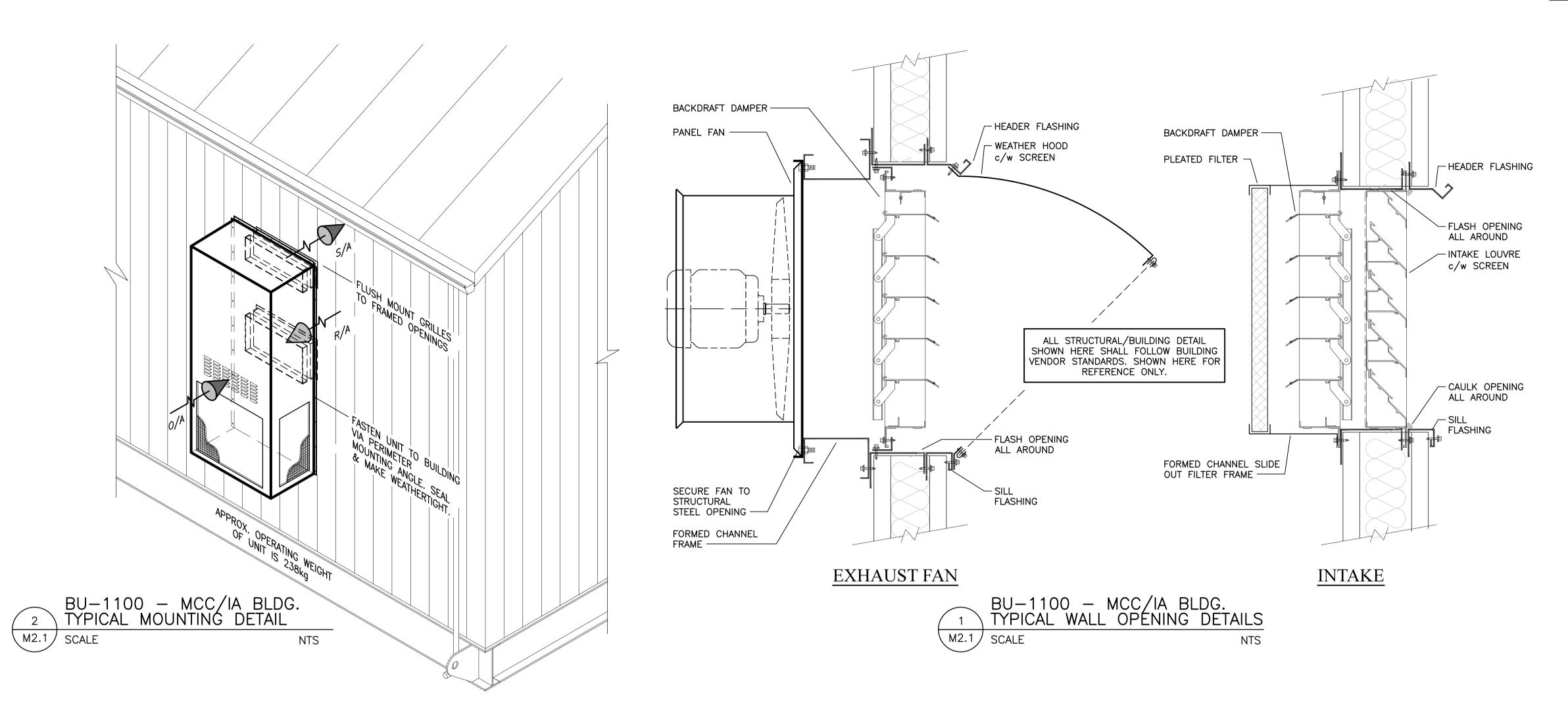
BU-1100 - MCC/IA BUILDING MCC ROOM HVAC FLOW DIAGRAM

AS SHOWN

M1.

BU-1100 - MCC/IA BLDG. HVAC - FLOW DIAGRAM M1.0 / SCALE NTS





**LEGEND** 

SIZE \VOL /

> S1 - SUPPLY AIR: DOUBLE DEFLECTION GRILLE EH PRICE, MODEL 620F/S/A OR EQUAL

R1 – RETURN AIR: 45' FIXED LOUVRE EH PRICE, MODEL 630F/L/A OR EQUAL

\*GRILLES SUPPLIED BY UNIT MANUFACTURER

S/A - SUPPLY AIR

R/A - RETURN AIR

E/A - EXHAUST (RELIEF) AIR

O/A - OUTSIDE AIR

ROUGH OPENING

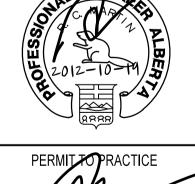
NOTES

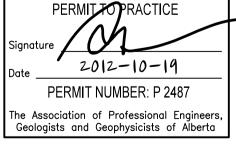
- 1. THIS DRAWING TO BE READ IN CONJUNCTION WITH HVAC FLOW DIAGRAM AND THE PROJECT SPECS. REFER TO APPLICABLE EQUIPMENT DATASHEETS FOR FURTHER DETAILS.
- 2. ALL EQUIPMENT SHALL BE APPROVED FOR USE IN A GENERAL PURPOSE AREA.
- 3. AREA CLASS.: NON-CLASSIFIED
- 4. ALL DUCT/PENETRATION OPENINGS ARE STATED AS 'FREE & CLEAR' INTERNAL AREA.
- 5. HVAC EQUIPMENT INSTALLATION BY BUILDING VENDOR PER MANUFACTURER'S RECOMMENDATIONS. SUPPORT, SEALING, ACCESSORIES AS PER ASHRAE & SMACNA STANDARDS. MAKE WEATHERTIGHT.
- 6. "±" DIMENSIONS MAY BE ALTERED TO SUIT BUILDING STEEL, CABLE TRAYS, OVERHEAD CRANES, EQUIPMENT ETC.
- 7. INSTALL THERMOSTATS 1500mm AFF MINIMUM UNLESS NOTED OTHERWISE.
- 8. ALL FIELD WIRING OF HVAC SYSTEM BY OTHERS.
- 9. ALL WEATHER HOODS BY BUILDING VENDOR.

2 2012-10-19 ISSUED FOR CONSTRUCTION 2012-08-03 ISSUED FOR REVIEW REVISIONS







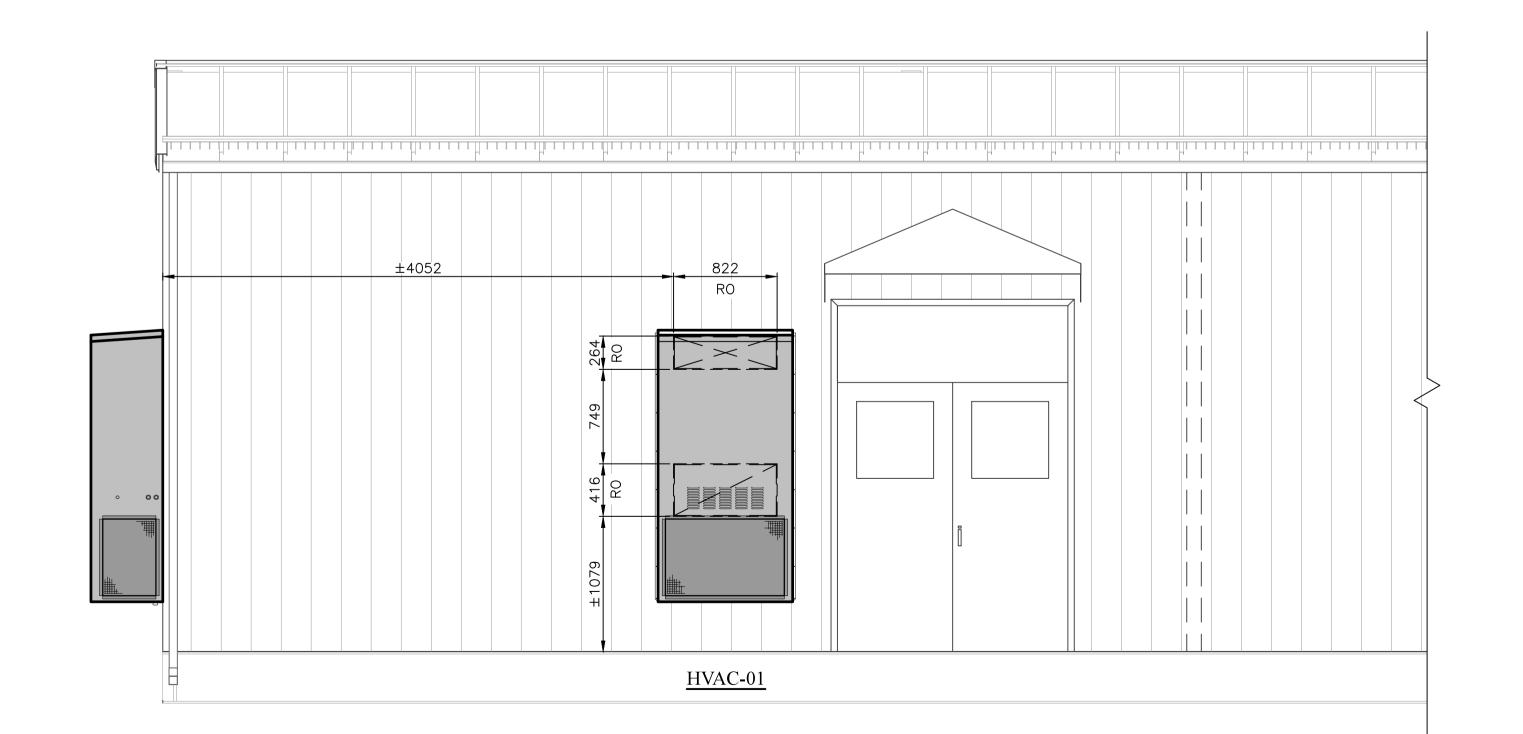


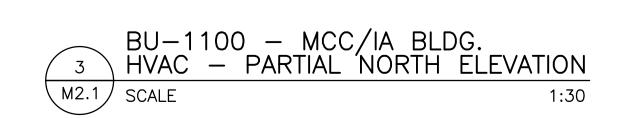
Murphy Oil Canada - Cadotte Cyclic Steam Stimulation (CSS) Pilot Project

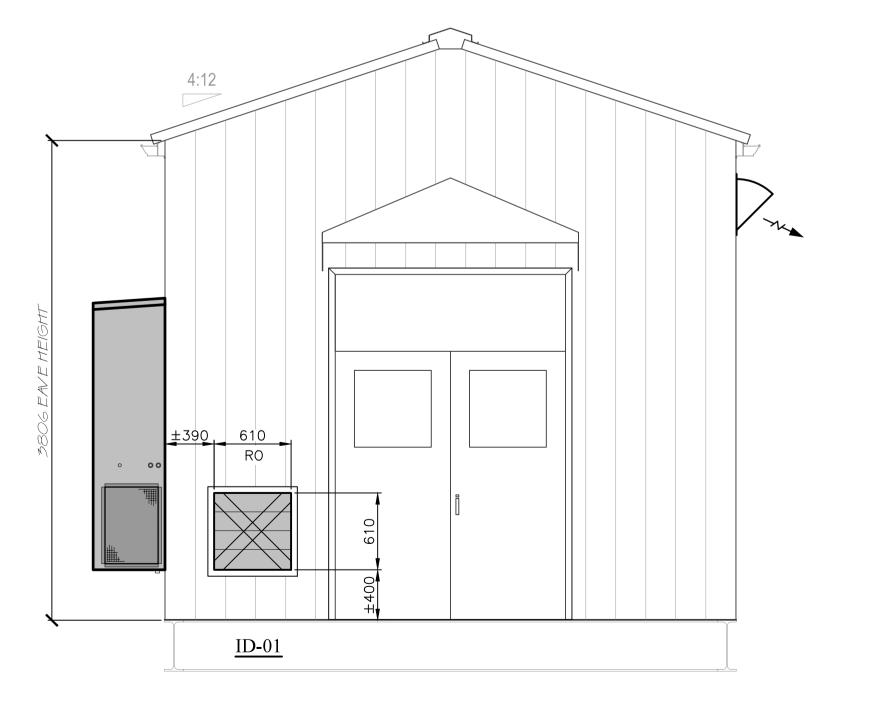
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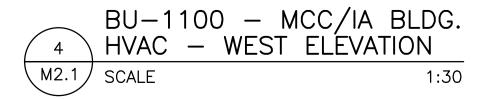
BU-1100-MCC/IA BUILDING HVAC GENERAL ARRANGEMENT

AS SHOWN











17321 - 106 Ave Edmonton, Alberta T5S 1E7 p: (780) 483-0141 f: (780) 489-4302



Rev: 2 - Issued for Construction

Date: 2012-09-19

For: Murphy Oil - Cadotte Heavy Oil Field

Cyclic Steam Stimulation (CSS) pilot

I/A Room (BU-1100)

Heating & Ventilation System Design

| Design Conditions: | Latituda  | 56 Time: | 4.00 DM   |
|--------------------|-----------|----------|-----------|
| Design Conditions: | Latitude: | ob Time: | 4:00 PIVI |

Indoor:

Elevation:

Summer temperature: Winter temperature:

95 F (35 C) 50 F ( 10 C)

n/a

2221 ft ( 677 m)

Outdoor:

Summer temperature:

dB 84 F wB 65 F

Winter temperature:

( 18 C) -49 F ( -45 C)

Summer grains of moisture: Daily temperature range:

76 gr/lb 18 F ( 10 C)

U-Values (1/R):

Hum. Ratio ΔW:

R 28 = 1/28Floor: Walls:

= 0.036R 12 = 1/12 = 0.083R 20 = 1/20 = 0.050

Roof: Doors:

Windows: R 2 = 1/2= 0.500= 1/6 = 0.167R 6

Bldg Volume:

measured from drawings

4,339 ft3( 122.87 m3)

| Duilding | Componente  |  |
|----------|-------------|--|
| Bullaina | Components: |  |

|                     | Area, Length<br>CFM or BTUH | Sensible<br>Gain (BTUH) | Latent Gain<br>(BTUH) | Total Heat<br>Gain (BTUH) | Total Heat<br>Loss (BTUH) |
|---------------------|-----------------------------|-------------------------|-----------------------|---------------------------|---------------------------|
| Floor               | 317 sqft                    | 0                       | 0                     | 0                         | 1,121                     |
| N Wall              | 266 sqft                    | 0                       | 0                     | 0                         | 2,195                     |
| W Wall              | 204 sqft                    | 0                       | 0                     | 0                         | 1,681                     |
| Window Area         | 8 sqft                      | 609                     | 0                     | 609                       | 396                       |
| 2 Man Doors         | 34 sqft                     | 0                       | 0                     | 0                         | 561                       |
| S Wall              | 266 sqft                    | 0                       | 0                     | 0                         | 2,195                     |
| Partition           | 204 sqft                    | 0                       | 0                     | 0                         | 0                         |
| Roof                | 334 sqft                    | 785                     | 0                     | 785                       | 1,653                     |
| Summer Infiltration | 72 CFM                      | 0                       | 0                     | 0                         | 0                         |
| Winter Infiltration | 145 CFM                     | 0                       | 0                     | 0                         | 15,794                    |
| People              | 2 kW                        | 500                     | 400                   | 900                       | 0                         |
| Given Ht Gain       | 0 kW                        | 0                       | 0                     | 0                         | 0                         |
| Ventilation         | 0 CFM                       | 0                       | 0                     | 0                         | 0                         |
| Lighting (1W/sqft)  | 317 W                       | 1,082                   | 0                     | 1,082                     | 0                         |
| 3                   |                             | 2,976                   | 400                   | 3,376                     | 25,594                    |

### Summary:

| Heat Loss:           |             |   |         |
|----------------------|-------------|---|---------|
| Ventilation Loss     | 0 BTUH      | ( | 0.0 kW) |
| Building Loss (+10%) | 28,154 BTUH | ( | 8.3 kW) |
| Total Heat Loss      | 28,154 BTUH | ( | 8.3 kW) |

### **Heat Gain:**

| Given Heat Gain      | 0 BTUH     | ( | 0.0 kW) |
|----------------------|------------|---|---------|
| Building Gain (+10%) | 3,713 BTUH | ( | 1.1 kW) |
| Total Heat Gain      | 3,713 BTUH | ( | 1.1 kW) |



17321 - 106 Ave Edmonton, Alberta T5S 1E7 p: (780) 483-0141 f: (780) 489-4302 Rev: 2 - Issued for Construction

Date: 2012-09-19

For: Murphy Oil - Cadotte Heavy Oil Field Cyclic Steam Stimulation (CSS) pilot

I/A Room (BU-1100)

Heating & Ventilation System Design

System Description:

The heating & ventilation system in this room consists of the following equipment. One 236L/s wall mounted exhaust fan. One 610x610 intake damper c/w filter. One 15kW electric unit heater c/w built-in thermostat. All equipment shall be rated for use in a general purpose area with 480/3/60 and 120/1/60 power supplied.

Summer (cooling):

As the room temp rises above the cooling set point, the exhaust fan starts and operates until set point is met. The room cooling set point is initially set at 74F (23C).

Winter (heating):

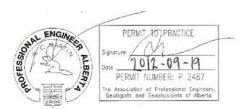
As the room temp falls below the heating set point, the unit heater starts and operates until the heating set point is met. The room heating set point is initially set at 55F (13C).

#### Notes:

- 1. HVAC system is designed based on the project specs which were available at the time of design.
- 2. The calc assumes lighting load to be in addition to the given heat gains and is based on one watt per square foot of floor space.
- 3. Building infiltration is estimated based on one air change for the cooling load and two air changes for the heating load.
- 4. Building envelope assumed to be constructed to an "average" tightness as defined by ASHRAE.
- 5. Heating requirements are based on building losses with no internal equipment heat gains present.
- 6. Room volume is measured from the building drawings provided and represents the volume when the room is empty.
- 7. Partition wall assumed to be uninsulated.
- 8. Refer to HVAC Flow Diagram for full sequence of operation of the HVAC system.



17321 - 106 Ave Edmonton, Alberta T5S 1E7 p: (780) 483-0141 f: (780) 489-4302



Rev: 2 - Issued for Construction

Date: 2012-09-19

For: Murphy Oil - Cadotte Heavy Oil Field

Cyclic Steam Stimulation (CSS) Pilot

MCC Rm (BU-1100) HVAC System Design

Design Conditions: Latitude: 56 Time: 4:00 PM

Indoor: Summer temperature: 74 F

74 F ( 23 C) 68 F ( 20 C)

Hum. Ratio ΔW: 0.00209 Elevation: 2221

Winter temperature:

2221 ft ( 677 m)

Outdoor:

Summer temperature:

dB 84 F ( 29 C) wB 65 F ( 18 C)

Winter temperature:

-49 F ( -45 C)

Summer grains of moisture:

76 gr/lb

Daily temperature range:

18 F ( 10 C)

U-Values (1/R): Floor: R 28 = 1 / 28 = 0.036 BI

Floor: R 28 = 1 / 28 = 0.036 Walls: R 12 = 1 / 12 = 0.083 Roof: R 20 = 1 / 20 = 0.050

Windows: R 2 = 1/2 = 0.500 Doors: R 6 = 1/6 = 0.167 Bldg Volume:

measured from drawings

5,477 ft<sup>3</sup>( 155.09 m<sup>3</sup>)

|                     | Area, Length<br>CFM or BTUH | Sensible<br>Gain (BTUH) | Latent Gain<br>(BTUH) | Total Heat<br>Gain (BTUH) | Total Heat<br>Loss (BTUH) |
|---------------------|-----------------------------|-------------------------|-----------------------|---------------------------|---------------------------|
| Floor               | 400 sqft                    | 192                     | 0                     | 192                       | 1,671                     |
| N Wall              | 335 sqft                    | 115                     | 0                     | 115                       | 3,263                     |
| Window Area         | 8 sqft                      | 240                     | 0                     | 240                       | 468                       |
| 2 Man Doors         | 34 sqft                     | 115                     | 0                     | 115                       | 663                       |
| E Wall              | 204 sqft                    | 424                     | 0                     | 424                       | 1,986                     |
| S Wall              | 335 sqft                    | 509                     | 0                     | 509                       | 3,263                     |
| Partition           | 204 sqft                    | 1,499                   | 0                     | 1,499                     | 1,989                     |
| Roof                | 424 sqft                    | 1,442                   | . 0                   | 1,442                     | 2,480                     |
| Summer Infiltration | 91 CFM                      | 803                     | 923                   | 1,726                     | 0                         |
| Winter Infiltration | 183 CFM                     | 0                       | 0                     | 0                         | 23,560                    |
| People              | 2 ppl                       | 500                     | 400                   | 900                       | 0                         |
| Given Eq Ht Gain    | 17.0 kW                     | 58,001                  | 0                     | 58,001                    | 0                         |
| Ventilation (10%)   | 310 CFM                     | 0                       | 0                     | 0                         | 40,006                    |
| Lighting (1W/sqft)  | 400 W                       | 1,365                   | 0                     | 1,365                     | C                         |
|                     |                             | 65,204                  | 1,323                 | 66,528                    | 79,351                    |

Summary:

**Total Heat Loss** 

 Heat Loss:

 Ventilation Loss
 40,006 BTUH ( 11.7 kW)

 Building Loss (+10%)
 43,279 BTUH ( 12.7 kW)

83,285 BTUH

Heat Gain:

Given Heat Gain Building Gain (+10%) Total Heat Gain 58,001 BTUH ( 17.0 kW) 9,380 BTUH ( 2.7 kW)

67,381 BTUH ( 19.7 kW)

24.4 kW)



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Date: 2012-09-19

For: Murphy Oil - Cadotte Heavy Oil Field

Cyclic Steam Stimulation (CSS) Pilot

MCC Rm (BU-1100) HVAC System Design

System Description:

The HVAC system in this room consists of the following equipment. Two 4ton, 732L/s wall mounted HVAC units c/w 15kW electric heat. One thermostat controller. All equipment shall be rated for use in a general purpose area with 460/3/60 power supplied.

Summer (cooling):

As the room temp rises above the cooling set point, the unit controller starts the lead unit's cooling system. If set point is not met within a set time the controller will start the lag unit until the set point is met. The room cooling set point is initially set at 74F (23C).

Winter (heating):

As the room temp falls below the heating set point, the unit controller starts the lead unit's heating system. If set point is not met within a set time the controller will start the lag unit until the set point is met. The room heating set point is initially set at 68F (20C).

#### Notes

- 1. HVAC system is designed based on the project specs which were available at the time of design.
- 2. The calc assumes lighting load to be in addition to the given heat gains and is based on one watt per square foot of floor space.
- 3. Building infiltration is estimated based on one air change for the cooling load and two air changes for the heating load.
- 4. Building envelope assumed to be constructed to an "average" tightness as defined by ASHRAE.
- 5. Heating requirements are based on building losses with no internal equipment heat gains present.
- 6. Room volume is measured from the building drawings provided and represents the volume when the room is empty.
- 7. Partition wall assumed to be uninsulated.
- 8. Refer to HVAC Flow Diagram for full sequence of operation of the HVAC system.

2 - W48A1-C15EPXXXJ 4 Ton Bard Unit c/w 15kW of Heat 480/3/60



### THE WALL-MOUNT™ AIR CONDITIONERS - 9.0 EER, (60HZ)

### Models W18A to W60A 1.5 to 5 Ton (16,400 to 55,000 Btuh) Right Side Control Panel 60Hz

## GREEN REFRIGERANT R-410A

The Bard Wall-Mount Air Conditioner is a self contained energy efficient system, which is designed to offer maximum indoor comfort at a minimal cost without using valuable indoor floor space or outside ground space. This unit is the ideal product for versatile applications such as: new construction, modular offices, school modernization, telecommunication structures, portable structures or correctional facilities. Factory or field installed accessories are available to meet specific job requirements.

### Engineered Features

### Aluminum Finned Copper Coils:

Grooved tubing and enhanced louvered fin for maximum heat transfer and energy efficiency.

#### Twin Blowers:

Move air quietly. Most models feature multispeed blower motors providing airflow adjustment for high and low static operation. Motor overload protection is standard on all models.

#### Air Conditioner Compressor:

Scroll Compressors eliminate need for crankcase heater. Standard on  $1\frac{1}{2}$  to 5 ton.

### R-410A Refrigerant:

Designed with R-410A (HFC) nonozone depleting refrigerant in compliance with the Montreal protocol and 2010 EPA requirements.

### **Phase Rotation Monitor:**

Standard on all 3 phase scroll compressors. Protects against reverse rotation if power supply is not properly connected.

### Galvanized 20 Gauge Zinc Coated Steel Cabinet:

Cleaned, rinsed, sealed and dried before the polyurethane primer is applied. The cabinet is handsomely finished with a baked on textured enamel, which allows it to withstand 1000 hours of salt spray tests per ASTM B117-03.

### Foil Faced Insulation: Standard on all units.

Full Length Mounting Brackets: Built into cabinet for improved appearance and easy installation. NOTE: Bottom mounting bracket included to assist in installation.

#### **Electrical Components:**

Are easily accessible for routine inspection and maintenance through a right side, service panel opening. Features a lockable, hinged access cover to the circuit breaker or toggle disconnect switch.

#### **Electric Heat Strips:**

Features an automatic limit and thermal cut-off safety control. Heater packages can be factory or field installed for all 1½ through 5 ton models.

#### Filter Service Door:

Separate service door provides easy access for filter change.

#### One Inch, Disposable Air Filters:

Are standard equipment. Optional one inch washable filters available and filter racks permit the addition of 2" pleated filter. Factory or field installed.

### Condenser Fan and Motor Shroud Assembly:

Slides out for easy access.

#### **Barometric Fresh Air Damper:**

Standard on all units. Allows up to 25% outside fresh air. Optional ventilation packages available.

#### **Built-in Circuit Breakers:**

Standard on all electric heat versions of single (230/208 volt) and three phase (230/208 volt) equipment. Toggle disconnects are standard on all electric heat versions of three phase (460 volt) equipment.

#### Slope Top:

Standard feature for water run-off.

### Top Rain Flashing:

Standard feature on all models.



MEA # 357-93-E

#### Liquid Line Filter Drier:

Standard on all units. Protects system against moisture.

#### **Compressor Control Module:**

Standard on all units. Built-in off-delay timer adjustable from 30 seconds to 5 minutes. 2-minute on-delay if power interrupt. 120-second bypass for low pressure control, and both soft and manual lockouts for high and low pressure controls. Alarm output for alarm relay.

### High & Low Pressure Switches are Auto-Reset:

Standard on all units. Built-in lockout circuit resets from the room thermostat. Provides commercial quality protection to the compressor.



Certified to ANSI/ARI Standard 390-2003 for SPVU (Single Package Vertical Units).

Commercial Product - Not intended for Residential application.







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| Capacity and Efficiency Ratings |        |        |        |        |        |        |        |  |  |  |  |  |
|---------------------------------|--------|--------|--------|--------|--------|--------|--------|--|--|--|--|--|
| MODELS                          | W18A1  | W24A1  | W30A1  | W36A1  | W42A1  | W48A1  | W60A1  |  |  |  |  |  |
| Cooling Capacity BTUH ①         | 16,400 | 24,000 | 29,400 | 35,400 | 41,000 | 47,000 | 55,000 |  |  |  |  |  |
| EER ②                           | 9.00   | 9.00   | 9.00   | 9.00   | 9.20   | 9.00   | 9.00   |  |  |  |  |  |

All ratings based on fresh air intake being 100% closed (no outside air introduction).

| Specification                                     | s 1-1/2 T                                                   | Ton thro    | ugh 3 T     | on         |             |             |            |             |             |            |
|---------------------------------------------------|-------------------------------------------------------------|-------------|-------------|------------|-------------|-------------|------------|-------------|-------------|------------|
| MODELS                                            | W18A1-A                                                     | W24A1-A     | W24A1-B     | W24A1-C    | W30A1-A     | W30A1-B     | W30A1-C    | W36A1-A     | W36A1-B     | W36A1-C    |
| Electrical Rating60 Hz                            | 230/208 - 1                                                 | 230/208 - 1 | 230/208 - 3 | 460 - 3    | 230/208 - 1 | 230/208 - 3 | 460 - 3    | 230/208 - 1 | 230/208 - 3 | 460 - 3    |
| Operating Voltage Range                           | erating Voltage Range 197-253 197-253 197-253 414-506       |             | 414-506     | 197-253    | 197-253     | 414-506     | 197-253    | 197-253     | 414-506     |            |
| CompressorCircuit A                               |                                                             |             |             |            |             |             |            |             |             |            |
| Voltage                                           | 230/208                                                     | 230/208     | 230/208     | 460        | 230/208     | 230/208     | 460        | 230/208     | 230/208     | 460        |
| Rated Load Amps                                   | 6.5/7.2                                                     | 11./12.4    | 7.2/8.1     | 5.0        | 11.7/13.3   | 7.5/8.5     | 5.3        | 15.9/17.7   | 11.8/13.1   | 6.0        |
| Branch Circuit<br>Selection Current               | 9.0                                                         | 12.9        | 8.4         | 5.2        | 14.2        | 9.0         | 5.7        | 18          | 13.3        | 6.0        |
| Lock Rotor Amps 48/48 64/64 58/58 28 78/78        |                                                             | 71/71       | 38          | 112/112    | 88/88       | 44          |            |             |             |            |
| Compressor Type                                   | Compressor Type Scroll Scroll Scroll Scroll Scroll Scroll S |             | Scroll      | Scroll     | Scroll      | Scroll      |            |             |             |            |
| Fan Motor & Condenser                             |                                                             |             |             |            |             |             |            |             |             |            |
| Fan MotorHPRPM                                    | 1/5 - 1075                                                  | 1/5 - 1075  | 1/5 - 1075  | 1/5 - 1075 | 1/5 - 1075  | 1/5 - 1075  | 1/5 - 1075 | 1/5 - 1075  | 1/5 - 1075  | 1/5 - 1075 |
| Fan MotorAmps                                     | 1.2                                                         | 1.2         | 1.2         | 1.4        | 1.5         | 1.5         | 1.4        | 1.5         | 1.5         | 1.4        |
| FanDIA/CFM                                        | 18" - 1600                                                  | 18" - 1600  | 18" - 1600  | 18" - 1600 | 20" - 2100  | 20" - 2100  | 20" - 2100 | 20" - 1900  | 20" - 1900  | 20" - 1900 |
| Blower Motor & Evap.                              |                                                             |             |             |            |             |             |            |             |             |            |
| Blower MotorHP-RPM-SPD                            | 1/6-1100-2                                                  | 1/6-1100-1  | 1/6-1100-1  | 1/3-1100-2 | 1/3-1100-2  | 1/3-1100-2  | 1/3-1100-2 | 1/3-1100-2  | 1/3-1100-2  | 1/3-1100-2 |
| Blower MotorAmps                                  | 1.0                                                         | 1.0         | 1.0         | 1.1        | 2.2         | 2.2         | 1.1        | 2.2         | 2.2         | 1.1        |
| CFM Cooling & E.S.P.<br>w/Filter (Rated-Wet Coil) | 60020                                                       | 80020       | 80020       | 80020      | 100040      | 100040      | 100040     | 110030      | 110030      | 110030     |
| Filter Sizes (inches) STD.                        | 16x25x1                                                     | 16x25x1     | 16x25x1     | 16x25x1    | 16x30x1     | 16x30x1     | 16x30x1    | 16x30x1     | 16x30x1     | 16x30x1    |
| Shipping WeightLBS.                               | 300                                                         | 300         | 300         | 300        | 355         | 355         | 355        | 355         | 355         | 355        |

| Specifications                                    | 3-1/2 To   | n throug   | h 5 Ton                     |            |            |            |            |            |            |  |
|---------------------------------------------------|------------|------------|-----------------------------|------------|------------|------------|------------|------------|------------|--|
| MODELS                                            | W42A1-A    | W42A1-B    | W42A1-C                     | W48A1-A    | W48A1-B    | W48A1-C    | W60A1-A    | W60A1-B    | W60A1-C    |  |
| Electrical Rating60 Hz                            | 230/208-1  | 230/208-3  | 460-3                       | 230/208-1  | 230/208-3  | 460-3      | 230/208-1  | 230/208-3  | 460-3      |  |
| Operating Voltage Range                           | 197-253    | 197-253    | 414-506                     | 197-253    | 197-253    | 414-506    | 197-253    | 197-253    | 414-506    |  |
| CompressorCircuit A                               |            |            |                             |            |            |            |            |            |            |  |
| Voltage                                           | 230/208    | 230/208    | 460                         | 230/208    | 230/208    | 460        | 230/208    | 230/208    | 460        |  |
| Rated Load Amps                                   | 16.7/18.9  | 11/12.5    | 5.8                         | 20/21.9    | 13.9/15.2  | 6.8        | 22.6/25.5  | 13.5/15.2  | 7.6        |  |
| Branch Circuit<br>Selection Current               | 19.9       | 13.2       | 6.1                         | 23.1       | 16.1       | 7.1        | 26.3       | 15.7       | 7.8        |  |
| Lock Rotor Amps                                   | 109/109    | 83.1/83.1  | 41                          | 134/134    | 91/91      | 46         | 134/134    | 110/110    | 52         |  |
| Compressor Type                                   | Scroll     | Scroll     | Scroll Scroll Scroll Scroll |            | Scroll     | Scroll     | Scroll     | Scroll     |            |  |
| Fan Motor & Condenser                             |            |            |                             | _          |            |            |            |            |            |  |
| Fan MotorHP-RPM-SPD                               | 1/3-825-2  | 1/3-825-2  | 1/3-825-1                   | 1/3-825-2  | 1/3-825-2  | 1/3-825-1  | 1/3-825-2  | 1/3-825-2  | 1/3-825-1  |  |
| Fan MotorAmps                                     | 2.5        | 2.5        | 1.3                         | 2.5        | 2.5        | 1.3        | 2.5        | 2.5        | 1.3        |  |
| FanDIA/CFM                                        | 24" - 2600 | 24" - 2600 | 24" - 2600                  | 24" - 2600 | 24" - 2600 | 24" - 2600 | 24" - 2600 | 24" - 2600 | 24" - 2600 |  |
| Blower Motor & Evap.                              |            |            |                             |            |            |            |            |            |            |  |
| Blower MotorHP-RPM-SPD                            | 1/2-1070-2 | 1/2-1070-2 | 1/2-1070-2                  | 1/2-1070-2 | 1/2-1070-2 | 1/2-1070-2 | 1/2-1070-2 | 1/2-1070-2 | 1/2-1070-2 |  |
| Blower MotorAmps                                  | 3.3        | 3.3        | 1.9                         | 3.3        | 3.3        | 1.9        | 3.3        | 3.3        | 1.9        |  |
| CFM Cooling & E.S.P.<br>w/Filter (Rated-Wet Coil) | 140030     | 140030     | 140030                      | 155020     | 155020     | 155020     | 170030     | 170030     | 170030     |  |
| Filter Sizes (inches) STD.                        | 20x30x1    | 20x30x1    | 20x30x1                     | 20x30x1    | 20x30x1    | 20x30x1    | 20x30x1    | 20x30x1    | 20x30x1    |  |
| Shipping WeightLBS.                               | 500        | 500        | 500                         | 500        | 500        | 500        | 500        | 500        | 500        |  |

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① Capacity is certified in accordance with ANSI/ARI Standard 390-2003. ② EER = Energy Efficiency Ratio and is certified in accordance with ANSI/ARI Standard 390-2003.

### Ventilation System Packages

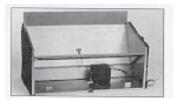
Bard Wall-Mounts are designed to provide optional ventilation packages to meet all of your ventilation and indoor air quality requirements. All units are equipped with a barometric fresh air damper as the standard ventilation package. All ventilation packages can be built-in at the factory or field-installed at a later date.



**Barometric Fresh Air Damper** 



**Motorized Fresh Air Damper** 



**Commercial Room Ventilator** 



**Economizer** 



**Energy Recovery Ventilator** 

### **BAROMETRIC FRESH AIR DAMPER - BFAD**

**STANDARD** 

The barometric fresh air damper is a standard feature on all models. It is installed on the inside of the service door and allows outside ventilation air, up to 25% of the total airflow rating of the unit, to be introduced through the air inlet openings and to be mixed with the conditioned air. The damper opens during blower operation and closes when the blower is off. Adjustable blade stops allow different amounts of outside air to be introduced into the building and can be easily locked closed if required.

#### **BLANK OFF PLATE - BOP**

**OPTIONAL** 

A blank off plate is installed on the inside of the service door. It covers the air inlet openings, which restricts any outside air from entering the unit. The blank off plate should be utilized in applications where outside air is not required to be mixed with the conditioned air.

#### **MOTORIZED FRESH AIR DAMPER - MFAD**

OPTIONAL

The motorized fresh air damper is internally mounted behind the service door and allows outside ventilation air, up to 25% of the total airflow rating of the unit, to be introduced through the air inlet openings and to be mixed with the conditioned air. The two position damper can be fully open or closed. The damper blade is powered open by a 24VAC motor with spring return on power loss. The damper can be controlled by indoor blower operation or can be field connected to be managed based on building occupancy.

**NOTE:** The above vent systems are intake only without built-in exhaust capability. Building will likely require separate field installed barometric relief or mechanical exhaust elsewhere within the conditioned space. Balancing dampers in the return air grille may be required to achieve specified amount of outdoor air intake.

#### **COMMERCIAL ROOM VENTILATOR - CRV**

OPTIONAL

The built-in commercial room ventilator is internally mounted behind the service door and allows outside ventilation air, up to 50% of the total airflow rating of the unit, to be introduced through the air inlet openings. It includes a built-in exhaust air damper.

The commercial room ventilator (CRV) is a simple and innovative approach to improving the indoor air quality by providing fresh air intake and exhaust capability through the CRV. The damper can be easily adjusted to control the amount of fresh air supplied into the building. The CRV can be controlled by indoor blower operation or field controlled based on room occupancy. Two versions available (except on 1.5 and 2-Ton models). The CRV and CRVS are power open - spring return on power loss, and CRVP is power open and power close. Complies with ANSI/ASHRAE Standard 62.1 "Ventilation for Acceptable Indoor Air Quality".

### **ECONOMIZER - EIFM**

OPTIONAL

The built-in economizer system is internally mounted behind the service door and allows outdoor air to be introduced through the air inlet openings. The amount of outdoor air varies in response to the system controls and settings defined by the end user. It includes a built-in exhaust air damper. The economizer is designed to provide "free cooling" when outside air conditions are cool and dry enough to satisfy cooling requirements without running the compressor. This in turn provides lower operating costs, while extending the life of the compressor.

### **Standard Features:**

- One Piece Construction Easy to install with no mechanical linkage adjustment required.
- Exhaust Air Damper Built in with positive closed position. Provides exhaust air capability to prevent pressurization of tight buildings.
- Actuator Motor 24 volt, power open, spring return with built in torque limiting switch.
- Proportioning Type Control for maximum "free cooling" economy and comfort.
- Moisture Eliminator & Prefilter permanent, washable aluminum construction.
- Enthalpy Control adjustable to monitor outdoor temperature and humidity.
- Minimum Position Potentiometer adjustable to control minimum damper blade position for ventilation purposes.
- Mixed Air Sensor to monitor outside and return air to automatically modulate damper position.

#### WALL-MOUNT ENERGY RECOVERY VENTILATOR - ERVF

**OPTIONAL** 

The wall-mount energy recovery ventilator (ERV) is a highly innovative approach to meeting indoor air quality ventilation requirements as established by ANSI/ASHRAE Standard 62.1. The ERV allows from 200 to 450 CFM (depending upon model) of fresh air and exhaust through the unit while maintaining superior indoor comfort and humidity levels. In most cases this can be accomplished without increasing equipment sizing or operating costs. Heat transfer efficiency is up to 67% during summer and 75% during winter conditions.

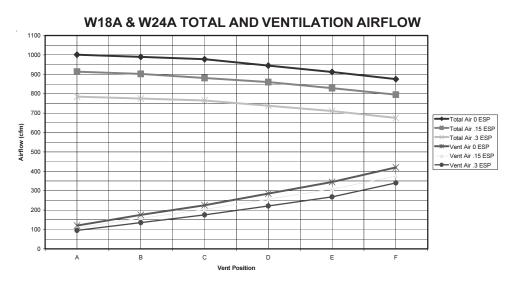
The ERV consists of a unique "rotary energy recovery cassette" that provides effective sensible and latent heat transfer capabilities during summer and winter conditions. Various control schemes are addressed including limiting ventilation during building occupancy only.

The ERV is designed to be internally mounted behind the service door in the W\*\*A, W\*\*H or W\*\*L model wall-mount units. It can be built-in at the factory or field installed as an option. ERVF-\*3 and ERVF-\*5 can be independently adjusted for intake and exhaust rates.

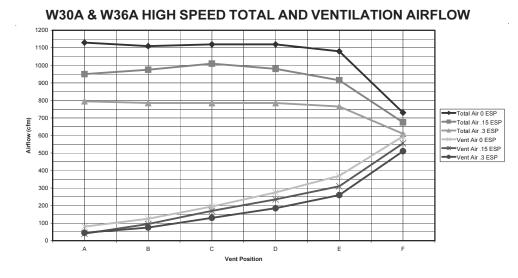
Manufactured under U.S. Patent Nos. 5,485,878; 5,301,744; 5,002,116; 4,924,934; 4,875,520; 4,825,936; 6,310,330.

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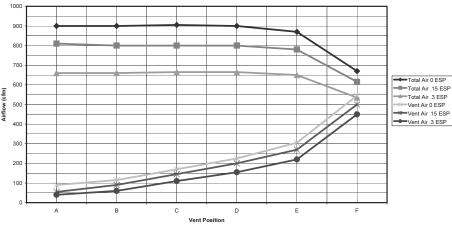
### Commercial Room Ventilator Performance Data - CRV-2



### Commercial Room Ventilator Performance Data - CRVS-3 and CRVP-3



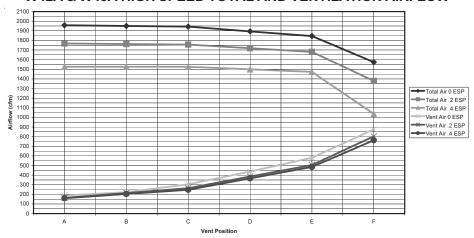
### W30A & W36A LOW SPEED TOTAL AND VENTILATION AIRFLOW



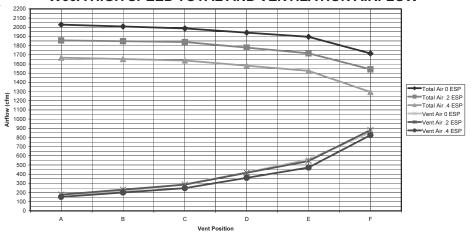
### Commercial Room Ventilator Performance Data - CRVS-5 and CRVP-5

### Commercial Room Ventilator Performance Data - CRVS-5 and CRVP-5

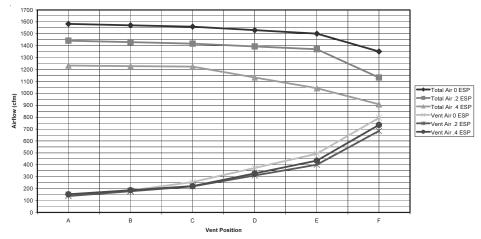
#### W42A & W48A HIGH SPEED TOTAL AND VENTILATION AIRFLOW



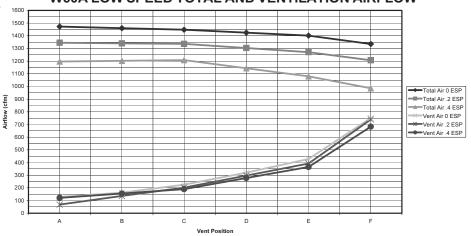
### W60A HIGH SPEED TOTAL AND VENTILATION AIRFLOW



#### W42A & W48A LOW SPEED TOTAL AND VENTILATION AIRFLOW



#### W60A LOW SPEED TOTAL AND VENTILATION AIRFLOW



### Performance and Application Data- ERVF-A2

### SUMMER COOLING PERFORMANCE (INDOOR DESIGN CONDITIONS 75°DB/62°WB)

| Amb<br>O. |          |               | VENTI        | LATION R<br>62% EFF |              |              | ·            |               | VENTI        | VENTILATION RATE 225 CFM 63% EFFICIENCY VENTILATION RATE 200 CFM 63% EFFICIENCY |              |              |              |              |              |              |              |              |              |
|-----------|----------|---------------|--------------|---------------------|--------------|--------------|--------------|---------------|--------------|---------------------------------------------------------------------------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|--------------|
| DB/<br>WB | F        | VLT           | VLS          | VLL                 | HRT          | HRS          | HRL          | VLT           | VLS          | VLL                                                                             | HRT          | HRS          | HRL          | VLT          | VLS          | VLL          | HRT          | HRS          | HRL          |
|           | 75       | 11925         | 8100         | 1325                | 7394         | 5022         | 822          | 10727         | 7287         | 3441                                                                            | 6758         | 4591         | 2168         | 9540         | 6480         | 3060         | 6010         | 4082         | 1928         |
| 105       | 70       | 8100          | 8100         | 0                   | 5022         | 5022         | 0            | 7287          | 7287         | 0                                                                               | 4591         | 4591         | 0            | 6480         | 6480         | 0            | 4082         | 4082         | 0            |
|           | 65       | 8100          | 8100         | 0                   | 5022         | 5022         | 0            | 7287          | 7287         | 0                                                                               | 4591         | 4591         | 0            | 6480         | 6480         | 0            | 4082         | 4082         | 0            |
|           | 80       | 17550         | 6750         | 10800               | 10881        | 4185         | 6696         | 15788         | 6072         | 9716                                                                            | 9946         | 3826         | 6121         | 14040        | 5400         | 8640         | 8845         | 3402         | 5443         |
|           | 75       | 11925         | 6750         | 5175                | 7394         | 4185         | 3209         | 10727         | 6072         | 4655                                                                            | 6758         | 3826         | 2933         | 9540         | 5400         | 4140         | 6010         | 3402         | 2608         |
| 100       | 70       | 6863          | 6750         | 113                 | 4255         | 4185         | 70           | 6173          | 6072         | 101                                                                             | 3889         | 3826         | 64           | 5490         | 5400         | 90           | 3458         | 3402         | 56           |
|           | 65       | 6750          | 6750         | 0                   | 4185         | 4185         | 0            | 6072          | 6072         | 0                                                                               | 3826         | 3826         | 0            | 5400         | 5400         | 0            | 3402         | 3402         | 0            |
|           | 60       | 6750          | 6750         | 0                   | 4185         | 4185         | 0            | 6072          | 6072         | 0                                                                               | 3826         | 3826         | 0            | 5400         | 5400         | 0            | 3402         | 3402         | 0            |
|           | 80       | 17550         | 5400         | 12150               | 10881        | 3348         | 7533         | 15788         | 4858         | 10930                                                                           | 9946         | 3060         | 6886         | 14040        | 4320         | 9720         | 8845         | 2722         | 6124         |
|           | 75       | 11925         | 5400         | 6525                | 7394         | 3348         | 4046         | 10727         | 4858         | 5870                                                                            | 6758         | 3060         | 3698         | 9540         | 4320         | 5220         | 6010         | 2722         | 3289         |
| 95        | 70       | 6863          | 5400         | 1463                | 4255         | 3348         | 907          | 6173          | 4858         | 1315                                                                            | 3889         | 3060         | 829          | 5490         | 4320         | 1170         | 3458         | 2722         | 737          |
|           | 65       | 5400          | 5400         | 0                   | 3348         | 3348         | 0            | 4858          | 4858         | 0                                                                               | 3060         | 3060         | 0            | 4320         | 4320         | 0            | 2722         | 2722         | 0            |
|           | 60       | 5400          | 5400         | 0                   | 3348         | 3348         | 0            | 4858          | 4858         | 0                                                                               | 3060         | 3060         | 0            | 4320         | 4320         | 0            | 2722         | 2722         | 0            |
|           | 80       | 17550         | 4050         | 13500               | 10881        | 2511         | 8370         | 15788         | 3643         | 12145                                                                           | 9946         | 2295         | 7651         | 14040        | 3240         | 10800        | 8845         | 2041         | 6804         |
|           | 75       | 11925         | 4050         | 7875                | 7394         | 2511         | 4883         | 10727         | 3643         | 7084                                                                            | 6758         | 2295         | 4463         | 9540         | 3240         | 6300         | 6010         | 2041         | 3969         |
| 90        | 70       | 6863          | 4050         | 2813                | 4255         | 2511         | 1744         | 6173          | 3643         | 2530                                                                            | 3889         | 2295         | 1594         | 5490         | 3240         | 2250         | 3458         | 2041         | 1417         |
|           | 65       | 4050          | 4050         | 0                   | 2511         | 2511         | 0            | 3643          | 3643         | 0                                                                               | 2295         | 2295         | 0            | 3240         | 3240         | 0            | 2041         | 2041         | 0            |
|           | 60       | 4050          | 4050         | 0                   | 2511         | 2511         | 0            | 3643          | 3643         | 0                                                                               | 2295         | 2295         | 0            | 3240         | 3240         | 0            | 2041         | 2041         | 0            |
|           | 80       | 17550         | 2700         | 14850               | 10881        | 1674         | 9207         | 15788         | 2429         | 13359                                                                           | 9946         | 1530         | 8416         | 14040        | 2160         | 11880        | 8845         | 1361         | 7484         |
| 85        | 75<br>70 | 11925<br>6863 | 2700<br>2700 | 9225<br>4163        | 7394<br>4255 | 1674<br>1674 | 5720<br>2581 | 10727<br>6173 | 2429<br>2429 | 8298<br>3744                                                                    | 6758<br>3889 | 1530<br>1530 | 5228<br>2359 | 9540<br>5490 | 2160<br>2160 | 7380<br>3300 | 6010<br>3458 | 1361<br>1361 | 4649<br>2098 |
| 00        | 65       | 2700          | 2700         | 0                   | 1674         | 1674         | 0            | 2429          | 2429         | 0                                                                               | 1530         | 1530         | 0            | 2160         | 2160         | 0            | 1361         | 1361         | 0            |
|           | 60       | 2700          | 2700         | 0                   | 1674         | 1674         | 0            | 2429          | 2429         | 0                                                                               | 1530         | 1530         | 0            | 2160         | 2160         | 0            | 1361         | 1361         | 0            |
|           | 75       | 11925         | 1350         | 10575               | 7394         | 837          | 6557         | 10727         | 1214         | 9513                                                                            | 6758         | 765          | 5993         | 9540         | 1080         | 8460         | 6010         | 680          | 5330         |
|           | 70       | 6863          | 1350         | 5513                | 4255         | 837          | 3418         | 6173          | 1214         | 4959                                                                            | 3889         | 765          | 3124         | 5490         | 1080         | 4410         | 3458         | 680          | 2778         |
| 80        | 65       | 2363          | 1350         | 1013                | 1465         | 837          | 628          | 2125          | 1214         | 911                                                                             | 1339         | 765          | 547          | 1890         | 1080         | 810          | 1190         | 680          | 510          |
|           | 60       | 1350          | 1350         | 0                   | 837          | 837          | 0            | 1214          | 1214         | 0                                                                               | 765          | 765          | 0            | 1080         | 1080         | 0            | 680          | 680          | 0            |
|           | 70       | 6863          | 0            | 6863                | 4255         | 0            | 4255         | 6173          | 0            | 6173                                                                            | 6889         | 0            | 3889         | 5490         | 0            | 5490         | 3458         | 0            | 3458         |
| 75        | 65       | 2363          | 0            | 2363                | 1465         | 0            | 1465         | 2125          | 0            | 2125                                                                            | 1339         | 0            | 1339         | 1890         | 0            | 1890         | 1190         | 0            | 1190         |
|           | 60       | 0             | 0            | 0                   | 0            | 0            | 0            | 0             | 0            | 0                                                                               | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            | 0            |

### ERVF-A2 WINTER HEATING PERFORMANCE (INDOOR DESIGN CONDITIONS 70°F DB)

| (INDOOR DESIGN CONDITIONS TO F DB) |          |                  |       |       |       |      |  |  |  |  |  |
|------------------------------------|----------|------------------|-------|-------|-------|------|--|--|--|--|--|
|                                    |          | VENTILATION RATE |       |       |       |      |  |  |  |  |  |
| Ambient                            | 250      | CFM              | 225   | CFM   | 200   | CFM  |  |  |  |  |  |
| O.D.                               | 74% EFF. |                  | 75%   | EFF.  | 75%   | EFF. |  |  |  |  |  |
| DB/°F                              | WVL      | WHR              | WVL   | WHR   | WVL   | WHR  |  |  |  |  |  |
| 65                                 | 1350     | 999              | 1214  | 911   | 1080  | 810  |  |  |  |  |  |
| 60                                 | 2700     | 1998             | 2429  | 1822  | 2160  | 1620 |  |  |  |  |  |
| 55                                 | 4050     | 2997             | 3643  | 2733  | 3240  | 2430 |  |  |  |  |  |
| 50                                 | 5400     | 3996             | 4858  | 3643  | 4320  | 3240 |  |  |  |  |  |
| 45                                 | 6750     | 4995             | 6072  | 4554  | 5400  | 4050 |  |  |  |  |  |
| 40                                 | 8100     | 5994             | 7287  | 5465  | 6480  | 4860 |  |  |  |  |  |
| 35                                 | 9450     | 6993             | 8501  | 6376  | 7560  | 5670 |  |  |  |  |  |
| 30                                 | 10800    | 7992             | 9716  | 7287  | 8640  | 6480 |  |  |  |  |  |
| 25                                 | 12150    | 8991             | 10930 | 8198  | 9720  | 7290 |  |  |  |  |  |
| 20                                 | 13500    | 9990             | 12145 | 9108  | 10800 | 8100 |  |  |  |  |  |
| 15                                 | 14850    | 10989            | 13359 | 10019 | 11880 | 8910 |  |  |  |  |  |

NOTE: Sensible performance only is shown for winter application.

### LEGEND:

VLT = Ventilation Load - Total
VLS = Ventilation Load - Sensible
VLL = Ventilation Load - Latent
HRT = Heat Recovery - Total
HRS = Heat Recovery - Sensible
HRL = Heat Recovery - Latent
WVL = Winter Ventilation Load
WHR = Winter Heat Recovery

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### Performance and Application Data- ERVF-\*3

VENTILATION RATE -- 400CFM

### SUMMER COOLING PERFORMANCE (INDOOR DESIGN CONDITIONS 75°DB/62°WB)

VENTILATION RATE -- 325 CFM

| 0.0       | 0.       |                | 6     | 3% EFF   | -ICIENC      | Y            |          |              | 6            | 4% EFF   | ICIENC       | Υ            |         | 65% EFFICIENCY |              |          |              |              |         |
|-----------|----------|----------------|-------|----------|--------------|--------------|----------|--------------|--------------|----------|--------------|--------------|---------|----------------|--------------|----------|--------------|--------------|---------|
| DB/<br>WB | F        | VLT            | VLS   | VLL      | HRT          | HRS          | HRL      | VLT          | VLS          | VLL      | HRT          | HRS          | HRL     | VLT            | VLS          | VLL      | HRT          | HRS          | HRL     |
|           | 75       | 19080          | 12960 | 6120     | 12020        | 8164         | 3855     | 15502        | 10530        | 4972     | 9921         | 6739         | 3182    | 11925          | 8100         | 3825     | 7751         | 5265         | 2486    |
| 105       | 70       | 12960          | 12960 | 0        | 8164         | 8164         | 0        | 10530        | 10530        | 0        | 6739         | 6739         | 0       | 8100           | 8100         | 0        | 5265         | 5265         | 0       |
|           | 65       | 12960          | 12960 | 0        | 8164         | 8164         | 0        | 10530        | 10530        | 0        | 6739         | 6739         | 0       | 8100           | 8100         | 0        | 5265         | 5265         | 0       |
|           | 80       | 28080          | 10800 | 17280    | 17690        | 6804         | 10886    | 22815        | 8775         | 14040    | 14601        | 5616         | 8985    | 17550          | 6750         | 10800    | 11407        | 4387         | 7019    |
|           | 75       |                | 10800 | 8280     | 12020        | 6804         | 5216     | 15502        | 8775         | 6727     | 9921         | 5616         | 4305    | 11925          | 6750         | 5175     | 7751         | 4387         | 3363    |
| 100       | 70<br>65 | 10980<br>10800 | 10800 | 180<br>0 | 6717<br>6804 | 6804<br>6804 | 113<br>0 | 8921<br>8775 | 8775<br>8775 | 146<br>0 | 5709<br>5616 | 5616<br>5616 | 93<br>0 | 6862<br>6750   | 6750<br>6750 | 112<br>0 | 4460<br>4387 | 4387<br>4387 | 73<br>0 |
|           | 60       | 10800          | 10800 | 0        | 6804         | 6804         | 0        | 8775         | 8775         | 0        | 5616         | 5616         | 0       | 6750           | 6750         | 0        | 4387         | 4387         | 0       |
|           | 80       | 28080          | 8640  | 19440    | 17690        | 5443         | 12247    | 22815        | 7020         | 15795    | 14601        | 4492         | 10108   | 17550          | 5400         | 12150    | 11407        | 3510         | 7897    |
|           | 75       | 19080          | 8640  | 10440    | 12020        | 5443         | 6577     | 15502        | 7020         | 8482     | 9921         | 4492         | 5428    | 11925          | 5400         | 6525     | 7751         | 3510         | 4241    |
| 95        | 70       | 10980          | 8640  | 2340     | 6917         | 5443         | 1474     | 8921         | 7020         | 1901     | 5709         | 4492         | 1216    | 6862           | 5400         | 1462     | 4460         | 3510         | 950     |
|           | 65       | 8640           | 8640  | 0        | 5443         | 5443         | 0        | 7020         | 7020         | 0        | 4492         | 4492         | 0       | 5400           | 5400         | 0        | 3510         | 3510         | 0       |
|           | 60       | 8640           | 8640  | 0        | 5443         | 5443         | 0        | 7020         | 7020         | 0        | 4492         | 4492         | 0       | 5400           | 5400         | 0        | 3510         | 3510         | 0       |
|           | 80       | 28080          | 6480  | 21600    | 17690        | 4082         | 13608    | 22815        | 5265         | 17550    | 14601        | 3369         | 11232   | 17550          | 4050         | 13500    | 11407        | 2632         | 8774    |
|           | 75       | 19080          | 6480  | 12600    | 12020        | 4082         | 7938     | 15502        | 5265         | 10237    | 9921         | 3369         | 6552    | 11925          | 4050         | 7875     | 7751         | 2632         | 5118    |
| 90        | 70       | 10980          | 6480  | 4500     | 6917         | 4082         | 2835     | 8921         | 5265         | 3656     | 5709         | 3369         | 2340    | 6862           | 4050         | 2812     | 4460         | 2632         | 1828    |
|           | 65       | 6480           | 6480  | 0        | 4082         | 4082         | 0        | 5265         | 5265         | 0        | 3369         | 3369         | 0       | 4050           | 4050         | 0        | 2632         | 2632         | 0       |
|           | 60       | 6480           | 6480  | 0        | 4082         | 4082         | 0        | 5265         | 5265         | 0        | 3369         | 3369         | 0       | 4050           | 4050         | 0        | 2632         | 2632         | 0       |
|           | 80       | 28080          | 4320  | 23760    | 17690        | 2721         | 14968    | 22815        | 3510         | 19305    | 14601        | 2246         | 12355   | 17550          | 2700         | 14850    | 11407        | 1755         | 9652    |
|           | 75       | 19080          | 4320  | 14760    | 12020        | 2721         | 9298     | 15502        | 3510         | 11992    | 9921         | 2246         | 7675    | 11925          | 2700         | 9225     | 7751         | 1755         | 5996    |
| 85        | 70       | 10980          | 4320  | 6660     | 6917         | 2721         | 4195     | 8921         | 3510         | 5411     | 5709         | 2246         | 3463    | 6862           | 2700         | 4162     | 4460         | 1755         | 2705    |
|           | 65       | 4320           | 4320  | 0        | 2721         | 2721         | 0        | 3510         | 3510         | 0        | 2246         | 2246         | 0       | 2700           | 2700         | 0        | 1755         | 1755         | 0       |
|           | 60       | 4320           | 4320  | 0        | 2721         | 2721         | 0        | 3510         | 3510         | 0        | 2246         | 2246         | 0       | 2700           | 2700         | 0        | 1755         | 1755         | 0       |
|           | 75       | 19080          | 2160  | 16920    | 12020        | 1360         | 10659    | 15502        | 1755         | 13747    | 9921         | 1123         | 8798    | 11925          | 1350         | 10575    | 7751         | 877          | 6873    |
| 0.0       | 70       | 10980          | 2160  | 8820     | 6917         | 1360         | 5556     | 8921         | 1755         | 7166     | 5709         | 1123         | 4586    | 6862           | 1350         | 5512     | 4460         | 877          | 3583    |
| 80        | 65       | 3780           | 2160  | 1620     | 2381         | 1360         | 1020     | 3071         | 1755         | 1316     | 1965         | 1123         | 842     | 2362           | 1350         | 1012     | 1535         | 877          | 658     |
|           | 60       | 2160           | 2160  | 0        | 1360         | 1360         | 0        | 1755         | 1755         | 0        | 1123         | 1123         | 0       | 1350           | 1350         | 0        | 877          | 877          | 0       |
|           | 70       | 10980          | 0     | 10980    | 6917         | 0            | 6917     | 8921         | 0            | 8921     | 5709         | 0            | 5709    | 6862           | 0            | 6862     | 4460         | 0            | 4460    |
| 75        | 65       | 3780           | 0     | 3780     | 2381         | 0            | 2380     | 3071         | 0            | 3071     | 1965         | 0            | 1965    | 2362           | 0            | 2362     | 1535         | 0            | 1535    |
|           | 60       | 0              | 0     | 0        | 0            | 0            | 0        | 0            | 0            | 0        | 0            | 0            | 0       | 0              | 0            | 0        | 0            | 0            | 0       |
|           |          |                |       |          |              |              |          |              |              |          |              |              |         |                |              |          |              |              |         |

### Performance and Application Data- ERVF-\*5

### SUMMER COOLING PERFORMANCE (INDOOR DESIGN CONDITIONS 75°DB/62°WB)

|            |          |           | (INDOOR DESIGN CONDITIONS 13 DB/02 WB) |           |              |             |           |              |       |           |              |              |           |                                            |              |       |              |      |       |
|------------|----------|-----------|----------------------------------------|-----------|--------------|-------------|-----------|--------------|-------|-----------|--------------|--------------|-----------|--------------------------------------------|--------------|-------|--------------|------|-------|
| Amb<br>O.I |          |           | VENTIL.                                |           | ATE 4        | 50 CFN<br>Y | 1         |              |       |           | ATE 3        |              | 1         | VENTILATION RATE 300 CFM<br>67% EFFICIENCY |              |       |              |      |       |
| DB/<br>WB  | F        | VLT       | VLS                                    | VLL       | HRT          | HRS         | HRL       | VLT          | VLS   | VLL       | HRT          | HRS          | HRL       | VLT                                        | VLS          | VLL   | HRT          | HRS  | HRL   |
|            | 75       | 21465     | 14580                                  | 6884      | 13952        | 9477        | 4475      | 17887        | 12150 | 5737      | 11805        | 8018         | 3786      | 14310                                      | 9720         | 4590  | 9587         | 6512 | 3075  |
| 105        | 70       | 14580     | 14580                                  | 0         | 9477         | 9477        | 0         | 12150        | 12150 | 0         | 8018         | 8018         | 0         | 9720                                       | 9720         | 0     | 6512         | 6512 | 0     |
|            | 65       | 14580     | 14580                                  | 0         | 9477         | 9477        | 0         | 12150        | 12150 | 0         | 8018         | 8018         | 0         | 9720                                       | 9720         | 0     | 6512         | 6512 | 0     |
|            | 80       | 31590     | 12150                                  | 19440     | 20533        | 7897        | 12635     | 26325        | 10125 | 16200     | 17374        | 6682         | 10692     | 21060                                      | 8100         | 12960 | 14110        | 5427 | 8683  |
|            | 75       | 21465     | 12150                                  | 9314      | 13952        | 7897        | 6054      | 17887        | 10125 | 7762      | 11805        | 6682         | 5123      | 14310                                      | 8100         | 6210  | 9587         | 5427 | 4160  |
| 100        | 70       | 12352     | 12150                                  | 202       | 8029         | 7897        | 131       | 10293        | 10125 | 168       | 6793         | 6682         | 111       | 8235                                       | 8100         | 135   | 5517         | 5427 | 90    |
|            | 65       | 12150     | 12150                                  | 0         | 7897         | 7897        | 0         | 10125        | 10125 | 0         | 6682         | 6682         | 0         | 8100                                       | 8100         | 0     | 5427         | 5427 | 0     |
|            | 60       | 12150     | 12150                                  | 0         | 7897         | 7897        | 0         | 10125        | 10125 | 0         | 6682         | 6682         | 0         | 8100                                       | 8100         | 0     | 5427         | 5427 | 0     |
|            | 80       | 31590     | 9720                                   | 21870     | 20533        | 6318        | 14215     | 26325        | 8100  | 18225     | 17374        | 5345         | 12028     | 21060                                      | 6480         | 14580 | 14110        | 4341 | 9768  |
|            | 75       | 21465     | 9720                                   | 11744     | 13952        | 6318        | 7634      | 17887        | 8100  | 9787      | 11805        | 5345         | 6459      | 14310                                      | 6480         | 7830  | 9587         | 4341 | 5246  |
| 95         | 70       | 12352     | 9720                                   | 2632      | 8029         | 6318        | 1711      | 10293        | 8100  | 2193      | 6793         | 5345         | 1447      | 8235                                       | 6480         | 1755  | 5517         | 4341 | 1175  |
|            | 65       | 9720      | 9720                                   | 0         | 6318         | 6318        | 0         | 8100         | 8100  | 0         | 5345         | 5345         | 0         | 6480                                       | 6480         | 0     | 4341         | 4341 | 0     |
|            | 60       | 9720      | 9720                                   | 0         | 6318         | 6318        | 0         | 8100         | 8100  | 0         | 5345         | 5345         | 0         | 6480                                       | 6480         | 0     | 4341         | 4341 | 0     |
|            | 80       | 31590     | 7290                                   | 24300     | 20533        | 4738        | 15794     | 26325        | 6075  | 20250     | 17374        | 4009         | 13365     | 21060                                      | 4860         | 16200 | 14110        | 3256 | 10854 |
|            | 75       | 21465     | 7290                                   | 14175     | 13952        | 4738        | 9213      | 17887        | 6075  | 11812     | 11805        | 4009         | 7796      | 14310                                      | 4860         | 9450  | 9587         | 3256 | 6331  |
| 90         | 70       | 12352     | 7290                                   | 5062      | 8029         | 4738        | 3290      | 10293        | 6075  | 4218      | 6793         | 4009         | 2784      | 8235                                       | 4860         | 3375  | 5517         | 3256 | 2261  |
|            | 65       | 7290      | 7290                                   | 0         | 4738         | 4738        | 0         | 6075         | 6075  | 0         | 4009         | 4009         | 0         | 4860                                       | 4860         | 0     | 3256         | 3256 | 0     |
|            | 60       | 7290      | 7290                                   | 0         | 4738         | 4738        | 0         | 6075         | 6075  | 0         | 4009         | 4009         | 0         | 4860                                       | 4860         | 0     | 3256         | 3256 | 0     |
|            | 80       | 31590     | 4860                                   | 26730     | 20533        | 3159        | 17374     | 26325        | 4050  | 22275     | 17374        | 2672         | 14701     | 21060                                      | 3240         | 17820 | 14110        | 2170 | 11939 |
|            | 75       | 21465     | 4860                                   | 16605     | 13952        | 3159        | 10793     | 17887        | 4050  | 13837     | 11805        | 2672         | 9132      | 14310                                      | 3240         | 11070 | 9587         | 2170 | 7416  |
| 85         | 70       | 12352     | 4860                                   | 7492      | 8029         | 3159        | 4870      | 10293        | 4050  | 6243      | 6793         | 2672         | 4120      | 8235                                       | 3240         | 4995  | 5517         | 2170 | 3346  |
|            | 65       | 4860      | 4860                                   | 0         | 3159         | 3159        | 0         | 4050         | 4050  | 0         | 2672         | 2672         | 0         | 3240                                       | 3240         | 0     | 2170         | 2170 | 0     |
|            | 60       | 4860      | 4860                                   | 0         | 3159         | 3159        | 0         | 4050         | 4050  | 0         | 2672         | 2672         | 0         | 3240                                       | 3240         | 0     | 2170         | 2170 | 0     |
|            | 75       | 21465     | 2430                                   | 19035     | 13952        | 1579        | 12372     | 17887        | 2025  | 15862     | 11805        | 1336         | 10469     | 14310                                      | 1620         | 12690 | 9587         | 1085 | 8502  |
| 80         | 70       | 12352     | 2430                                   | 9922      | 8029         | 1579        | 6449      | 10293        | 2025  | 8268      | 6793         | 1336         | 5457      | 8235                                       | 1620         | 6615  | 5517         | 1085 | 4432  |
|            | 65       | 4252      | 2430<br>2430                           | 1822      | 2764         | 1579        | 1184      | 3543<br>2025 | 2025  | 1518<br>0 | 2338<br>1336 | 1336<br>1336 | 1002      | 2835<br>1620                               | 1620<br>1620 | 1215  | 1899<br>1085 | 1085 | 814   |
|            | 60<br>70 | 2430      | 0                                      | 12352     | 1579<br>8029 | 1579        | 8029      | 10293        | 0     | 10293     | 6793         | 1336         | 0<br>6793 | 8235                                       | 1620         | 8235  | 5517         | 1085 | 5517  |
| 7.         |          | 12352     |                                        |           |              | 1           |           |              |       |           |              |              |           |                                            |              |       |              | 1    |       |
| 75         | 65<br>60 | 4252<br>0 | 0                                      | 4252<br>0 | 2764<br>0    | 0           | 2764<br>0 | 3543<br>0    | 0     | 3543<br>0 | 2338         | 0            | 2338      | 2835                                       | 0            | 2835  | 1899         | 0    | 1899  |
|            | υď       | U         | U                                      | U         | U            | U           | U         | U            | U     | U         | U            | U            | U         | U                                          | U            | L U   | L U          | U    | U     |

### ERVF-\*3 WINTER HEATING PERFORMANCE (INDOOR DESIGN CONDITIONS 70°F DB)

|                | (INDOGN BEGIGN CONDINIONS TO LED) |          |          |          |                |       |  |  |
|----------------|-----------------------------------|----------|----------|----------|----------------|-------|--|--|
| A mala i a mat |                                   |          | VENTILAT | ION RATE |                |       |  |  |
| Ambient O.D.   | 400                               | CFM      | 325      | CFM      | 250 CFM        |       |  |  |
| O.D.           | 75% EFF                           | FICIENCY | 76% EFF  | FICIENCY | 77% EFFICIENCY |       |  |  |
| DB/°F          | WVL                               | WHR      | WVL      | WHR      | WVL            | WHR   |  |  |
| 65             | 2160                              | 1620     | 1755     | 1333     | 1350           | 1039  |  |  |
| 60             | 4320                              | 3240     | 3510     | 2667     | 2700           | 2079  |  |  |
| 55             | 6480                              | 4860     | 5265     | 4001     | 4050           | 3118  |  |  |
| 50             | 8640                              | 6480     | 7020     | 5335     | 5400           | 4158  |  |  |
| 45             | 10800                             | 8100     | 8775     | 6669     | 6750           | 5197  |  |  |
| 40             | 12960                             | 9720     | 10530    | 8002     | 8100           | 6237  |  |  |
| 35             | 15120                             | 11340    | 12285    | 9336     | 9450           | 7276  |  |  |
| 30             | 17280                             | 12960    | 14040    | 10670    | 10800          | 8316  |  |  |
| 25             | 19440                             | 14580    | 15795    | 12004    | 12150          | 9355  |  |  |
| 20             | 21600                             | 16200    | 17550    | 13338    | 13500          | 10395 |  |  |
| 15             | 23760                             | 17820    | 19305    | 14671    | 14850          | 11434 |  |  |

NOTE: Sensible performance only is shown for winter application.

#### LEGEND:

VENTILATION RATE -- 250 CFM

VLT = Ventilation Load - Total
VLS = Ventilation Load - Sensible
VLL = Ventilation Load - Latent
HRT = Heat Recovery - Total
HRS = Heat Recovery - Sensible
HRL = Heat Recovery - Latent
WVL = Winter Ventilation Load
WHR = Winter Heat Recovery

#### ERVF-\*5 WINTER HEATING PERFORMANCE (INDOOR DESIGN CONDITIONS 70°F DB)

| (INDOOR DESIGN CONDITIONS 70 F DB) |         |         |          |          |                |       |  |  |  |  |
|------------------------------------|---------|---------|----------|----------|----------------|-------|--|--|--|--|
| Ambient                            |         |         | VENTILAT | ION RATE |                |       |  |  |  |  |
| O.D.                               | 450     | CFM     | 375      | CFM      | 300 CFM        |       |  |  |  |  |
| O.D.                               | 80% EFF | ICIENCY | 81% EFF  | FICIENCY | 82% EFFICIENCY |       |  |  |  |  |
| DB/°F                              | WVL     | WHR     | WVL      | WHR      | WVL            | WHR   |  |  |  |  |
| 65                                 | 2430    | 1944    | 2025     | 1640     | 1620           | 1328  |  |  |  |  |
| 60                                 | 4860    | 3888    | 4050     | 3280     | 3240           | 2656  |  |  |  |  |
| 55                                 | 7290    | 5832    | 6075     | 4920     | 4860           | 3985  |  |  |  |  |
| 50                                 | 9720    | 7776    | 8100     | 6561     | 6480           | 5313  |  |  |  |  |
| 45                                 | 12150   | 9720    | 10125    | 8201     | 8100           | 6642  |  |  |  |  |
| 40                                 | 14580   | 11664   | 12150    | 9841     | 9720           | 7970  |  |  |  |  |
| 35                                 | 17010   | 13608   | 14175    | 11481    | 11340          | 9298  |  |  |  |  |
| 30                                 | 19440   | 15552   | 16200    | 13122    | 12960          | 10627 |  |  |  |  |
| 25                                 | 21870   | 17496   | 18225    | 14762    | 14580          | 11955 |  |  |  |  |
| 20                                 | 24300   | 19440   | 20250    | 16402    | 16200          | 13284 |  |  |  |  |
| 15                                 | 26730   | 21384   | 22275    | 18042    | 17820          | 14612 |  |  |  |  |

NOTE: Sensible performance only is shown for winter application.

Ambient

| Electrical S                | Electrical Specifications |                   |                     |                                |                    |          |          |               |          |                  |        |              |          |          |
|-----------------------------|---------------------------|-------------------|---------------------|--------------------------------|--------------------|----------|----------|---------------|----------|------------------|--------|--------------|----------|----------|
|                             |                           |                   |                     | Single (                       | Circuit            |          |          |               |          | Dual (           |        |              |          |          |
|                             | Rated                     | No. Field         | 3 Minimum           | ① Maximum                      | ② Field            | ② Ground |          | nimum<br>cuit |          | ximum<br>al Fuse |        | Field<br>wer | ② Gr     | round    |
| Model                       | Volts<br>and Phase        | Power<br>Circuits | Circuit<br>Ampacity | External Fuse<br>or Ckt. Brkr. | Power<br>Wire Size | Wire     | Amp      | acity         | or Ck    | t. Brkr.         | Wire   | Size         | Wire     |          |
| W18A1 - A00, A0Z            | and i nasc                | 1                 | 16                  | 20                             | 12                 | 12       | Ckt. A   | Ckt. B        | Ckt. A   | Ckt. B           | Ckt. A | Ckt. B       | Ckt. A   | Ckt. B   |
| A05                         | 230/208-1                 | 1                 | 30                  | 30                             | 10                 | 10       |          |               |          |                  |        |              |          |          |
| A08<br>A10                  | 200/200 1                 | 1                 | 46<br>56            | 50<br>60                       | 8<br>6             | 10<br>10 |          |               |          |                  |        |              |          |          |
| W24A1 - A00, A0Z            |                           | 1                 | 21                  | 30                             | 10                 | 10       |          |               |          |                  |        |              |          |          |
| A05<br>A08                  | 230/208-1                 | 1                 | 30<br>46            | 30<br>50                       | 10<br>8            | 10<br>10 |          |               |          |                  |        |              |          |          |
| A10                         |                           | 1                 | 56                  | 60                             | 6                  | 10       |          |               |          |                  |        |              |          |          |
| W24A1 - B00, B0Z<br>B06     | 230/208-3                 | 1<br>1            | 15<br>22            | 15<br>25                       | 14<br>10           | 14<br>10 |          |               |          |                  |        |              |          |          |
| W24A1 - C00, C0Z            | 460-3                     | 1                 | 10                  | 15                             | 14                 | 14       |          |               |          |                  |        |              |          |          |
| C06<br>W30A1 - A00*, A0Z*   | 400-3                     | 1                 | 12<br>24            | 15<br>35                       | 14<br>8            | 14<br>10 |          |               |          |                  |        |              |          |          |
| A05*                        |                           | 1                 | 32                  | 35                             | 8                  | 10       |          |               |          |                  |        |              |          |          |
| A08<br>A10*                 | 230/208-1                 | 1                 | 48<br>58            | 50<br>60                       | 8<br>6             | 10<br>10 |          |               |          |                  |        |              |          |          |
| A15                         |                           | 1 or 2            | 84                  | 90                             | 4                  | 8        | 58       | 26            | 60       | 30               | 6      | 10           | 10       | 10       |
| W30A1 - B00*, B0Z*<br>B06   | 230/208-3                 | 1                 | 18<br>24            | 20<br>25                       | 12<br>10           | 12<br>10 |          |               |          |                  |        |              |          |          |
| B09*                        | 230/200-3                 | i                 | 33                  | 35                             | 8                  | 10       |          |               |          |                  |        |              |          |          |
| B15<br>W30A1 - C00*, C0Z*   |                           | 1                 | 51<br>11            | 60<br>15                       | 8<br>14            | 10<br>14 |          |               |          |                  |        |              |          |          |
| C06                         | 460-3                     | 1                 | 12                  | 15                             | 14                 | 14       |          |               |          |                  |        |              |          |          |
| C09*<br>C15                 | 400-3                     | 1                 | 17<br>26            | 20<br>30                       | 12<br>10           | 12<br>10 |          |               |          |                  |        |              |          |          |
| W36A1 - A00*, A0Z*          |                           | 1                 | 29                  | 35                             | 8                  | 10       |          |               |          |                  |        |              |          |          |
| A05*<br>A08                 | 230/208-1                 | 1<br>1            | 32<br>48            | 35<br>50                       | 8<br>8             | 10<br>10 |          |               |          |                  |        |              |          |          |
| A10*                        | 230/200-1                 | 1                 | 58                  | 60                             | 6                  | 10       |          |               |          |                  |        |              |          |          |
| A15<br>W36A1 - B00*, B0Z*   |                           | 1 or 2            | 84<br>23            | 90<br>30                       | 4<br>10            | 8<br>10  | 58       | 26            | 60       | 30               | 6      | 10           | 10       | 10       |
| B06                         | 230/208-3                 | 1                 | 23<br>24            | 30                             | 10                 | 10       |          |               |          |                  |        |              |          |          |
| B09*<br>B15                 | 230/208-3                 | 1<br>1            | 33<br>51            | 35<br>60                       | 8<br>6             | 10<br>10 |          |               |          |                  |        |              |          |          |
| W36A1 - C00*, C0Z*          |                           | 1                 | 12                  | 15                             | 14                 | 14       |          |               |          |                  |        |              |          |          |
| C06<br>C09*                 | 460-3                     | 1<br>1            | 12<br>17            | 15<br>20                       | 14<br>10           | 14<br>10 |          |               |          |                  |        |              |          |          |
| C15                         |                           | 1                 | 26                  | 30                             | 10                 | 10       |          |               |          |                  |        |              |          |          |
| W42A1 - A00, A0Z ④<br>A05 ④ |                           | 1                 | 33<br>33            | 50<br>50                       | 8<br>8             | 10<br>10 |          |               |          |                  |        |              |          |          |
| A10 ④                       | 230/208-1                 | i                 | 59                  | 60                             | 6                  | 10       |          |               |          |                  |        |              |          |          |
| A15<br>A20                  |                           | 1 or 2<br>1 or 2  | 85<br>111           | 90<br>125                      | 4<br>2             | 8<br>6   | 59<br>59 | 26<br>52      | 60<br>60 | 30<br>60         | 6<br>6 | 10<br>6      | 10<br>10 | 10<br>10 |
| W42A1 - B00, B0Z ④          |                           | 1                 | 25                  | 35                             | 8                  | 10       | - 55     | 52            | 00       | - 00             | 0      |              | 10       | 10       |
| B09                         | 230/208-3                 | 1 1               | 34<br>53            | 35<br>60                       | 8<br>6             | 10<br>10 |          |               |          |                  |        |              |          |          |
| B18 ④                       |                           | i                 | 62                  | 70                             | 6                  | 8        |          |               |          |                  |        |              |          |          |
| W42A1 - C00, C0Z            | 460-3                     | 1                 | 13<br>18            | 15<br>20                       | 14<br>12           | 14<br>12 |          |               |          |                  |        |              |          |          |
| C15                         | 400 0                     | 1                 | 27                  | 30                             | 10                 | 10       |          |               |          |                  |        |              |          |          |
| W48A1 - A00, A0Z ④<br>A05 ④ |                           | 1<br>1            | 37<br>37            | 50<br>50                       | 8<br>8             | 10<br>10 |          |               |          |                  |        |              |          |          |
| A10 ④                       | 230/208-1                 | 1                 | 59                  | 60                             | 6                  | 10       |          |               |          |                  |        |              |          |          |
| A15<br>A20                  |                           | 1 or 2<br>1 or 2  | 85<br>111           | 90<br>125                      | 4<br>2             | 8<br>6   | 59<br>59 | 26<br>52      | 60<br>60 | 30<br>60         | 6<br>6 | 10<br>6      | 10<br>10 | 10<br>10 |
| W48A1- B00, B0Z ④           |                           | 1                 | 29                  | 40                             | 8                  | 10       |          |               |          |                  |        |              | - 10     |          |
| B09                         | 230/208-3                 | 1                 | 34<br>52            | 40<br>60                       | 8<br>6             | 10<br>10 |          |               |          |                  |        |              |          |          |
| B18 ④                       |                           | 1                 | 62                  | 70                             | 6                  | 8        |          |               |          |                  |        |              |          |          |
| W48A1 - C00, C0Z ④<br>C09 ④ | 460-3                     | 1<br>1            | 14<br>18            | 20<br>20                       | 12<br>12           | 12<br>12 |          |               |          |                  |        |              |          |          |
| C15                         | .55 5                     | 1                 | 27                  | 30                             | 10                 | 10       |          |               |          |                  |        |              |          |          |
| W60A1 - A00, A0Z ④<br>A05 ④ |                           | 1<br>1            | 41<br>41            | 60<br>60                       | 8<br>8             | 10<br>10 |          |               |          |                  |        |              |          |          |
| A10 ④                       | 230/208-1                 | 1                 | 59                  | 60                             | 6                  | 10       |          |               |          |                  |        |              |          |          |
| A15<br>A20                  |                           | 1 or 2<br>1 or 2  | 85<br>111           | 90<br>125                      | 4<br>2             | 8<br>6   | 59<br>59 | 26<br>52      | 60<br>60 | 30<br>60         | 6<br>6 | 10<br>6      | 10<br>10 | 10<br>10 |
| W60A1 - B00, B0Z ④          |                           | 1                 | 28                  | 40                             | 8                  | 10       | - 55     | Ü_            |          | - 55             |        |              | .,       |          |
| B09                         | 230/208-3                 | 1                 | 34<br>53            | 40<br>60                       | 8<br>6             | 10<br>10 |          |               |          |                  |        |              |          |          |
| B18 ④                       |                           | 1                 | 62                  | 70                             | 6                  | 10       |          |               |          |                  |        |              |          |          |
| W60A1 - C00, C0Z ④<br>C09 ④ | 460-3                     | 1                 | 15<br>18            | 20<br>20                       | 12<br>12           | 12<br>12 |          |               |          |                  |        |              |          |          |
| C15                         |                           | 1                 | 27                  | 30                             | 10                 | 10       |          |               |          |                  |        |              |          |          |

IMPORTANT: While this electrical data is presented as a guide, it is important to electrically connect properly sized fuses & conductor wires in accordance with the National Electrical Code & all local codes.

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② Based on 75C copper wire. All wiring must conform to the National Electrical Code and all local codes.
③ These "Minimum Circuit Ampacity" values are to be used for sizing the field power conductors. Refer to the National Electrical code (latest version), Article 310 for power conductor sizing.

① These models are available with dehumidification with hot gas reheat.

Caution: When more than one field power circuit is run through one conduit, the conductors must be derated. Pay special attention to note 8 of Table 310 regarding Ampacity Adjustment Factors when more than three (3) current carrying conductors are in a raceway.

<sup>\*</sup> Top outlet supply option is available only factory installed and only on the selected models.

| Indoo            | Indoor Blower Performance - CFM at Rated Volts |                           |                              |                            |                           |                            |                           |                            |                           |  |  |  |  |
|------------------|------------------------------------------------|---------------------------|------------------------------|----------------------------|---------------------------|----------------------------|---------------------------|----------------------------|---------------------------|--|--|--|--|
| ESP<br>in        | W18                                            | 8A1                       | W24A1                        | W30A1<br>W36A1             |                           | W42A1<br>W48A1             |                           | W60A1                      |                           |  |  |  |  |
| H <sub>2</sub> O | High Speed<br>Dry/Wet Coil                     | Low Speed<br>Dry/Wet Coil | Single Speed<br>Dry/Wet Coil | High Speed<br>Dry/Wet Coil | Low Speed<br>Dry/Wet Coil | High Speed<br>Dry/Wet Coil | Low Speed<br>Dry/Wet Coil | High Speed<br>Dry/Wet Coil | Low Speed<br>Dry/Wet Coil |  |  |  |  |
| 0                | 925/885                                        | 670/655                   | 1020/975                     | 1395/1315                  | 950/935                   | 1885/1800                  | 1650/1600                 | 2200/2000                  | 1600/1450                 |  |  |  |  |
| .1               | 875/845                                        | 650/630                   | 960/905                      | 1340/1270                  | 930/915                   | 1770/1665                  | 1550/1500                 | 2100/1900                  | 1525/1375                 |  |  |  |  |
| .2               | 825/795                                        | 625/600                   | 865/800                      | 1285/1190                  | 910/885                   | 1635/1550                  | 1450/1400                 | 2000/1800                  | 1465/1200                 |  |  |  |  |
| .3               | 775/740                                        | 575/555                   | 820/735                      | 1205/1100                  | 855/830                   | 1500/1400                  | 1350/1300                 | 1875/1700                  | -/-                       |  |  |  |  |
| .4               | 710/670                                        | 525/500                   | 735/650                      | 1110/1000                  | 800/755                   | 1370/1285                  | 1300/1175                 | 1775/1600                  | -/-                       |  |  |  |  |
| .5               | 635/600                                        | 465/440                   | 615/535                      | 1005/870                   | -/-                       | 1250/1150                  | -/-                       | 1650/1475                  | -/-                       |  |  |  |  |

Above data is with 1" standard throwaway filter and 1" washable filter.

For optional 2" pleated filter - reduce ESP by .15 in.

See installation instructions for maximum ESP information on various KW application.

Speeds marked "bold" above are **Factory Connected**.

| Elec    | Electric Heat Table - Refer to Electrical Specifications for Availability by Unit Model |           |           |        |       |           |           |        |      |             |        |       |             |        |  |
|---------|-----------------------------------------------------------------------------------------|-----------|-----------|--------|-------|-----------|-----------|--------|------|-------------|--------|-------|-------------|--------|--|
| Nominal |                                                                                         | At 24     | 0V (1)    |        |       | At 20     | 8V (1)    |        |      | At 480V (2) |        |       | At 460V (2) |        |  |
| KW      | Kw                                                                                      | 1-Ph Amps | 3-Ph Amps | Btuh   | Kw    | 1-Ph Amps | 3-Ph Amps | Btuh   | Kw   | 3-Ph Amps   | Btuh   | Kw    | 3-Ph Amps   | Btuh   |  |
| 5.0     | 5.0                                                                                     | 20.8      |           | 17,065 | 3.75  | 18.0      |           | 12,799 |      |             |        |       |             |        |  |
| 6.0     | 6.0                                                                                     |           | 14.4      | 20,478 | 4.50  |           | 12.5      | 15,359 | 6.0  | 7.2         | 20,478 | 5.52  | 6.9         | 18,840 |  |
| 8.0     | 8.0                                                                                     | 33.3      |           | 27,304 | 6.00  | 28.8      |           | 20,478 |      |             |        |       |             |        |  |
| 9.0     | 9.0                                                                                     |           | 21.7      | 30,717 | 6.75  |           | 18.7      | 23,038 | 9.0  | 10.8        | 30,717 | 8.28  | 10.4        | 28,260 |  |
| 10.0    | 10.0                                                                                    | 41.7      |           | 34,130 | 7.50  | 36.1      |           | 25,598 |      |             | ·      |       |             |        |  |
| 15.0    | 15.0                                                                                    | 62.5      | 36.1      | 51,195 | 11.25 | 54.1      | 31.2      | 38,396 | 15.0 | 18.0        | 51,195 | 13.80 | 17.3        | 47,099 |  |
| 18.0    | 18.0                                                                                    |           | 43.3      | 61,434 | 13.50 |           | 37.5      | 46,076 | 18.0 | 21.7        | 61,434 | 16.56 | 20.8        | 56,519 |  |
| 20.0    | 20.0                                                                                    | 83.3      |           | 68,260 | 15.00 | 72.1      |           | 51,195 |      |             |        |       |             |        |  |

<sup>(1)</sup> These electric heaters are available in 230/208V units only.

<sup>(2)</sup> These electric heaters are available in 480V units only.

| Heater Package                                                             | es - Field Install                                   | led                 |                                                  |               |                                           |              |
|----------------------------------------------------------------------------|------------------------------------------------------|---------------------|--------------------------------------------------|---------------|-------------------------------------------|--------------|
| <ul><li>Designed for adding Ele</li><li>Circuit Breaker Standard</li></ul> |                                                      |                     | • ETL US & Canada Lis<br>• Toggle Disconnect Sta |               | /lodels                                   |              |
| Air Conditioner<br>Models                                                  | -A00 Models<br>230/208-1                             |                     | -B00 Models<br>230/208-3                         |               | -C00 Models<br>460-3                      |              |
| IVIOGOIS                                                                   | Heater Model #                                       | KW                  | Heater Model #                                   | KW            | Heater Model #                            | KW           |
| W18A1                                                                      | EHWA02-A05<br>EHW02A-A08<br>EHWA02A-A10              | 5<br>8<br>10        | N/A                                              |               | N/A                                       |              |
| W24A1                                                                      | EHWA02-A05<br>EHW02A-A08<br>EHWA02A-A10              | 5<br>8<br>10        | EHWA24-B06                                       | 6             | EHWH24B-C06                               | 6            |
| W30A1                                                                      | EHWA03-A05<br>EHWA03-A08<br>EHWA03-A10<br>EHWA03-A15 | 5<br>8<br>10<br>15  | EHWA03-B06<br>EHWA03-B09<br>EHWA37-B15           | 6<br>9<br>15  | EHWC03A-C06<br>EHWC03A-C09<br>EHWA03A-C15 | 6<br>9<br>15 |
| W36A1                                                                      | EHWA03-A05<br>EHWA03-A08<br>EHWA03-A10<br>EHWA03-A15 | 5<br>8<br>10<br>15  | EHW36A-B06<br>EHWA03-B09<br>EHWA37-B15           | 6<br>9<br>15  | EHWC03A-C06<br>EHWC03A-C09<br>EHWA03A-C15 | 6<br>9<br>15 |
| W42A1<br>W48A1                                                             | EHWA05-A05                                           | 5<br>10<br>15<br>20 | EHWA05-B09                                       | 9<br>15<br>18 | EHWA05A-C09                               | 9<br>15      |
| W60A1                                                                      | EHWA60-A05 ① EHWA05-A10 ① EHWA05-A15 EHWA05-A20      | 5<br>10<br>15<br>20 | EHW60A-B09                                       | 9<br>15<br>18 | EHWA05A-C09                               | 9<br>15      |

**NOTE:** Field installed Heater Packages are not approved for use with top supply opening models.

Form No. \$3397-109 Supersedes \$3397-1008 Page 9 of 12

① These heater packages approved for use in dehumidification versions with hot gas reheat.

| 13,600<br>12,200<br>15,800<br>12,400<br>17,300<br>12,000<br>20,000<br>17,900<br>23,300<br>18,200<br>25,500<br>17,600<br>24,700<br>21,800<br>28,600<br>22,200 | 105°F  12,900 11,800  15,200 12,100  16,400 11,600  19,100 17,400  22,500 17,800  24,300 17,000  23,700 21,300  27,800                                                                                                                       | 110°F  12,200 11,500 14,500 11,800 15,500 11,100 18,400 16,900 21,900 17,400 23,300 16,300 22,700 20,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 115°F  11,600 11,100 13,900 11,500 14,600 10,600 17,600 16,400 21,200 17,000 22,300 15,700 21,700 20,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 120°F  10,800 10,700  13,100 11,200  13,700 10,200  17,100 15,900  20,700 16,600  21,500 15,000  20,900 19,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
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| 12,200<br>15,800<br>12,400<br>17,300<br>12,000<br>20,000<br>17,900<br>23,300<br>18,200<br>25,500<br>17,600<br>24,700<br>21,800<br>28,600<br>22,200           | 11,800<br>15,200<br>12,100<br>16,400<br>11,600<br>19,100<br>17,400<br>22,500<br>17,800<br>24,300<br>17,000<br>23,700<br>21,300<br>27,800                                                                                                     | 11,500<br>14,500<br>11,800<br>15,500<br>11,100<br>18,400<br>16,900<br>21,900<br>17,400<br>23,300<br>16,300<br>22,700<br>20,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 11,100<br>13,900<br>11,500<br>14,600<br>10,600<br>17,600<br>16,400<br>21,200<br>17,000<br>22,300<br>15,700<br>21,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10,700<br>13,100<br>11,200<br>13,700<br>10,200<br>17,100<br>15,900<br>20,700<br>16,600<br>21,500<br>15,000<br>20,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 12,400<br>17,300<br>12,000<br>20,000<br>17,900<br>23,300<br>18,200<br>25,500<br>17,600<br>24,700<br>21,800<br>28,600<br>22,200                               | 12,100<br>16,400<br>11,600<br>19,100<br>17,400<br>22,500<br>17,800<br>24,300<br>17,000<br>23,700<br>21,300<br>27,800                                                                                                                         | 11,800<br>15,500<br>11,100<br>18,400<br>16,900<br>21,900<br>17,400<br>23,300<br>16,300<br>22,700<br>20,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 11,500<br>14,600<br>10,600<br>17,600<br>16,400<br>21,200<br>17,000<br>22,300<br>15,700<br>21,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 11,200<br>13,700<br>10,200<br>17,100<br>15,900<br>20,700<br>16,600<br>21,500<br>15,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 12,000<br>20,000<br>17,900<br>23,300<br>18,200<br>25,500<br>17,600<br>24,700<br>21,800<br>28,600<br>22,200                                                   | 11,600<br>19,100<br>17,400<br>22,500<br>17,800<br>24,300<br>17,000<br>23,700<br>21,300<br>27,800                                                                                                                                             | 11,100<br>18,400<br>16,900<br>21,900<br>17,400<br>23,300<br>16,300<br>22,700<br>20,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 10,600<br>17,600<br>16,400<br>21,200<br>17,000<br>22,300<br>15,700<br>21,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10,200<br>17,100<br>15,900<br>20,700<br>16,600<br>21,500<br>15,000<br>20,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| 17,900<br>23,300<br>18,200<br>25,500<br>17,600<br>24,700<br>21,800<br>28,600<br>22,200                                                                       | 17,400<br>22,500<br>17,800<br>24,300<br>17,000<br>23,700<br>21,300<br>27,800                                                                                                                                                                 | 16,900<br>21,900<br>17,400<br>23,300<br>16,300<br>22,700<br>20,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 16,400<br>21,200<br>17,000<br>22,300<br>15,700<br>21,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 15,900<br>20,700<br>16,600<br>21,500<br>15,000<br>20,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 18,200<br>25,500<br>17,600<br>24,700<br>21,800<br>28,600<br>22,200                                                                                           | 17,800<br>24,300<br>17,000<br>23,700<br>21,300<br>27,800                                                                                                                                                                                     | 17,400<br>23,300<br>16,300<br>22,700<br>20,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 17,000<br>22,300<br>15,700<br>21,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 16,600<br>21,500<br>15,000<br>20,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 17,600<br>24,700<br>21,800<br>28,600<br>22,200                                                                                                               | 17,000<br>23,700<br>21,300<br>27,800                                                                                                                                                                                                         | 16,300<br>22,700<br>20,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 15,700<br>21,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 15,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 21,800<br>28,600<br>22,200                                                                                                                                   | 21,300<br>27,800                                                                                                                                                                                                                             | 20,700                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
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| 57,900                                                                                                                                                       | 54,800                                                                                                                                                                                                                                       | 51,800                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 48,900                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 46,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 37,900                                                                                                                                                       | 36,500                                                                                                                                                                                                                                       | 35,000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 33,500                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 32,100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                                                                                                                              | 31,500<br>21,500<br>29,600<br>25,200<br>34,500<br>25,600<br>37,800<br>24,800<br>33,900<br>31,000<br>39,500<br>31,500<br>43,200<br>30,500<br>35,500<br>45,400<br>36,100<br>49,700<br>34,900<br>45,400<br>38,500<br>52,900<br>39,200<br>57,900 | 31,500         30,100           21,500         20,800           29,600         28,600           25,200         24,700           34,500         25,300           37,800         25,300           37,800         24,100           33,900         32,100           31,000         30,100           39,500         37,900           31,500         40,900           30,500         29,500           39,000         37,100           35,500         34,500           45,400         43,700           36,100         47,100           34,900         33,800           45,400         43,100           38,500         37,300           52,900         50,800           39,200         38,300           57,900         54,800 | 31,500         30,100         28,800           21,500         20,800         20,100           29,600         28,600         27,700           25,200         24,700         24,200           34,500         33,700         33,000           25,600         25,300         25,000           37,800         36,400         35,100           24,800         24,100         23,500           33,900         32,100         30,400           31,000         30,100         29,200           39,500         37,900         36,200           31,500         30,900         30,200           43,200         40,900         38,500           30,500         29,500         28,300           35,500         34,500         33,600           45,400         43,700         31,700           34,900         33,800         32,500           45,400         43,100         44,600           34,900         33,800         32,500           45,400         43,100         40,800           38,500         37,300         36,100           52,900         50,800         48,700           39,200         < | 31,500         30,100         28,800         27,500           21,500         20,800         20,100         19,300           29,600         28,600         27,700         26,900           25,200         24,700         24,200         23,700           34,500         33,700         33,000         32,400           25,600         25,300         25,000         24,600           37,800         36,400         35,100         34,100           24,800         24,100         23,500         22,700           33,900         32,100         30,400         28,700           31,000         30,100         29,200         28,400           39,500         37,900         36,200         34,500           31,500         30,900         30,200         29,500           43,200         40,900         38,500         36,300           35,500         34,500         33,600         32,700           45,400         43,700         41,900         34,000           49,700         47,100         34,600         34,000           45,400         43,100         40,800         38,600           34,500         37,300         36,100 |

| Capacity Multiplier Factors |       |       |      |  |  |  |  |  |  |  |
|-----------------------------|-------|-------|------|--|--|--|--|--|--|--|
| % of Rated Airflow          | -10   | Rated | +10  |  |  |  |  |  |  |  |
| Total BTUH                  |       | 1.0   | 1.02 |  |  |  |  |  |  |  |
| Sensible BTUH               | 0.950 | 1.0   | 1.05 |  |  |  |  |  |  |  |

 $<sup>\, \</sup>oplus \,$  Below 65°F (18.3C), unit requires a factory or field installed low ambient control.  $\, \otimes \,$  Return air temperature.

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#### Air Conditioning Wall-Mount Model Nomenclature **CONTROL MODULES** SERIES (See Chart Below) KW ① TYPE **NOMINAL** COIL OPTIONS Air Conditioner CAPACITY X - Standard 18 - 1½ Ton 1 - Phenolic Coated Evaporator **COLOR OPTIONS** 24 - 2 Ton Specialty Products ② **VENTILATION OPTIONS** 2 - Phenolic Coated Condenser X - Beige (Standard) 30 - 21/2 Ton (Non-Standard) (See Table Below) 3 - Phenolic Coated Evaporator 1 - White 36 - 3 Ton and Condenser 2 - Mesa Tan 42 - 31/2 Ton 4 - Buckeye Gray 48 - 4 Ton **VOLTS & PHASE** 5 - Desert Brown **OUTLET OPTIONS** 60 - 5 Ton **FILTER OPTIONS** A - 230/208/60/1 8 - Dark Bronze X - Front (Standard) B - 230/208/60/3 X - 1-inch Throwaway (Standard) A - Aluminum T - Top (on W30A and W - 1-inch Washable C - 460/60/3 S - Stainless Steel W36A Models) P - 2-inch Pleated

- ① For 0KW and circuit breakers (230/208 Volt) or toggle disconnects (460 Volt) applications, insert 0Z in the KW field of the model number.
- ② Insert "D" for dehumidification with hot gas reheat Models W42 60 only. See Form 7960-572 for complete details.

| Ventilation Options                             |                               |                             |                            |                             |                            |                             |  |  |  |  |  |
|-------------------------------------------------|-------------------------------|-----------------------------|----------------------------|-----------------------------|----------------------------|-----------------------------|--|--|--|--|--|
| Models                                          | W18A1                         | , W24A1                     | W30A1                      | , W36A1                     | W42A1, W48A1, W60A1        |                             |  |  |  |  |  |
| Description                                     | Factory Installed<br>Code No. | Field Installed<br>Part No. | Factory Installed Code No. | Field Installed<br>Part No. | Factory Installed Code No. | Field Installed<br>Part No. |  |  |  |  |  |
| Barometric Fresh Air Damper - Standard          | X                             | BFAD-2                      | Х                          | BFAD-3                      | X                          | BFAD-5                      |  |  |  |  |  |
| Blank-Off Plate                                 | В                             | BOP-2                       | В                          | BOP-3                       | В                          | BOP-5                       |  |  |  |  |  |
| Motorized Fresh Air Damper                      | М                             | MFAD-2                      | М                          | MFAD-3                      | M                          | MFAD-5                      |  |  |  |  |  |
| Commercial Ventilator - Spring Return w/Exhaust | V                             | CRV-2                       | V                          | CRVS-3                      | V                          | CRVS-5                      |  |  |  |  |  |
| Commercial Ventilator - Power Return w/Exhaust  |                               |                             | Р                          | CRVP-3                      | Р                          | CRVP-5                      |  |  |  |  |  |
| Economizer - Fully Modulating ①                 | Е                             | EIFM-2B                     | Е                          | EIFM-3C                     | Е                          | EIFM-5C                     |  |  |  |  |  |
| Economizer - Fully Modulating ①②                | D                             | N/A                         | D                          | N/A                         | D                          | N/A                         |  |  |  |  |  |
| Energy Recovery Ventilator - 230 Volt *         | R                             | ERVF-A2                     | R                          | ERVF-A3 3                   | R                          | ERVF-A5 3                   |  |  |  |  |  |
| Energy Recovery Ventilator - 460 Volt *         | N/A                           | ERVF-C2 ④                   | R                          | ERVF-C3 3                   | R                          | ERVF-C5 3                   |  |  |  |  |  |
| Door Kit for ERVF (Required)                    | N/A                           | WMDK2-*                     | N/A                        | WMDK3-*                     | N/A                        | WMDK5-*                     |  |  |  |  |  |

- $\ensuremath{\mathbb{O}}$  Low ambient control is required with economizer for low temperature compressor operation.
- ② For use only with "V" Control Module and TCS23 Controller.
- ③ Intake and exhaust can be independently adjusted.
- Model W24A1-C only.
- \* WMDK Door Kit must be ordered in addition to ERVF Assembly and color matched to unit ("X" = Beige; "4" = Buckeye Gray; "8" = Dark Bronze)

| Air Conditioning Control Modules |       |       |         |       |      |      | All Models Except As Noted |       |                        |                                          |
|----------------------------------|-------|-------|---------|-------|------|------|----------------------------|-------|------------------------|------------------------------------------|
| HPC ①                            | LPC ② | ссм ③ | LAC @11 | ALR © | SK ® | SK Ø | ODT ®                      | DDC 9 | Factory Installed Code | Field Installed Part                     |
| STD                              | STD   | STD   |         |       |      |      |                            |       | Х                      | N/A                                      |
| STD                              | STD   | STD   | •       |       |      |      |                            |       | E 11                   | CMA-28                                   |
| STD                              | STD   | STD   | •       | •     |      |      |                            |       | J 🕦                    | Factory Only                             |
| STD                              | STD   | STD   | •       |       | •    |      |                            |       | K 🕦                    | CMC-15 and CMA-28                        |
| STD                              | STD   | STD   | •       | •     | •    |      |                            |       | M ①                    | Factory Only                             |
| STD                              | STD   | STD   |         | •     |      |      |                            |       | N, W18A Only @         | N/A                                      |
| STD                              | STD   | STD   |         |       | •    |      |                            |       | Field Installed Only   | CMC-15                                   |
| STD                              | STD   | STD   |         |       |      |      | •                          |       | Field Installed Only   | CMA-14                                   |
| STD                              | STD   | STD   | •       | •     |      |      |                            | •     | V 100 111              | Factory Only                             |
| STD                              | STD   | STD   |         |       |      |      |                            | •     | Field Installed Only   | CMA-23 for W18-36A<br>CMA-24 for W42-60A |
| STD                              | STD   | STD   |         |       |      | •    |                            |       | Field Installed Only   | SK111                                    |

- STD = Standard equipment for these specified models.
- ① HPC. High pressure control is auto reset. Always used with compressor control module (CCM) which is included. See note ③.
- ② LPC. Low pressure control is auto reset. Always used with compressor control module (CCM) which is included. See note ③.
- ③ CCM. Compressor control module has adjustable 30-second to 5-minute delay-on-break timer. On initial power-up, or any time the power is interrupted, the delay-on-make will be 2-minutes plus 10% of the delay-on-break setting. There is no delay-on-make during routine operation of the unit. The module also provides the lockout feature (with 1 retry) for high and/or low-pressure controls, and a 2-minute timed bypass for low-pressure control.
- $\ensuremath{\mathfrak{P}}$  LAC. Low ambient control permits cooling operation down to  $0\ensuremath{^\circ} F$
- S ALR. The alarm relay has a set of normally open and normally closed dry contacts to provide the ability to signal a condition of shutdown on either high or low pressure controls.
- ® SK. PTCR start kit can be used with all -A single phase models. Increases starting torque 2-3x. Not used for -B or -C three phase models. Do not use if SK111 is used.
- © SK. Start capacitor and potential relay start kit can be used with all -A single phase models. Increases starting torque 9x. Not used for -B or -C three phase models. Do not use if CMC-15 is used.
- ® ODT. Outdoor thermostat is adjustable from 0 to 50°F. It is suitable for use as a compressor cut-off thermostat.
- ® DDC. Incorporates 4 additional sensors: discharge air temperature, indoor blower airflow, compressor current, and dirty filter. These sensing devices function to input analog data such as temperature, as well as digital data such as airflow, compressor status or filter status.
- ® "V" control module should be ordered in conjunction with direct digital controller (DDC) model TCS23. Refer to DDC specification sheet S3280 for more information.
- (1) Option not available for Model W18A.
- Use option N for Alarm Relay on Model W18A only

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### Clearances Required for Service Access and Adequate Condenser Inlet Airflow

| MODELS                 | LEFT SIDE | RIGHT SIDE |
|------------------------|-----------|------------|
| W18A, W24A, W30A, W36A | 15"       | 20"        |
| W42A, W48A, W60A       | 20"       | 20"        |

NOTE: For side by side installation of two (2) WA models there must be 20" between units. This can be reduced to 15" by using a WL model (left side compressor and controls) for the left unit and WA (right side compressor and controls) for right unit. See WL Specifications S3400.

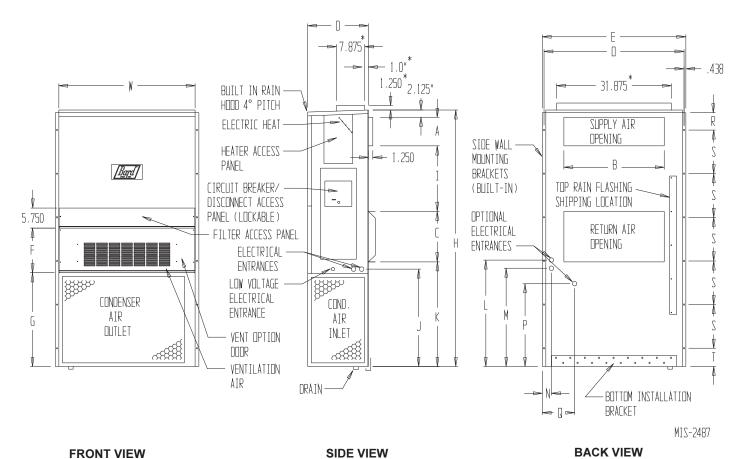
### Minimum Clearances Required to Combustible Materials

| MODELS ①         | SUPPLY AIR DUCT<br>FIRST THREE FEET | CABINET |
|------------------|-------------------------------------|---------|
| W18A, W24A       | 0"                                  | 0"      |
| W30A, W36A       | 1/4"                                | 0"      |
| W42A, W48A, W60A | 1/4"                                | 0"      |

① Refer to the Installation Manual for more detailed information.

#### Dimensions of Basic Unit for Architectural and Installation Requirements (Nominal) WIDTH DEPTH HEIGHT **SUPPLY RETURN** MODE (W) (D) (H) Α В С В Ε G W18A 33.300 17.125 70.563 7.88 19.88 11.88 | 19.88 | 35.00 | 18.50 | 25.75 | 20.56 | 26.75 | 28.06 | 29.25 | 27.00 | 2.63 | 34.13 | 22.06 | 10.55 | 4.19 | 12.00 | 5.00 W24A W30A 38.200 7.88 27.88 13.88 27.88 40.00 18.50 25.75 17.93 26.75 28.75 29.25 27.00 2.75 39.13 22.75 17.125 70.563 9.14 4.19 12.00 5.00 W36A W42A 22.432 | 84.875 | 9.88 | 29.88 | 15.88 | 29.88 | 43.88 | 19.10 | 31.66 | 30.00 | 32.68 | 26.94 | 34.69 | 32.43 | 3.37 | 43.00 | 23.88 | 10.00 | 1.44 | 16.00 | 1.88 W48A 42.075 W60A

All dimensions are in inches. Dimensional drawings are not to scale.



\*Optional top outlet (factory installed only) for W30A and W36A models only.



Bard Manufacturing Company, Inc. Bryan, Ohio 43506 www.bardhvac.com

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Before purchasing this appliance, read important energy cost and efficiency information available from your retailer.

Form No. S3397 January, 2009

Supersedes: S3397-1008

### INSTALLATION INSTRUCTIONS

# WALL MOUNTED PACKAGE AIR CONDITIONERS

# MODELS W17A1

| W18A1        | W18L1  |
|--------------|--------|
| <b>W24A1</b> | W24L1  |
| <b>W30A1</b> | W30L1  |
| <b>W36A1</b> | W36L1  |
| W42A1        | W42L1  |
| W48A1        | W48L1  |
| W60A1        | W60L1  |
| W70Δ1        | W701 1 |



Bard Manufacturing Company, Inc. Bryan, Ohio 43506

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Manual : Supersedes: File: 2100-508B 2100-508A Volume III Tab 1

Date:

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### GETTING OTHER INFORMATION AND PUBLICATIONS

These publications can help you install the air conditioner or heat pump. You can usually find these at your local library or purchase them directly from the publisher. Be sure to consult current edition of each standard.

National Electrical Code ...... ANSI/NFPA 70

Standard for the Installation ...... ANSI/NFPA 90A of Air Conditioning and Ventilating Systems

Standard for Warm Air ...... ANSI/NFPA 90B Heating and Air Conditioning Systems

Duct Design for Residential ...... ACCA Manual D Winter and Summer Air Conditioning and Equipment Selection

### FOR MORE INFORMATION, CONTACT THESE PUBLISHERS:

**ACCA** Air Conditioning Contractors of America

1712 New Hampshire Ave. N.W.

Washington, DC 20009 Telephone: (202) 483-9370 Fax: (202) 234-4721

ANSI American National Standards Institute

11 West Street, 13th Floor New York, NY 10036 Telephone: (212) 642-4900 Fax: (212) 302-1286

ASHRAE American Society of Heating, Refrigeration and Air Conditioning Engineers, Inc.

1791 Tullie Circle, N.E. Atlanta, GA 30329-2305 Telephone: (404) 636-8400

Fax: (404) 321-5478

**NFPA** National Fire Protection Association

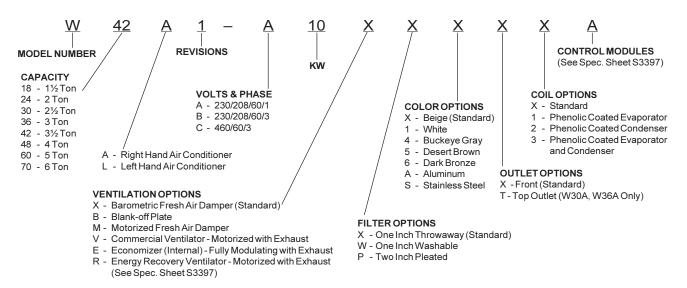
Batterymarch Park P.O. Box 9101

Quincy, MA 02269-9901 Telephone: (800) 344-3555 Fax: (617) 984-7057

Manufactured under the following U.S. Patent numbers: 5,485,878; 5,301,777; 5,002,116

### WALL MOUNT GENERAL INFORMATION

### AIR CONDITIONER WALL MOUNT MODEL NOMENCLATURE



NOTE: Vent options X, B and M are without exhaust capability. May require separate field supplied barometric relief in building.

### SHIPPING DAMAGE

Upon receipt of equipment, the carton should be checked for external signs of shipping damage. If damage is found, the receiving party must contact the last carrier immediately, preferably in writing, requesting inspection by the carrier's agent.

### **GENERAL**

The equipment covered in this manual is to be installed by trained, experienced service and installation technicians.

The refrigerant system is completely assembled and charged. All internal wiring is complete.

The unit is designed for use with or without duct work. Flanges are provided for attaching the supply and return ducts.

These instructions explain the recommended method to install the air cooled self-contained unit and the electrical wiring connections to the unit.

These instructions and any instructions packaged with any separate equipment required to make up the entire air conditioning system should be carefully read before beginning the installation. Note particularly "Starting Procedure" and any tags and/or labels attached to the equipment.

While these instructions are intended as a general recommended guide, they do not supersede any national and/or local codes in any way. Authorities having jurisdiction should be consulted before the installation is made. See Page 3 for information on codes and standards.

Size of unit for a proposed installation should be based on heat loss calculation made according to methods of Air Conditioning Contractors of America (ACCA). The air duct should be installed in accordance with the Standards of the National Fire Protection Association for the Installation of Air Conditioning and Ventilating Systems of Other Than Residence Type, NFPA No. 90A, and Residence Type Warm Air Heating and Air Conditioning Systems, NFPA No. 90B. Where local regulations are at a variance with instructions, installer should adhere to local codes.

#### **DUCT WORK**

All duct work, supply and return, must be properly sized for the design airflow requirement of the equipment. Air Conditioning Contractors of America (ACCA) is an excellent guide to proper sizing. All duct work or portions thereof not in the conditioned space should be properly insulated in order to both conserve energy and prevent condensation or moisture damage.

Refer to Maximum ESP of operation Electric Heat Table 6.

Design the duct work according to methods given by the Air Conditioning Contractors of America (ACCA). When duct runs through unheated spaces, it should be insulated with a minimum of one inch of insulation. Use insulation with a vapor barrier on the outside of the insulation. Flexible joints should be used to connect the duct work to the equipment in order to keep the noise transmission to a minimum.

Models W18 & W24 as approved for zero inch clearance to the supply duct. For model series W30, W36, W42, W48, W60 and W70 a 1/4 inch clearance to combustible material for the first three feet of duct attached to the outlet air frame is required. See Wall Mounting Instructions and Figures 3 and 4 for further details.

Ducts through the walls must be insulated and all joints taped or sealed to prevent air or moisture entering the wall cavity.

Some installations may not require any return air duct. A metallic return air grille is required with installations not requiring a return air duct. The spacing between louvers on the grille shall not be larger than 5/8 inch.

Any grille that meets with 5/8 inch louver criteria may be used. It is recommended that Bard Return Air Grille Kit RG2 through RG5 or RFG2 through RFG5 be installed when no return duct is used. Contact distributor or factory for ordering information. If using a return air filter grille, filters must be of sufficient size to allow a maximum velocity of 400 fpm.

NOTE: If no return air duct is used, applicable installation codes may limit this cabinet to installation only in a single story structure.

#### **FILTERS**

A 1-inch throwaway filter is standard with each unit. The filter slides into position making it easy to service. This filter can be serviced from the outside by removing the filter access panel. A 1-inch washable filter and 2-inch pleated filter are also available as optional accessories. The internal filter brackets are adjustable to accommodate the 2-inch filter by bending two (2) tabs down on each side of the filter support bracket.

#### **FRESH AIR INTAKE**

All units are built with fresh air inlet slots punched in the service door.

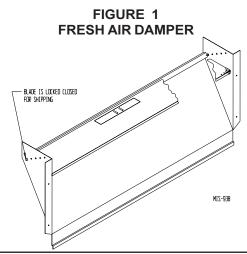
If the unit is equipped with a fresh air damper assembly, the assembly is shipped already attached to the unit. The damper blade is locked in the closed position. To allow the damper to operate, the maximum and minimum blade position stops must be installed. See Figure 1.

All capacity, efficiency and cost of operation information is based upon the fresh air blank-off plate in place and is recommended for maximum energy efficiency.

The blank-off plate is available upon request from the factory and is installed in place of the fresh air damper shipped with each unit.

#### **CONDENSATE DRAIN**

A plastic drain hose extends from the drain pan at the top of the unit down to the unit base. There are openings in the unit base for the drain hose to pass through. In the event the drain hose is connected to a drain system of some type, it must be an open or vented type system to assure proper drainage.



#### WALL MOUNTING INFORMATION

- 1. Two holes for the supply and return air openings must be cut through the wall as shown in Figure 3.
- 2. On wood frame walls, the wall construction must be strong and rigid enough to carry the weight of the unit without transmitting any unit vibration.
- Concrete block walls must be thoroughly inspected to insure that they are capable of carrying the weight of the installed unit.

#### **MOUNTING THE UNIT**

- These units are secured by wall mounting brackets which secure the unit to the outside wall surface at both sides. A bottom mounting bracket, attached to skid for shipping, is provided for ease of installation, but is not required.
- 2. The unit itself is suitable for 0 inch clearance, but the supply air duct flange and the first 3 feet of supply air duct require a minimum of 1/4 inch clearance to combustible material for model series W30, W36, W42, W48, W60 and W70. However, it is generally recommended that a 1-inch clearance is used for ease of installation and maintaining the required clearance to combustible material. See Figure 3 for details on opening sizes.
- 3. Locate and mark lag bolt locations and bottom mounting bracket location. See Figure 3.
- 4. Mount bottom mounting bracket.
- 5. Hook top rain flashing, attached to front right of supply flange for shipping, under back bend of top.

# **<b>MARNING**

Failure to provide the 1/4 inch clearance between the supply duct and a combustible surface for the first 3 feet of duct can result in fire causing damage, injury or death.

- 6. Position unit in opening and secure with 5/16 lag bolts; use 7/8 inch diameter flat washers on the lag bolts.
- 7. Secure rain flashing to wall and caulk across entire length of top. See Figure 3.
- 8. For additional mounting rigidity, the return air and supply air frames or collars can be drilled and screwed or welded to the structural wall itself (depending upon wall construction). Be sure to observe required clearance if combustible wall.
- 9. On side-by-side installations, maintain a minimum of 20 inches clearance on right side to allow access to control panel and heat strips, and to allow proper airflow to the outdoor coil. Additional clearance may be required to meet local or national codes.

# Clearances Required for Service Access and Adequate Condenser Airflow

| MODELS                       | LEFT SIDE | RIGHT SIDE |
|------------------------------|-----------|------------|
| W17A, W18A, W24A, W30A, W36A | 15"       | 20"        |
| W18L, W24L, W30L, W36L       | 20"       | 15"        |
| W42A, W48A, W60A, W70A       | 20"       | 20"        |
| W42L, W48L, W60L, W70L       | 20"       | 20"        |

NOTE: For side by side installation of two (2) W\*\*A models there must be 20" between units. This can be reduced to 15" by using a W\*\*L model (left side compressor and controls) for the left unit and WA (right side compressor and controls) for right unit.

See W\*\*A Specification S3397 & W\*\*L Specification S3400.

# Minimum Clearances Required to Combustible Materials

| MODELS                                 | SUPPLY AIR DUCT FIRST THREE FEET | CABINET |
|----------------------------------------|----------------------------------|---------|
| W18A, L / W24A, L                      | 0"                               | 0"      |
| W30A, L/W36A, L                        | 1/4"                             | 0"      |
| W42A, L / W48A, L<br>W60A, L / W70A, L | 1/4"                             | 0"      |

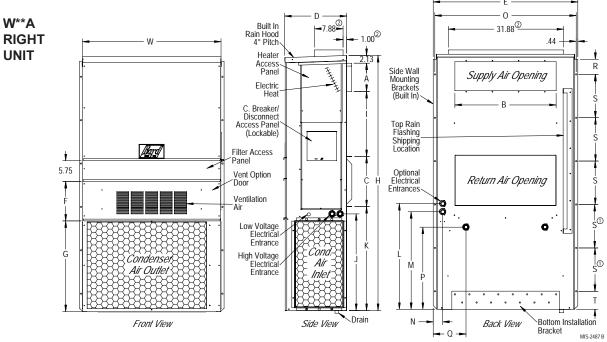
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FIGURE 2

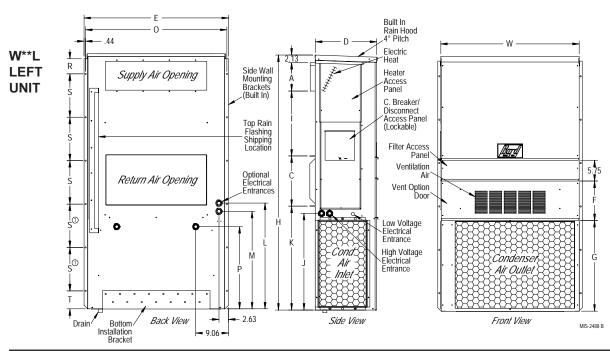
#### Dimensions of Basic Unit for Architectural and Installation Requirements (Nominal)

| MODEL              | WIDTH  | DEPTH  | HEIGHT | SUI  | PPLY  | RET   | URN   |       |       |       |       |       |       |       |       |      |       |       |       |      |       |      |
|--------------------|--------|--------|--------|------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|------|-------|-------|-------|------|-------|------|
| WODLL              | (W)    | (D)    | (H)    | Α    | В     | С     | В     | Е     | F     | G     | - 1   | J     | K     | L     | М     | N    | 0     | Р     | Q     | R    | S     | T    |
| W17A               |        |        |        |      |       |       |       |       |       |       |       |       |       |       |       |      |       |       |       |      |       |      |
| W18A, L            | 33.300 | 17.125 | 70.563 | 7.88 | 19.88 | 11.88 | 19.88 | 35.00 | 11.00 | 25.75 | 20.56 | 26.75 | 28.06 | 29.25 | 27.00 | 2.63 | 34.13 | 22.06 | 10.55 | 4.19 | 12.00 | 5.00 |
| W24A, L            |        |        |        |      |       |       |       |       |       |       |       |       |       |       |       |      |       |       |       |      |       | L    |
| W30A, L<br>W36A, L | 38 200 | 17 125 | 70 563 | 7 88 | 27 88 | 13 88 | 27 88 | 40 OO | 11 00 | 25 75 | 17 03 | 26 75 | 28 75 | 20 25 | 27 00 | 2 75 | 30 10 | 22 75 | 0 1/  | / 1Q | 12 00 | 5.00 |
| W36A, L            | 30.200 | 17.123 | 70.505 | 7.00 | 27.00 | 13.00 | 27.00 | 40.00 | 11.00 | 20.10 | 17.50 | 20.73 | 20.73 | 23.23 | 21.00 | 2.75 | 55.15 | 22.10 | 3.14  | 4.13 | 12.00 | 5.00 |
| W42A, L            |        |        |        |      |       |       |       |       |       |       |       |       |       |       |       |      |       |       |       |      |       | 1    |
| W48A, L            |        | 22.432 | 84.875 | 9.88 | 29.88 | 15.88 | 29.88 | 43.88 | 13.63 | 31.66 | 30.00 | 32.68 | 26.94 | 34.69 | 32.43 | 3.37 | 42.88 | 23.88 | 10.00 | 1.44 | 16.00 | 1.88 |
| W60A, L            |        |        |        |      |       |       |       |       |       |       |       |       |       |       |       |      |       |       |       |      |       | L    |
| W70A, L            | 42.075 | 22.432 | 94.875 | 9.88 | 29.88 | 15.88 | 29.88 | 43.88 | 13.63 | 41.66 | 30.00 | 42.68 | 36.94 | 44.69 | 42.43 | 3.37 | 42.88 | 33.88 | 10.00 | 1.44 | 16.00 | 1.88 |

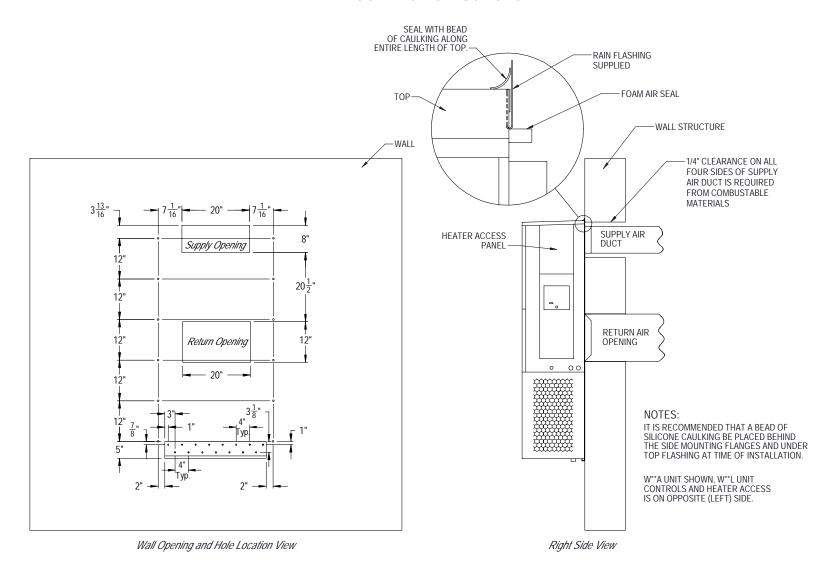
All dimensions are in inches. Dimensional drawings are not to scale.



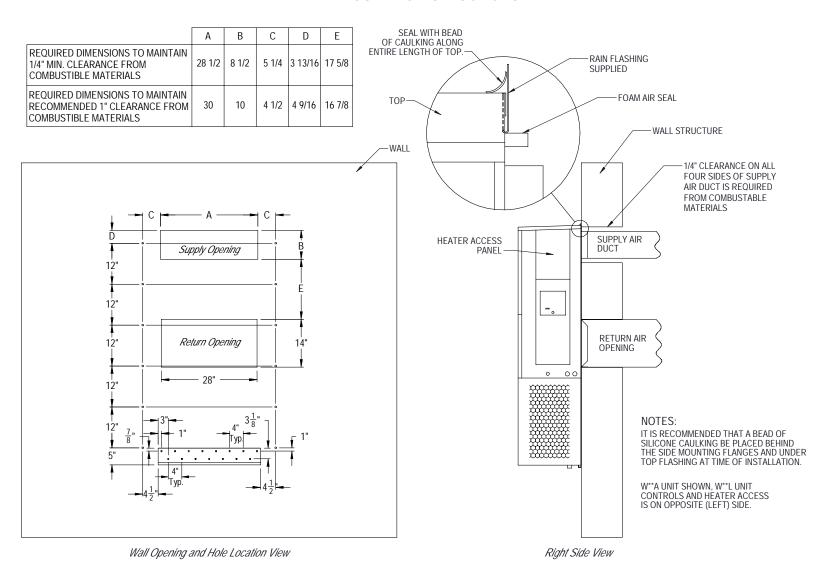
- ① Dimension is 21.00 inches on W70A & W70L models.
- ② Optional top outlet (factory installed only) for W30A and W36A models only.



#### FIGURE 3A W17A1, W18A1, W18L1, W24A1, W24L1 MOUNTING INSTRUCTIONS



#### FIGURE 3B W30A1, W30L1, W36A1, W36L1 MOUNTING INSTRUCTIONS



#### FIGURE 3C W42A1, W42L1, W48A1, W48L1, W60A1, W60L1, W70A1, W70L1 MOUNTING INSTRUCTIONS

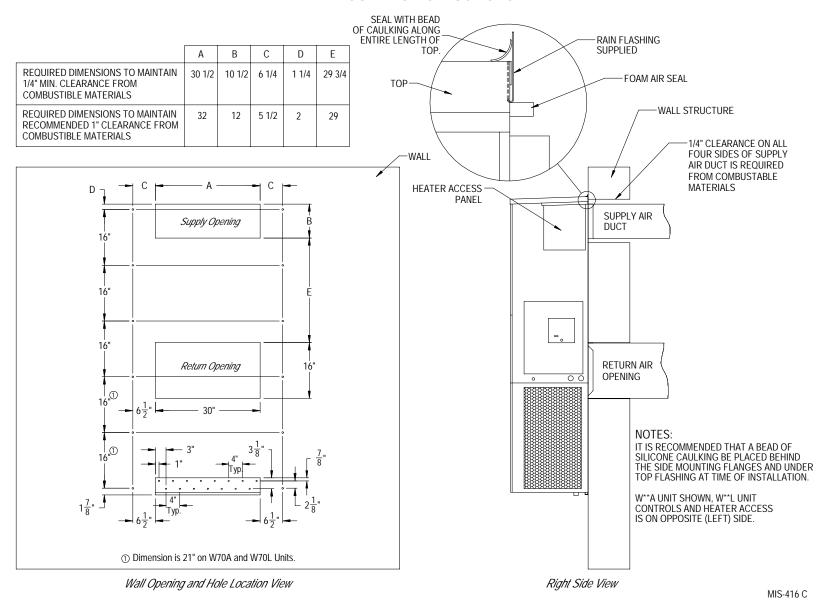
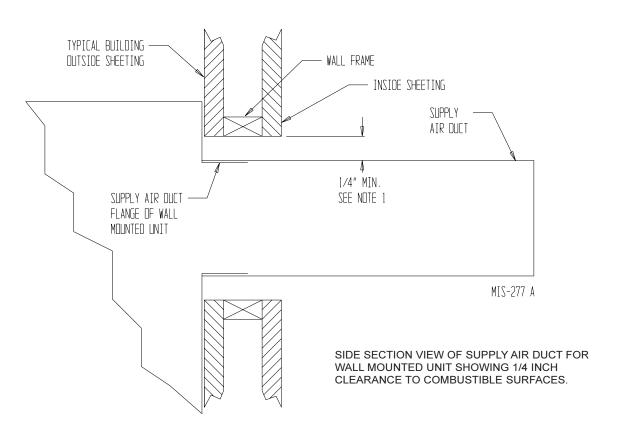


FIGURE 4
ELECTRIC HEAT CLEARANCE
W30A1, W30L1, W36A1, W36L1, W42A1, W42L1, W48A1, W48L1, W60A1, W60L1, W70A1, W70L1



# **⚠ WARNING**

A *minimum* of 1/4 inch clearance must be maintained between the supply air duct and combustible materials. This is required for the first 3 feet of ducting.

It is important to insure that the 1/4 inch minimum spacing is maintained at all points.

Failure to do this could result in overheating the combustible material and may result in a fire causing damage, injury or death.

FIGURE 5
WALL MOUNTING INSTRUCTIONS

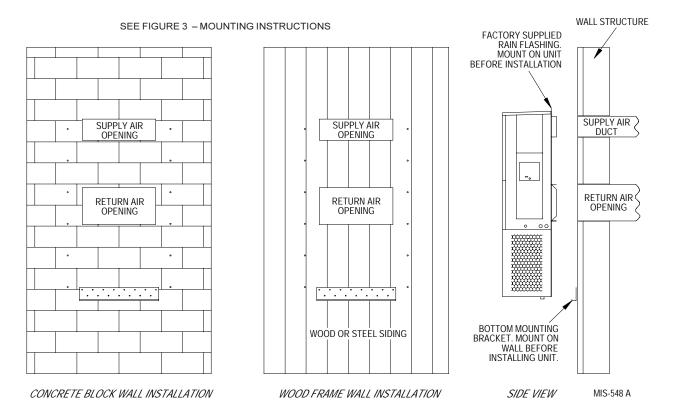
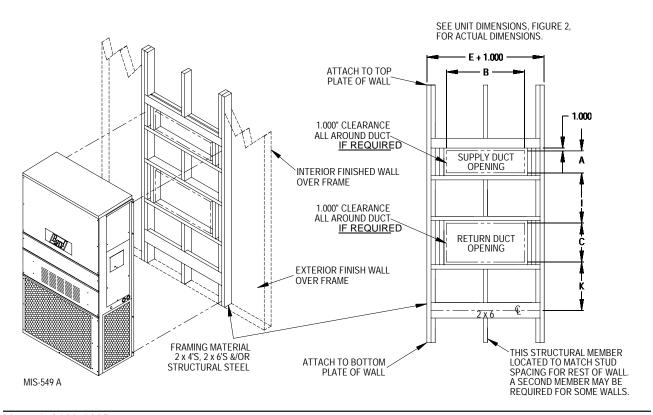
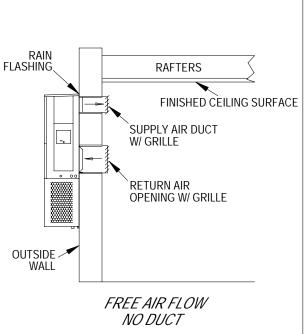


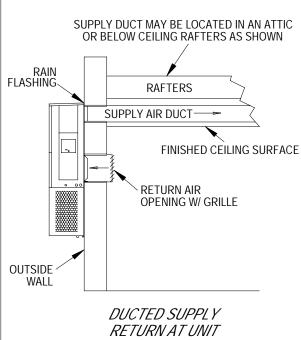
FIGURE 6
WALL MOUNTING INSTRUCTIONS

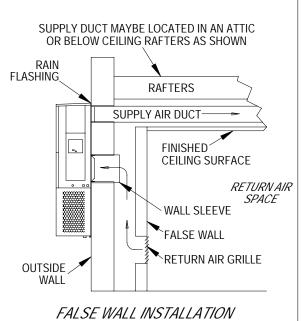


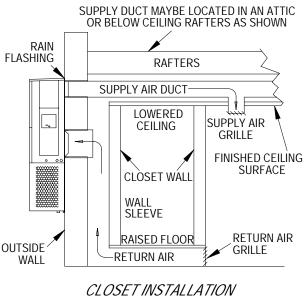
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# FIGURE 7 COMMON WALL MOUNTING INSTALLATIONS









MIS-550 B

#### WIRING - MAIN POWER

Refer to the unit rating plate for wire sizing information and maximum fuse or "HACR" type circuit breaker size. Each outdoor unit is marked with a "Minimum Circuit Ampacity". This means that the field wiring used must be sized to carry that amount of current. Depending on the installed KW of electric heat, there may be two field power circuits required. If this is the case, the unit serial plate will so indicate. All models are suitable only for connection with copper wire. Each unit and/or wiring diagram will be marked "Use Copper Conductors Only". These instructions *must be* adhered to. Refer to the National Electrical Code (NEC) for complete current carrying capacity data on the various insulation grades of wiring material. All wiring must conform to NEC and all local codes.

The electrical data lists fuse and wire sizes (75° C copper) for all models including the most commonly used heater sizes. Also shown are the number of field power circuits required for the various models with heaters.

The unit rating plate lists a "Maximum Time Delay Relay Fuse" or "HACR" type circuit breaker that is to be used with the equipment. The correct size must be used for proper circuit protection and also to assure that there will be no nuisance tripping due to the momentary high starting current of the compressor motor.

The disconnect access door on this unit may be locked to prevent unauthorized access to the disconnect. To convert for the locking capability, bend the tab located in the bottom left-hand corner of the disconnect opening under the disconnect access panel straight out. This tab will now line up with the slot in the door. When shut, a padlock may be placed through the hole in the tab preventing entry.

See "Start Up" section for important information on three phase scroll compressor start ups.

See Tables 4 & 5 for Electrical Specifications.

#### WIRING - LOW VOLTAGE WIRING

230/208V, 1 phase and 3 phase equipment dual primary voltage transformers. All equipment leaves the factory wired on 240V tap. For 208V operation, reconnect from 240V to 208V tap. The acceptable operating voltage range for the 240 and 208V taps are:

| TAP | RANGE     |
|-----|-----------|
| 240 | 253 – 216 |
| 208 | 220 – 187 |

NOTE: The voltage should be measured at the field power connection point in the unit and while the unit is operating at full load (maximum amperage operating condition).

For wiring size and connections, refer to Wiring Manual 2100-507.

#### START UP

#### THESE UNITS REQUIRE R-410A REFRIGERANT AND POLYOL ESTER OIL.

#### **GENERAL:**

- 1. Use separate service equipment to avoid cross contamination of oil and refrigerants.
- Use recovery equipment rated for R-410A refrigerant.
- 3. Use manifold gauges rated for R-410A (800 psi/250 psi low).
- 4. R-410A is a binary blend of HFC-32 and HFC-125.
- 5. R-410A is nearly azeotropic similar to R-22 and R-12. Although nearly azeotropic, charge with liquid refrigerant.
- 6. R-410A operates at 40-70% higher pressure than R-22, and systems designed for R-22 cannot withstand this higher pressure.
- 7. R-410A has an ozone depletion potential of zero, but must be reclaimed due to its global warming potential.
- 8. R-410A compressors use polyolester oil.
- 9. Polyol Ester oil is hygroscopic; it will rapidly absorb moisture and strongly hold this moisture in the oil.
- 10. A liquid line dryer must be used even a deep vacuum will not separate moisture from the oil.
- 11. Limit atmospheric exposure to 15 minutes.
- 12. If compressor removal is necessary, always plug compressor immediately after removal. Purge with small amount of nitrogen when inserting plugs.

#### TOPPING OFF SYSTEM CHARGE

If a leak has occurred in the system, Bard Manufacturing recommends reclaiming, evacuating (see criteria above), and charging to the nameplate charge. If done correctly, topping off the system charge can be done without problems.

With R-410A, there are no significant changes in the refrigerant composition during multiple leaks and recharges. R-410A refrigerant is close to being an azeotropic blend (it behaves like a pure compound or single component refrigerant). The remaining refrigerant charge, in the system, may be used after leaks have occurred and then "top-off" the charge by utilizing the charging charts on the inner control panel cover as a guideline.

REMEMBER: When adding R-410A refrigerant, it must come out of the charging cylinder/tank as a liquid to avoid any fractionation, and to insure optimal system performance. Refer to instructions for the cylinder that is being utilized for proper method of liquid extraction.



Failure to conform to these practices could lead to damage, injury or death.

#### **SAFETY PRACTICES:**

- 1. Never mix R-410A with other refrigerants.
- 2. Use gloves and safety glasses, Polyol Ester oils can be irritating to the skin, and liquid refrigerant will freeze the skin.
- 3. Never use air and R-410A to leak check; the mixture may become flammable.
- 4. Do not inhale R-410A the vapor attacks the nervous system, creating dizziness, loss of coordination and slurred speech. Cardiac irregularities, unconsciousness and ultimate death can result from breathing this concentration.
- 5. Do not burn R-410A. This decomposition produces hazardous vapors. Evacuate the area if exposed.
- 6. Use only cylinders rated DOT4BA/4BW 400.
- 7. Never fill cylinders over 80% of total capacity.
- 8. Store cylinders in a cool area, out of direct sunlight.
- 9. Never heat cylinders above 125°F.
- 10. Never trap liquid R-410A in manifold sets, gauge lines or cylinders. R-410A expands significantly at warmer temperatures. Once a cylinder or line is full of liquid, any further rise in temperature will cause it to burst.

#### IMPORTANT INSTALLER NOTE

For improved start up performance wash the indoor coil with a dish washing detergent.

#### HIGH PRESSURE SWITCH

All W\*\*A/W\*\*L wall mounted air conditioner series models are supplied with a remote reset for the high and low pressure switch. If tripped, this pressure switch may be reset by turning the thermostat off then back on again.

# THREE PHASE SCROLL COMPRESSOR START UP INFORMATION

Scroll compressors, like several other types of compressors, will only compress in one rotational direction. Direction of rotation is not an issue with single phase compressors since they will always start and run in the proper direction.

However, three phase compressors will rotate in either direction depending upon phasing of the power. Since there is a 50-50 chance of connecting power in such a way as to cause rotation in the reverse direction, verification of proper rotation must be made. Verification of proper rotation direction is made by observing that suction pressure drops and discharge pressure rises when the compressor is energized. Reverse rotation also results in an elevated sound level over that with correct rotation, as well as substantially reduced current draw compared to tabulated values.

Verification of *proper rotation* must be made at the time the equipment is put into service. If improper rotation is corrected at this time, there will be no negative impact on the durability of the compressor. However, reverse operation for over one hour may have a negative impact on the bearing due to oil pump out.

NOTE: If compressor is allowed to run in reverse rotation for several minutes, the compressor's internal protector will trip.

All three phase compressors are wired identically internally. As a result, once the correct phasing is determined for a specific system or installation, connecting properly phased power leads to the same Fusite terminal should maintain proper rotation direction.

The direction of rotation of the compressor may be changed by reversing any two line connections to the unit.

#### **PHASE MONITOR**

All units with three phase scroll compressors are equipped with a 3 phase line monitor to prevent compressor damage due to phase reversal.

The phase monitor in this unit is equipped with two LEDs. If the Y signal is present at the phase monitor and phases are correct the green LED will light.

If phases are reversed, the red fault LED will be lit and compressor operation is inhibited.

If a fault condition occurs, reverse two of the supply leads to the unit. *Do not reverse any of the unit factory wires as damage may occur.* 

#### **CONDENSER FAN OPERATION**

Applies to W42, W48, W60 and W70 models only. The condenser fan motor on 230/208 volt, one and three phase, 60 HZ units is a two-speed motor that comes factory wired on high speed for peak performance. If ambient conditions permit, it can be reconnected to low speed (red wire) for lower sound level. See wiring diagram.

50 HZ models must have fan wired on low speed. These models are factory wired on low speed.

#### **SERVICE HINTS**

- 1. Caution owner/operator to maintain clean air filters at all times. Also, not to needlessly close off supply and return air registers. This reduces airflow through the system, which shortens equipment service life as well as increasing operating costs.
- 2. Check all power fuses or circuit breakers to be sure they are the correct rating.
- 3. Periodic cleaning of the outdoor coil to permit full and unrestricted airflow circulation is essential.

#### **SEQUENCE OF OPERATION**

COOLING — Circuit R-Y makes at thermostat pulling in compressor contactor, starting the compressor and outdoor motor. The G (indoor motor) circuit is automatically completed on any call for cooling operation or can be energized by manual fan switch on subbase for constant air circulation. On a call for heating, circuit R-W1 make at the thermostat pulling in heat contact for the strip heat and blower operation. On a call for second stage heat, R-W2 makes bringing on second heat contactor, if so equipped.

#### **COMPRESSOR CONTROL MODULE**

The compressor control module is standard on all models covered by this manual. The compressor control module is an anti-short cycle/lockout timer with high and low pressure switch monitoring and alarm relay output.

#### Adjustable Delay On Make And Break Timer

On initial power up or anytime power is interrupted to the unit, the *delay on make* period begins, which will be 2 minutes plus 10% of the *delay on break* setting. When the delay on make is complete and the high pressure switch and low pressure switch is closed, the compressor contactor is energized. Upon shutdown, the delay on break timer starts and prevents restart until the delay on break and delay on make periods have expired.

During routine operation of the unit with no power interruptions, the compressor will operate on demand with no delay.

#### **High Pressure Switch and Lockout Sequence**

If the high pressure switch opens, the compressor contactor will de-energize immediately. The lockout timer will go into a *soft lockout* and stay in soft lockout until the high pressure switch closes and the delay on break time has expired. If the high pressure switch opens again in this same operating cycle, the unit will go into *manual lockout* condition and the alarm relay circuit will energize. Recycling the wall thermostat resets the manual lockout.

# Low Pressure Switch, Bypass, and Lockout Sequence

If the low pressure switch opens for more than 120 seconds, the compressor contactor will de-energize and go into a soft lockout. Regardless the state of the low pressure switch, the contactor will reenergize after the delay on make time delay has expired. If the low pressure switch remains open, or opens again for longer than 120 seconds, the unit will go into manual lockout condition and the alarm relay circuit will energize. Recycling the wall thermostat resets the manual lockout.

#### **Alarm Relay Output**

Alarm terminal is output connection for applications where alarm relay is employed. This terminal is powered whenever the compressor is locked out due to HPC or LPC sequences as described.

NOTE: Both high and low pressure switch controls are inherently automatic reset devices. The high pressure switch and low pressure switch cut out and cut in settings are fixed by specific air conditioner unit model. The lockout features, both soft and manual, are a function of the Compressor Control Module.

#### **ADJUSTMENTS**

### Adjustable Delay on Make and Delay on Break Timer

The potentiometer is used to select Delay on Break time from 30 seconds to 5 minutes. Delay on Make (DOM) timing on power-up and after power interruptions is equal to 2 minutes plus 10% of Delay on Break (DOB) setting:

```
0.5 minute (30 seconds) DOB = 123 second DOM

1.0 minute (60 seconds) DOB = 126 second DOM

2.0 minute (120 seconds) DOB = 132 second DOM

3.0 minute (180 seconds) DOB = 138 second DOM

4.0 minute (240 seconds) DOB = 144 second DOM

5.0 minute (300 seconds) DOB = 150 second DOM
```

During routine operation of the unit with no power interruptions the compressor will operate on demand with no delay.

#### **Typical Settings for Dual Unit Installation:**

Unit 1: DOB set at 2 minutes, and DOM is 132 seconds Unit 2: DOB set at 4 minutes, and DOM is 144 seconds

#### PRESSURE SERVICE PORTS

High and low pressure service ports are installed on all units so that the system operating pressures can be observed. A pressure table can be found later in the manual covering all models. It is imperative to match the correct pressure table to the unit by model number. See Table 3.

#### TROUBLESHOOTING

#### **FAN BLADE SETTING DIMENSIONS**

Shown in Figure 8 is the correct fan blade setting for proper air delivery across the outdoor coil. Refer to Table 1 for unit specific dimension.

Any service work requiring removal or adjustment in the fan and/or motor area will require that the dimensions below be checked and blade adjusted in or out on the motor shaft accordingly.

### FIGURE 8 FAN BLADE SETTING

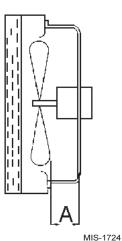


TABLE 1
FAN BLADE DIMENSION

WIIO-1724

| Model                                           | Dimension<br>A |
|-------------------------------------------------|----------------|
| W17A1<br>W18A1 / W18L1<br>W24A1 / W24L1         | 1.00"          |
| W30A1 / W30L1<br>W36A1 / W36L1                  | 1.25"          |
| W42A1 / W42L1<br>W48A1 / W48L1<br>W60A1 / W60L1 | 1.75"          |
| W70A1 / W70L1                                   | .75"           |

#### **REMOVAL OF FAN SHROUD**

- 1. Disconnect all power to the unit.
- 2. Remove the screws holding both grilles, one on each side of unit, and remove grilles.
- 3. Remove screws holding fan shroud to condenser and bottom. Nine (9) screws.
- 4. Unwire condenser fan motor.
- 5. Slide complete motor, fan blade, and shroud assembly out the left side of the unit.
- 6. Service motor/fan as needed.
- 7. Reverse steps to reinstall.

#### REFRIGERANT CHARGE

The correct system R-410A charge is shown on the unit rating plate. Optimum unit performance will occur with a refrigerant charge resulting in a suction line temperature (6" from compressor) as shown in Table 2A. If charge quantity is in doubt, reclaim unit and recharge to factory nameplate quantity.

# TABLE 2A REFRIGERANT CHARGE

| Model                  | Rated<br>Airflow | 95°F OD<br>Temperature | 82°F OD<br>Temperature |
|------------------------|------------------|------------------------|------------------------|
| W17A1<br>W18A1 / W18L1 | 600              | 61 - 65                | 62 - 66                |
| W24A1 / W24L1          | 800              | 56 - 60                | 56 - 60                |
| W30A1 / W30L1          | 1000             | 57 - 61                | 57 - 61                |
| W36A1 / W36L1          | 1100             | 56 - 60                | 57 - 61                |
| W42A1 / W42L1          | 1400             | 58 - 62                | 60 - 64                |
| W48A1 / W48L1          | 1550             | 63 - 67                | 65 - 69                |
| W60A1 / W60L1          | 1650             | 63 - 67                | 64 - 68                |

The suction line temperatures in Table 2 above are based upon 80°F dry bulb / 67°F wet bulb (50% R.H.) temperature and rated airflow across the evaporator during cooling cycle.

#### TABLE 2B REFRIGERANT CHARGE

| Model         | Rated<br>Airflow | 95°F<br>Subcooling | 82°F<br>Subcooling |
|---------------|------------------|--------------------|--------------------|
| W70A1 / W70L1 | 1800             | 15 - 18°           | 16 - 19°           |

The correct system R-410A charge is shown on the unit nameplate. Optimum unit performance will occur with a refrigerant charge resulting in a liquid subcooling as shown in Table 2B. If charge is in doubt, reclaim and recharge to factory nameplate charge.

# TABLE 3 COOLING PRESSURE TABLE

Air Temperature Entering Outdoor Coil °F

|          | D.1 A.                    |           |     |     |     |     |     |     |     |     |     |     |
|----------|---------------------------|-----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| Model    | Return Air<br>Temperature | Pressure  | 75  | 80  | 85  | 90  | 95  | 100 | 105 | 110 | 115 | 120 |
|          | 75 deg. DB                | Low Side  | 127 | 129 | 131 | 133 | 135 | 137 | 138 | 140 | 141 | 143 |
|          | 62 deg. WB                | High Side | 295 | 316 | 337 | 360 | 383 | 407 | 432 | 457 | 484 | 511 |
| W17A1    | 80 deg. DB                | Low Side  | 136 | 138 | 140 | 142 | 144 | 146 | 148 | 150 | 151 | 153 |
| W18A1/L1 | 67 deg. WB                | High Side | 303 | 324 | 346 | 369 | 393 | 417 | 443 | 469 | 496 | 524 |
|          | 85 deg. DB                | Low Side  | 141 | 143 | 145 | 147 | 149 | 151 | 153 | 155 | 156 | 158 |
|          | 72 deg. WB                | High Side | 314 | 335 | 358 | 382 | 407 | 432 | 459 | 485 | 513 | 542 |
|          | 75 deg. DB                | Low Side  | 121 | 123 | 125 | 127 | 130 | 132 | 134 | 135 | 137 | 138 |
|          | 62 deg. WB                | High Side | 326 | 350 | 375 | 401 | 426 | 450 | 477 | 502 | 527 | 553 |
| W24A1/L1 | 80 deg. DB                | Low Side  | 129 | 132 | 134 | 136 | 139 | 141 | 143 | 144 | 146 | 148 |
|          | 67 deg. WB                | High Side | 334 | 359 | 385 | 411 | 437 | 462 | 489 | 515 | 541 | 567 |
|          | 85 deg. DB                | Low Side  | 134 | 137 | 139 | 141 | 144 | 146 | 148 | 149 | 151 | 153 |
|          | 72 deg. WB                | High Side | 346 | 372 | 398 | 425 | 452 | 478 | 506 | 533 | 560 | 587 |
|          | 75 deg. DB                | Low Side  | 121 | 122 | 125 | 127 | 130 | 132 | 134 | 136 | 137 | 138 |
|          | 62 deg. WB                | High Side | 335 | 357 | 380 | 404 | 429 | 454 | 481 | 509 | 537 | 566 |
| W30A1/L1 | 80 deg. DB                | Low Side  | 129 | 131 | 134 | 136 | 139 | 141 | 143 | 145 | 146 | 148 |
|          | 67 deg. WB                | High Side | 344 | 366 | 390 | 414 | 440 | 466 | 493 | 522 | 551 | 581 |
|          | 85 deg. DB                | Low Side  | 134 | 136 | 139 | 141 | 144 | 146 | 148 | 150 | 151 | 153 |
|          | 72 deg. WB                | High Side | 356 | 379 | 404 | 428 | 455 | 482 | 510 | 540 | 570 | 601 |
|          | 75 deg. DB                | Low Side  | 123 | 125 | 127 | 129 | 131 | 133 | 136 | 138 | 140 | 143 |
|          | 62 deg. WB                | High Side | 350 | 372 | 396 | 420 | 445 | 470 | 496 | 524 | 552 | 581 |
| W36A1/L1 | 80 deg. DB                | Low Side  | 132 | 134 | 136 | 138 | 140 | 142 | 145 | 148 | 150 | 153 |
|          | 67 deg. WB                | High Side | 359 | 382 | 406 | 431 | 456 | 482 | 509 | 537 | 566 | 596 |
|          | 85 deg. DB                | Low Side  | 137 | 139 | 141 | 143 | 145 | 147 | 150 | 153 | 155 | 158 |
|          | 72 deg. WB                | High Side | 372 | 395 | 420 | 446 | 472 | 499 | 527 | 556 | 586 | 617 |
|          | 75 deg. DB                | Low Side  | 128 | 130 | 132 | 133 | 135 | 137 | 138 | 140 | 142 | 144 |
|          | 62 deg. WB                | High Side | 341 | 362 | 383 | 406 | 429 | 453 | 480 | 506 | 534 | 564 |
| W42A1/L1 | 80 deg. DB                | Low Side  | 137 | 139 | 141 | 142 | 144 | 146 | 148 | 150 | 152 | 154 |
|          | 67 deg. WB                | High Side | 350 | 371 | 393 | 416 | 440 | 465 | 492 | 519 | 548 | 578 |
|          | 85 deg. DB                | Low Side  | 142 | 144 | 146 | 147 | 149 | 151 | 153 | 155 | 157 | 159 |
|          | 72 deg. WB                | High Side | 362 | 384 | 407 | 431 | 455 | 481 | 509 | 537 | 567 | 598 |
|          | 75 deg. DB                | Low Side  | 125 | 127 | 129 | 131 | 133 | 136 | 137 | 140 | 143 | 146 |
|          | 62 deg. WB                | High Side | 349 | 370 | 391 | 415 | 440 | 467 | 495 | 526 | 557 | 590 |
| W48A1/L1 | 80 deg. DB                | Low Side  | 134 | 136 | 138 | 140 | 142 | 145 | 147 | 150 | 153 | 156 |
|          | 67 deg. WB                | High Side | 358 | 379 | 401 | 426 | 451 | 479 | 508 | 539 | 571 | 605 |
|          | 85 deg. DB                | Low Side  | 139 | 141 | 143 | 145 | 147 | 150 | 152 | 155 | 158 | 161 |
|          | 72 deg. WB                | High Side | 371 | 392 | 415 | 441 | 467 | 496 | 526 | 558 | 591 | 626 |
|          | 75 deg. DB                | Low Side  | 126 | 128 | 130 | 132 | 133 | 135 | 137 | 137 | 139 | 141 |
|          | 62 deg. WB                | High Side | 352 | 373 | 396 | 418 | 442 | 466 | 491 | 517 | 544 | 571 |
| W60A1/L1 | 80 deg. DB                | Low Side  | 135 | 137 | 139 | 141 | 142 | 144 | 146 | 147 | 149 | 151 |
|          | 67 deg. WB                | High Side | 361 | 383 | 406 | 429 | 453 | 478 | 504 | 530 | 558 | 586 |
|          | 85 deg. DB                | Low Side  | 140 | 142 | 144 | 146 | 147 | 149 | 151 | 152 | 154 | 156 |
|          | 72 deg. WB                | High Side | 374 | 396 | 420 | 444 | 469 | 495 | 522 | 549 | 578 | 607 |
|          | 75 deg. DB                | Low Side  | 118 | 119 | 121 | 122 | 123 | 125 | 127 | 130 | 132 | 135 |
|          | 62 deg. WB                | High Side | 326 | 347 | 370 | 392 | 416 | 440 | 465 | 489 | 516 | 542 |
| W70A1/L1 | 80 deg. DB                | Low Side  | 126 | 127 | 129 | 131 | 132 | 134 | 136 | 139 | 141 | 144 |
|          | 67 deg. WB                | High Side | 334 | 356 | 379 | 402 | 427 | 451 | 477 | 502 | 529 | 556 |
|          | 85 deg. DB                | Low Side  | 130 | 131 | 134 | 136 | 137 | 139 | 141 | 144 | 146 | 149 |
|          | 72 deg. WB                | High Side | 346 | 368 | 392 | 416 | 442 | 467 | 494 | 520 | 548 | 575 |

Low side pressure ± 2 PSIG High side pressure ± 5 PSIG

Tables are based upon rated CFM (airflow) across the evaporator coil. If there is any doubt as to correct operating charge being in the system, the charge should be removed, system evacuated and recharged to serial plate charge weight.

NOTE: Pressure table based on high speed condenser fan operation. If condensing pressures appear elevated check condenser fan wiring. See "Condenser Fan Operation".

TABLE 4

|                                          |                |                            |                       |                           | TAI                  | BLE 4                 |          |                        |          |                              |                                                  |                     |          |                                                  |
|------------------------------------------|----------------|----------------------------|-----------------------|---------------------------|----------------------|-----------------------|----------|------------------------|----------|------------------------------|--------------------------------------------------|---------------------|----------|--------------------------------------------------|
| Electric                                 | cal Spe        | cificati                   | ions —                | W**A .                    | Series               |                       |          |                        |          |                              |                                                  |                     |          |                                                  |
|                                          |                | ı                          | ı                     |                           | Circuit              |                       |          |                        |          | Dual                         | Circuit                                          |                     |          |                                                  |
| Model                                    | Rated<br>Volts | No. Field<br>Power         | 3 Minimum<br>Circuit  | Maximum     External Fuse | ② Field<br>Power     | Ground     Wire       | Cir      | nimum<br>cuit<br>acity | Extern   | ximum<br>al Fuse<br>t. Brkr. | Po                                               | ield<br>wer<br>Size |          | round<br>Size                                    |
|                                          | and Phase      | Circuits                   | Ampacity              | or Ckt. Brkr.             | Wire Size            |                       | Ckt. A   | Ckt. B                 | Ckt. A   | Ckt. B                       | Ckt. A                                           | Ckt. B              | Ckt. A   | Ckt. B                                           |
| W17, 18A1 - A00, A0Z<br>A05<br>A08       | 230/208-1      | 1 1 1                      | 16<br>30<br>46        | 20<br>30<br>50            | 12<br>10<br>8        | 12<br>10<br>10        |          |                        |          |                              |                                                  |                     |          |                                                  |
| A10<br>W24A1 - A00, A0Z                  |                | 1                          | 56<br>21              | 60<br>30                  | 6<br>10              | 10                    | _        |                        |          |                              |                                                  |                     |          |                                                  |
| A05<br>A08<br>A10                        | 230/208-1      | 1<br>1<br>1                | 30<br>46<br>56        | 30<br>50<br>60            | 10<br>8<br>6         | 10<br>10<br>10        |          |                        |          |                              |                                                  |                     |          |                                                  |
| W24A1 - B00, B0Z<br>B06                  | 230/208-3      | 1<br>1                     | 15<br>22              | 15<br>25                  | 14<br>10             | 14<br>10              |          |                        |          |                              |                                                  |                     |          |                                                  |
| W24A1 - C00, C0Z<br>C06                  | 460-3          | 1                          | 10<br>12              | 15<br>15                  | 14<br>14             | 14<br>14              |          |                        |          |                              |                                                  |                     |          |                                                  |
| W30A1 - A00*, A0Z*                       |                | 1                          | 24                    | 35                        | 8                    | 10                    |          |                        |          |                              |                                                  |                     |          |                                                  |
| A05*<br>A08<br>A10*                      | 230/208-1      | 1<br>1<br>1                | 32<br>48<br>58<br>84  | 35<br>50<br>60<br>90      | 8<br>8<br>6<br>4     | 10<br>10<br>10<br>8   | 58       | 26                     | 60       | 30                           | 6                                                | 10                  | 10       | 10                                               |
| A15<br>W30A1 - B00*, B0Z*                |                | 1 or 2                     | 18                    | 20                        | 12                   | 12                    | 58       | 26                     | 60       | 30                           | ь                                                | 10                  | 10       | 10                                               |
| B06<br>B09*<br>B15                       | 230/208-3      | 1<br>1<br>1                | 24<br>33<br>51        | 25<br>35<br>60            | 10<br>8<br>8         | 10<br>10<br>10        |          |                        |          |                              |                                                  |                     |          |                                                  |
| W30A1 - C00*, C0Z*<br>C06<br>C09*<br>C15 | 460-3          | 1<br>1<br>1                | 11<br>12<br>17<br>26  | 15<br>15<br>20<br>30      | 14<br>14<br>12<br>10 | 14<br>14<br>12<br>10  |          |                        |          |                              |                                                  |                     |          |                                                  |
| W36A1 - A00*, A0Z*                       |                | 1                          | 29                    | 35                        | 8                    | 10                    |          |                        |          |                              |                                                  |                     |          |                                                  |
| A05*<br>A08<br>A10*                      | 230/208-1      | 1<br>1<br>1                | 32<br>48<br>58        | 35<br>50<br>60            | 8<br>8<br>6          | 10<br>10<br>10        | E0       | 26                     | 60       | 20                           |                                                  | 10                  | 10       | 10                                               |
| A15<br>W36A1 - B00*, B0Z*                |                | 1 or 2                     | 84<br>23              | 90<br>30                  | 10                   | 10                    | 58       | 26                     | 60       | 30                           | 6                                                | 10                  | 10       | 10                                               |
| B06<br>B09*<br>B15                       | 230/208-3      | 1<br>1<br>1                | 24<br>33<br>51        | 30<br>35<br>60            | 10<br>8<br>6         | 10<br>10<br>10        |          |                        |          |                              |                                                  |                     |          |                                                  |
| W36A1 - C00*, C0Z*<br>C06<br>C09*<br>C15 | 460-3          | 1<br>1<br>1                | 12<br>12<br>17<br>26  | 15<br>15<br>20<br>30      | 14<br>14<br>10<br>10 | 14<br>14<br>10<br>10  |          |                        |          |                              |                                                  |                     |          |                                                  |
| W42A1 - A00, A0Z                         |                | 1                          | 33                    | 50                        | 8                    | 10                    |          |                        |          |                              |                                                  |                     |          |                                                  |
| A05<br>A10<br>A15<br>A20                 | 230/208-1      | 1<br>1<br>1 or 2<br>1 or 2 | 33<br>59<br>85<br>111 | 50<br>60<br>90<br>125     | 8<br>6<br>4<br>2     | 10<br>10<br>8<br>6    | 59<br>59 | 26<br>52               | 60<br>60 | 30<br>60                     | 6<br>6                                           | 10<br>6             | 10<br>10 | 10<br>10                                         |
| W42A1 - B00, B0Z                         |                | 1                          | 25                    | 35                        | 8                    | 10                    | 33       | 32                     | 00       | 00                           | -                                                |                     | 10       | 10                                               |
| B09<br>B15<br>B18                        | 230/208-3      | 1<br>1<br>1                | 34<br>53<br>62        | 35<br>60<br>70            | 8<br>6<br>6          | 10<br>10<br>8         |          |                        |          |                              |                                                  |                     |          |                                                  |
| W42A1 - C00, C0Z<br>C09<br>C15           | 460-3          | 1<br>1<br>1                | 13<br>18<br>27        | 15<br>20<br>30            | 14<br>12<br>10       | 14<br>12<br>10        |          |                        |          |                              |                                                  |                     |          |                                                  |
| W48A1 - A00, A0Z<br>A05                  |                | 1                          | 37<br>37              | 50<br>50                  | 8<br>8               | 10<br>10              |          |                        |          |                              |                                                  |                     |          |                                                  |
| A10<br>A15<br>A20                        | 230/208-1      | 1<br>1 or 2<br>1 or 2      | 59<br>85<br>111       | 60<br>90<br>125           | 6<br>4<br>2          | 10<br>8<br>6          | 59<br>59 | 26<br>52               | 60<br>60 | 30<br>60                     | 6                                                | 10<br>6             | 10<br>10 | 10<br>10                                         |
| W48A1- B00, B0Z                          |                | 1                          | 29                    | 40                        | 8                    | 10                    | - 00     | - 02                   | - 00     | - 00                         |                                                  | Ů                   | - 10     | - 10                                             |
| B09<br>B15<br>B18                        | 230/208-3      | 1<br>1<br>1                | 34<br>52<br>62        | 40<br>60<br>70            | 8<br>6<br>6          | 10<br>10<br>8         |          |                        |          |                              |                                                  |                     |          |                                                  |
| W48A1 - C00, C0Z<br>C09<br>C15           | 460-3          | 1<br>1<br>1                | 14<br>18<br>27        | 20<br>20<br>30            | 12<br>12<br>10       | 12<br>12<br>10        |          |                        |          |                              |                                                  |                     |          |                                                  |
| W60A1 - A00, A0Z<br>A05                  |                | 1<br>1                     | 41<br>41              | 60<br>60                  | 8<br>8               | 10<br>10              |          |                        |          |                              |                                                  |                     |          |                                                  |
| A10<br>A15<br>A20                        | 230/208-1      | 1<br>1 or 2<br>1 or 2      | 59<br>85<br>111       | 60<br>90<br>125           | 6<br>4<br>2          | 10<br>8<br>6          | 59<br>59 | 26<br>52               | 60<br>60 | 30<br>60                     | 6                                                | 10<br>6             | 10<br>10 | 10<br>10                                         |
| W60A1 - B00, B0Z<br>B09<br>B15           | 230/208-3      | 1<br>1<br>1                | 28<br>34<br>53        | 40<br>40<br>60            | 8<br>8<br>6          | 10<br>10<br>10        | 30       |                        | - 50     | 30                           | Ĭ                                                | Ĭ                   |          |                                                  |
| B18<br>W60A1 - C00, C0Z<br>C09           | 460-3          | 1<br>1<br>1                | 62<br>15<br>18        | 70<br>20<br>20            | 6<br>12<br>12        | 10<br>12<br>12        |          |                        |          |                              |                                                  |                     |          |                                                  |
| C15<br>W70A1 - A00, A0Z                  |                | 1                          | 27<br>49              | 30<br>60                  | 10<br>8              | 10<br>10              | $\vdash$ |                        |          |                              | <del>                                     </del> |                     |          | <del>                                     </del> |
| A05<br>A10<br>A15                        | 230/208-1      | 1<br>1 or 2<br>1 or 2      | 49<br>49<br>59<br>85  | 60<br>60<br>90            | 8<br>6<br>4          | 10<br>10<br>10<br>8   | 59       | 26                     | 60       | 30                           | 6                                                | 10                  | 10       | 10                                               |
| A20                                      |                | 1 or 2                     | 111                   | 125                       | 2                    | 6                     | 59       | 52                     | 60       | 60                           | 6                                                | 6                   | 10       | 10                                               |
| W70A1 - B00, B0Z<br>B09<br>B15<br>B18    | 230/208-3      | 1<br>1<br>1<br>2           | 43<br>43<br>53<br>N/A | 60<br>60<br>60<br>N/A     | 8<br>8<br>6<br>N/A   | 10<br>10<br>10<br>N/A | 43       | 28                     | 60       | 30                           | 8                                                | 10                  | 10       | 10                                               |

W70A1 - C00, C0Z C09 C15 ① Maximum size of the time delay fuse or HACR type circuit breaker for protection of field wiring conductors.

30 30 35

10 10 10

Caution: When more than one field power circuit is run through one conduit, the conductors must be derated. Pay special attention to note 8 of Table 310 regarding Ampacity Adjustment Factors when more than three (3) current carrying conductors are in a raceway.

23 23 27

IMPORTANT: While this electrical data is presented as a guide, it is important to electrically connect properly sized fuses and conductor wires in accordance with the National Electrical Code and all local codes.

Based on 75C copper wire. All wiring must conform to the National Electrical Code and all local codes.

<sup>3</sup> These "Minimum Circuit Ampacity" values are to be used for sizing the field power conductors. Refer to the National Electrical code (latest version), Article 310 for power conductor sizing.

<sup>\*</sup> Top outlet supply option is available only factory installed and only on the selected models.

TABLE 5

#### Electrical Specifications — W\*\*L Series Single Circuit Dual Circuit ③ Minimum ① Maximum ② Field No Field 3 Minimum Maximum @ Field @ Ground Rated @ Ground Circuit External Fuse Power Volts and Phase Circuit Ampacity Model External Fuse or Ckt. Brkr. Power Wire Size Wire Size or Ckt. Brkr. Wire Size Circuits Ckt. A Ckt. B Ckt. A Ckt. B Ckt. A Ckt. B Ckt. A Ckt. B W18L1 - A00, A0Z A05 46 230/208-1 A08 - A00, A0Z A05 30 46 30 10 10 230/208-1 A08 W24L1 - B00, B0Z 10 10 230/208-3 B06 W30L1 - A00\*, A0Z 35 A05\* 48 A08 230/208-1 A10 A15 1 or 2 W30L1 - B00\*, B0Z\* 33 35 8 10 230/208-3 B15 W30L1 - C00\*, C0Z 17 C09\* 460-3 32 A05\* 230/208-1 A10\* A15 1 or 2 W36L1 B00\*, B0Z\* 230/208-3 B09\* B15 W36L1 - C00\*, C0Z\* 17 20 10 10 460-3 C09<sup>3</sup> W42L1 - A00, A0Z A05 59 60 10 230/208-1 A10 A15 1 or 2 W42L1 - B00, B0Z 34 35 230/208-3 B15 W42L1 C00, C0Z Cng 460-3 W48L1 - A00, A0Z 37 50 10 A05 230/208-1 A10 A15 85 90 1 or 2 W48L1- B00, B0Z B09 230/208-3 B15 W48I 1 - C00 C07 C15 W60L1 - A00, A0Z A05 60 230/208-1 A10 85 A15 1 or 2 W60L1 - B00, B0Z B09 230/208-3 B15 W60L1 - C00, C0Z 460-3 C09 W70L1 - A0Z A05 49 60 10 230/208-1 A10 1 or 2 1 or 2 W70L1 - B0Z 43 60 230/208-3 B09 B15 W70L1 - C0Z 23 30 10 10

Caution: When more than one field power circuit is run through one conduit, the conductors must be derated. Pay special attention to note 8 of Table 310 regarding Ampacity Adjustment Factors when more than three (3) current carrying conductors are in a raceway.

IMPORTANT: While this electrical data is presented as a guide, it is important to electrically connect properly sized fuses and conductor wires in accordance with the National Electrical Code and all local codes.

① Maximum size of the time delay fuse or HACR type circuit breaker for protection of field wiring conductors. ② Based on 75C copper wire. All wiring must conform to the National Electrical Code and all local codes.

<sup>3</sup> These "Minimum Circuit Ampacity" values are to be used for sizing the field power conductors. Refer to the National Electrical code (latest version), Article 310 for power conductor sizing.

<sup>\*</sup> Top outlet supply option is available only factory installed and only on the selected models.

TABLE 6
RECOMMENDED AIRFLOW

| Model              | Rated<br>CFM * | Rated<br>ESP * | Recommended<br>Airflow Range | Factory Speed<br>Connection |
|--------------------|----------------|----------------|------------------------------|-----------------------------|
| W17A<br>W18A, W18L | 550            | .40            | 575 - 725                    | High                        |
| W24A, W24L         | 800            | .20            | 700 - 950                    | High                        |
| W30A, W30L         | 1000           | .40            | 930 - 1300                   | High                        |
| W36A, W36L         | 1100           | .30            | 930 - 1350                   | High                        |
| W42A, W42L         | 1400           | .30            | 1600 - 1150                  | High                        |
| W48A, W48L         | 1550           | .20            | 1750 - 1285                  | High                        |
| W60A, W60L         | 1650           | .30            | 1950 - 1375                  | High                        |
| W70A, W70L         | 1800           | .20            | 2000 - 1475                  | High                        |

<sup>\*</sup> Rated CFM and ESP on high speed tap.

# TABLE 7 INDOOR BLOWER PERFORMANCE

|                        | W1<br>W18<br>W24 | A/L,        | V           | V30A/L,     | W36A/       | L           | V           | V42A/L,     | W48A/       | L           | V           | V60A/L,     | W70A/       | L           |
|------------------------|------------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|-------------|
| E.S.P.                 | High \$          | Speed       | High \$     | Speed       | Low S       | Speed       | High \$     | Speed       | Low S       | Speed       | High S      | Speed       | Low S       | Speed       |
| In<br>H <sub>2</sub> O | Dry<br>Coil      | Wet<br>Coil | Dry<br>Coil | Wet<br>Coil | Dry<br>Coil | Wet<br>Coil | Dry<br>Coil | Wet<br>Coil | Dry<br>Coil | Wet<br>Coil | Dry<br>Coil | Wet<br>Coil | Dry<br>Coil | Wet<br>Coil |
| .0                     | 1020             | 975         | 1395        | 1315        | 950         | 935         | 1885        | 1800        | 1650        | 1600        | 2200        | 2000        | 1600        | 1450        |
| .1                     | 960              | 905         | 1340        | 1270        | 930         | 915         | 1770        | 1665        | 1550        | 1500        | 2100        | 1900        | 1525        | 1375        |
| .2                     | 865              | 800         | 1285        | 1190        | 910         | 885         | 1635        | 1540        | 1450        | 1400        | 2000        | 1800        | _           | _           |
| .3                     | 820              | 735         | 1205        | 1100        | 855         | 830         | 1500        | 1400        | 1350        | 1300        | 1875        | 1700        | _           | _           |
| .4                     | 735              | 650         | 1110        | 1000        | 800         | 755         | 1370        | 1285        | 1300        | 1175        | 1775        | 1600        | _           | _           |
| .5                     | 615              | 535         | 1005        | 870         | _           |             | 1250        | 1150        |             | _           | 1650        | 1475        | _           | _           |

TABLE 8
MAXIMUM ESP OF OPERATION
ELECTRIC HEAT ONLY

| Model                | W17A<br>W18A/L, W24A/L | ,          | W30A/L,    | W36A/L     | •          | W42A/L,           | W48A/L            | W60A/L,           | W70A/L            |
|----------------------|------------------------|------------|------------|------------|------------|-------------------|-------------------|-------------------|-------------------|
| Outlet               | FRONT                  | FRO        | TNC        | TC         | )P         | FRO               | TNC               | FRO               | TNC               |
| Speed                | Single                 | High       | Low        | High       | Low        | High              | Low               | High              | Low               |
| -A0Z<br>-A04         | .50                    | .50        | .50        | .50<br>.50 | .50<br>.45 | .50               | .50               | .50               | .50               |
| -A05<br>-A08         | .50<br>.50             | .50<br>.50 | .50<br>.50 |            |            | .50               | .50               | .50               | .50               |
| -A10<br>-A15<br>-A20 |                        | .50<br>.40 | .45<br>.35 | .50        | .35        | .50<br>.50<br>.50 | .50<br>.50<br>.45 | .50<br>.50<br>.50 | .50<br>.50<br>.40 |
| -B0Z<br>-B06         | .50<br>.50             | .50<br>.50 | .50<br>.40 | .50        | .50        | .50               | .50               | .50               | .50               |
| -B09<br>-B15<br>-B18 |                        | .50<br>.45 | .50<br>.30 | .45        | .40        | .50<br>.50<br>.50 | .50<br>.50<br>.50 | .50<br>.50<br>.50 | .50<br>.50<br>.50 |
| -C0Z<br>-C06         |                        | .50<br>.50 | .50<br>.50 | .50        | .50        | .50               | .50               | .50               | .50               |
| -C09<br>-C15         |                        | .50<br>.45 | .40<br>.35 | .45        | .40        | .50<br>.50        | .50<br>.50        | .50<br>.50        | .50<br>.50        |

Values shown are for units equipped with standard 1-inch throwaway filter or 1-inch washable filter. Derate ESP by .15 for 2-inch pleated filters.

#### TABLE 9 ELECTRIC HEAT

| Models | 240V-1 |       | 208V-1 |       | 24   | 0V-3  | 20   | 8V-3  | 460V-3 |       |  |
|--------|--------|-------|--------|-------|------|-------|------|-------|--------|-------|--|
| KW     | Amps   | втин  | Amps   | втин  | Amps | втин  | Amps | втин  | Amps   | втин  |  |
| 4      | 16.7   | 13650 | 14.4   | 10240 |      |       |      |       |        |       |  |
| 5      | 20.8   | 17065 | 18.1   | 12800 |      |       |      |       |        |       |  |
| 6      |        |       |        |       | 14.4 | 20500 | 12.5 | 15360 | 7.2    | 20500 |  |
| 8      | 33.3   | 27300 | 28.8   | 20475 |      |       |      |       |        |       |  |
| 9      |        |       |        |       | 21.7 | 30600 | 18.7 | 23030 | 10.8   | 30700 |  |
| 10     | 41.6   | 34130 | 36.2   | 25600 |      |       |      |       |        |       |  |
| 12     |        |       |        |       |      |       |      |       | 14.4   | 40950 |  |
| 15     | 62.5   | 51250 | 54.0   | 38400 | 36.2 | 51200 | 31.2 | 38400 | 18.0   | 51200 |  |
| 18     |        |       |        |       | 43.3 | 61430 | 37.5 | 46100 |        |       |  |
| 20     | 83.2   | 68260 | 72.1   | 51200 |      |       |      |       |        |       |  |

# TABLE 10 OPTIONAL ACCESSORIES

|                                                 |             | ℴ          | OPTIONAL ACCESSORIES  ◀ |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|-------------------------------------------------|-------------|------------|-------------------------|---------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|
|                                                 | Part Number | W17/18A1-A | W24A1-A                 | W24A1-B | W24A1-C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | W30A1-A | W30A1-B | W30A1-C | W36A1-A | W36A1-B | W36A1-C | W42A1-A | W42A1-B | W42A1-C | W48A1-A | W48A1-B | W48A1-C | W60A1-A | W60A1-B | W60A1-C | W70A1-A | W70A1-B | W70A1-C |
|                                                 | EHWA02-A05  | Х          | Х                       |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                 | EHW02A-A08  | Х          | Х                       |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                 | EHWA02A-A10 | Х          | Х                       |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                 | EHWA24-B06  |            |                         | Х       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                 | EHWH24B-C06 |            |                         |         | Х                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                 | EHWA03-A05  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Х       |         |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                 | EHWA03-A08  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Х       |         |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                 | EHWA03-A10  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Х       |         |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                 | EHWA03-A15  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Х       |         |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                 | EHWA03-B06  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                 | EHW36A-B06  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 13                                              | EHWA03-B09  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         | Х       |         |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |         |
| HEATER KITS                                     | EHWA37-B15  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         | Х       |         |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |         |
| 🖺                                               | EHWC03A-C06 |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         | Х       |         |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |
| 🔚                                               | EHWC03A-C09 |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         | Х       |         |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |
| =                                               | EHWA03A-C15 |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         | Х       |         |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |
|                                                 | EHWA05-A05  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         | Х       |         |         | Х       |         |         |         |         |         |         |         |         |
|                                                 | EHWA05-A10  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         | Х       |         |         | Х       |         |         | Х       |         |         | Х       |         |         |
|                                                 | EHWA05-A15  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         | Х       |         |         | Х       |         |         | Х       |         |         | Х       |         |         |
|                                                 | EHWA05-A20  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         | Х       |         |         | Х       |         |         | Х       |         |         | Х       |         |         |
|                                                 | EHWA05-B09  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         | Х       |         |         | Х       |         |         |         |         |         |         |         |
|                                                 | EHWA05-B15  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         | Х       |         |         | Х       |         |         | Х       |         |         | Х       |         |
|                                                 | EHW05A-B18  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         | Х       |         |         | Х       |         |         | Х       |         |         | Х       |         |
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|                                                 | EHWA05A-C15 |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         |         | Х       |         |         | Х       |         |         | Х       |         |         | Х       |
|                                                 | EHWA60-A05  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         |         |         |         |         |         | Х       |         |         | Х       |         |         |
|                                                 | EHWA60-B09  |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         |         |         |         |         |         |         | Х       |         |         | Χ       |         |
|                                                 | WMCB-01B    |            |                         | Х       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| ∞ (C)                                           | WMCB-02A    | Х          |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
| CB<br>MP                                        | WMCB-02B    |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
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| R()                                             | WMCB-04B    |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         | Χ       |         |         |         |         |         |         |         |         |         |         |         |         | Ш       |
| A H                                             | WMCB-05A    |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Х       |         |         | Х       |         |         |         |         |         |         |         |         |         |         |         |         |         | Ш       |
| CIRCUIT BREAKER (WMCB) & PULL DISCONNECT (WMPD) | WMCB-05B    |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         | Χ       |         |         | Χ       |         |         |         |         |         |         | Ш       |
| BF                                              | WMCB-06B    |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         |         |         |         |         |         |         |         | Х       |         |         |         | Ш       |
| CIRCUIT<br>PULL DI                              | WMCB-08A    |            |                         |         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |         |         |         |         |         |         | Χ       |         |         | Х       |         |         |         |         |         |         |         | Ш       |
| RC UL                                           | WMCB-09A    |            |                         |         | $ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{ldsymbol{le}}}}}}$ |         |         |         |         |         |         |         |         |         |         |         |         | Х       |         |         | Х       | Щ       | Ш       |
| 고 교                                             | WMPD-01C    |            |                         |         | Х                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |         |         | Х       |         |         | Χ       |         |         | Х       |         |         | Χ       |         |         | Χ       |         |         | Х       |
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# TABLE 11 VENT & CONTROL OPTIONS

|             | VENT & CONTROL OF HONO                 |               |          |                      |
|-------------|----------------------------------------|---------------|----------|----------------------|
| Part Number | Description                            | W17, W18, W24 | W30, W36 | ] W42, W48, W60, W70 |
| CMC-14      | ODT                                    | Χ             | Χ        | Х                    |
| CMC-15      | Start Kit (230V 1-Phase)               | Х             | Χ        | Х                    |
| CMC-23      | DDC                                    | Х             | Χ        |                      |
| CMC-24      | DDC                                    |               |          | Х                    |
| CMC-28      | LAC                                    | Х             | Х        | Χ                    |
| BFAD-2      | Barometric Fresh Air Damper - Standard | Х             |          |                      |
| BOP-2       | Blank Off Plate                        | Х             |          |                      |
| MFAD-2      | Motorized Fresh Air Damper             | Х             |          |                      |
| CRV-2       | Commercial Ventilator - Spring Return  | Х             |          |                      |
| EIFM-2B     | Economizer                             | Х             |          |                      |
| ERVF-2A     | Energy Recovery Ventilator - 230 Volt  | Х             |          |                      |
| BFAD-3      | Barometric Fresh Air Damper - Standard |               | Х        |                      |
| BOP-3       | Blank Off Plate                        |               | Х        |                      |
| MFAD-3      | Motorized Fresh Air Damper             |               | Χ        |                      |
| CRVS-3      | Commercial Ventilator - Spring Return  |               | Х        |                      |
| CRVP-3      | Commercial Ventilator - Power Return   |               | Х        |                      |
| EIFM-3C     | Economizer                             |               | Χ        |                      |
| ERVF-3A     | Energy Recovery Ventilator - 230 Volt  |               | Х        |                      |
| ERVF-3C     | Energy Recovery Ventilator - 460 Volt  |               | Χ        |                      |
| BFAD-5      | Barometric Fresh Air Damper - Standard |               |          | Х                    |
| BOP-5       | Blank Off Plate                        |               |          | Х                    |
| MFAD-5      | Motorized Fresh Air Damper             |               |          | Х                    |
| CRVS-5      | Commercial Ventilator - Spring Return  |               |          | Х                    |
| CRVP-5      | Commercial Ventilator - Power Return   |               |          | Х                    |
| EIFM-5C     | Economizer                             |               |          | Х                    |
| ERVF-5A     | Energy Recovery Ventilator - 230 Volt  |               |          | Х                    |
| ERVF-5C     | Energy Recovery Ventilator - 460 Volt  |               |          | Х                    |
|             |                                        |               |          |                      |



# TEC40 Environmental Controller

The TEC40 is an electronic multi-stage controller for control of 3 or 4 air conditioners as 1 stage systems, or 2 air conditioners each operating as 2 stage systems. The latter is an excellent control method for dual air conditioners each with economizers, allowing maximum benefit of the economizer and switching to mechanical cooling based on building demand rather than a predetermined outdoor enthalpy condition.

### Engineered Features

#### **Unit Operation**

LED's indicate the primary unit running and which stage(s) of cooling or heating are energized. The controller is powered (24VAC, 50/60 Hz) from any of the air conditioners controlled. In the event of a power loss to one or more air conditioners the controller will continue to operate from any other air conditioner still being powered. If all power is interrupted to the building the controller has a power loss memory and will remember the unit sequence when power is restored. An On/Off for controller activation is provided.

#### **Thermostat**

The thermostat is an integrated 4-stage cool and 4-stage heat electronic control with a 2°F differential between each stage. Adjustable thermostat range is 55°F (13°C) to 90°F (32°C) and has a thermistor type sensor. The "dead band" between heating and cooling is adjustable between 4°F and 20°F.

#### Staging Delay Periods

The following delays are built in for both cooling and heating: stage 1 - 0 seconds; stage 2 - 10 seconds; stage 3 - 15 seconds; stage 4 - 20 seconds.

#### **Fire Suppression**

Dedicated terminals (F1 and F2) are provided for use with a field supplied fire suppression system, and will de-energize all air conditioners in the event of a fire.

#### Compact size

The TEC40 controller is 7 inches wide, 11.5 inches high, and 3 inches deep. Twelve (12) .875 inch diameter knockouts are provided for wiring connections.

#### **Isolation Circuitry**

The TEC40 circuitry totally isolates the 24VAC power supplies of all connected air conditioners from each other to prevent feedback or phasing problems.



#### **Sequence Timer**

The jumper selectable sequence timer can be set for 1, 3, 7, 14 or 24 days to rotate in sequence each connected air conditioner to the lead position and equalize run time. There is also a 0 day position available if necessary to halt rotation for test purposes or other reasons. There is a speedup feature located inside controller to accelerate the timer switch over periods (approximately 1 second per day).

#### **Manual Sequence Advance**

A recessed but externally accessible push-button advance button is provided for testing and service. This feature will force the lead unit to last place, and restart the selected sequence timer period.

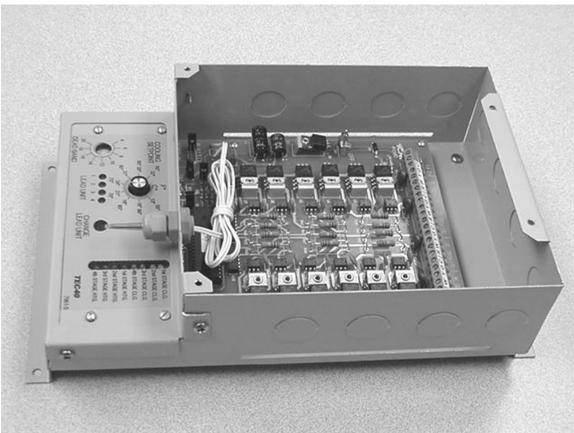
#### **Lead Unit Continuous Blower Option**

The blower on the air conditioner in the number 1 (lead unit) position can be forced to run continuously if desired by making a simple jumper selection.

#### 2 Unit / 2-Stage Operating Sequences

Both alternating and non-alternating sequence option can be selected to control 2 air conditioners with economizers.







BARD MANUFACTURING CO. BRYAN, OH 43506

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### **INSTALLATION INSTRUCTIONS**

# TEC40 ELECTRONIC CONTROLLER



BARD MANUFACTURING COMPANY Bryan, Ohio 43506

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Supersedes: File:

Manual:

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#### \*\* IMPORTANT \*\*

The equipment covered in this manual is to be installed by trained, experienced service and installation technicians. Please read entire manual before proceeding.

#### SHIPPING DAMAGE

Upon receipt of equipment, the carton should be checked for external signs of shipping damage. If damage is found, the receiving party must contact the last carrier immediately, preferably in writing, requesting inspection by the carrier's agent.

#### **GENERAL**

These instructions explain the operation, installation and troubleshooting of the TEC40 controller.

All internal wiring is complete. Only attach low voltage field wiring to designated terminal strips.

The controller is for use with up to four (4) Bard air conditioning wall mount series units. The TEC40 is for use with units with or without economizers.

It is recommended that a five (5) minute compressor time delay relay be factory or field installed in each unit.

The TEC40 controller is suitable for both 50 and 60 HZ operation.

#### THEORY OF OPERATION

The controller is used to control up to four wall mount air conditioners from one thermostat. It provides total redundancy for the structure and equal wear on all units. It can be used with units with economizers, but all units must be equipped alike. That is, all must have economizers or all must be without economizers. See Figure 1 for component locations.

#### LEAD-LAG CHANGEOVER TIME

The lead-lag changeover time period is user selectable. Time periods available are 0, 1, 3, 7, 14 and 28 days. Once every time period the lead unit will be advanced to the next unit providing equal wear on the units. For timer speed up, push and hold the change lead unit pushbutton for one second. Timer speed up is supplied for ease of trouble shooting.

Lead unit cycles between all 4 units in four unit mode; between 1, 2 and 3 in three unit mode; and between units 1 and 2 in both two unit modes.

In the event of a unit(s) failure, the changeover time jumper may be set to 0 days. This will prevent the TEC40 from switching lead unit to the next unit. Push the push-button to make a functional unit the lead unit if necessary. If power is lost the controller will remember which unit was the lead unit when power is reapplied.

#### **MODES OF OPERATION**

The TEC40 has four modes of operation.

- 1. Four Unit Mode
- 2. Three Unit Mode
- 3. Two Unit Alternating Mode
- 4. Two Unit Non-Alternating Mode.

#### STAGING DELAY PERIODS

The following delays are built in for both cooling and heating: stage 1-0 seconds; stage 2-10 seconds; stage 3-15 seconds; and stage 4-20 seconds. The delays are active anytime there is a power interruption or the controller ON–OFF switch is exercised.

#### **FOUR UNIT MODE**

In four unit mode the TEC40 will control four air conditioners with or without economizers. Make connections per Figure 2 on Page 6.

#### Sequence of Operation - Cooling

First stage cooling set point is determined by the position of the cooling set point potentiometer. On a call for first stage cooling, the blower and either economizer or compressor of the lead unit is energized. The enthalpy control on the economizer will make the decision as to which is energized. If not equipped with economizers the compressor will energize. First stage cooling LED will light.

Second stage cooling set point is 2.0 degrees warmer than first stag cooling set point. On a call for second stage cooling, the blower and either economizer of compressor of the next unit is energized. The enthalpy control on the economizer will make the decision as to which is energized. If not equipped with economizer the compressor will energize. Second stage cooling LED will light.

Third stage cooling set point is 2.0 degrees warmer than second stage cooling set point. On a call for third stage cooling, the blower and either economizer is energized. The enthalpy control on the economizer will make the decision as to which is energized. If not equipped with economizer the compressor will energize. Third stage cooling LED will light.

Fourth stage cooling set point is 2.0 degrees warmer than third stage cooling set point. On a call for fourth stage cooling, the blower and either economizer or compressor of the next unit is energized. The enthalpy control on the economizer will make the decision as to which is energized. If not equipped with economizer the compressor will energize. Fourth stage cooling LED will light.

#### Sequence of Operation - Heating

First stage heating set point is determined by subtracting the dead band setting from cooling set point setting. For example, if the cooling set point is 74 degrees and the dead band adjustment is set at 4 degrees the heating set point is 70 degrees. On a call for first stage heating, the blower and electric heat of the lead unit is energized. First stage heating LED will light.

Second stage heating set point is 2.0 degrees colder than first stage heating set point. On a call for second stage heating, the blower and electric heat of the next unit is energized. Second stage heating LED will light.

Third stage heating set point is 2.0 degrees colder than second stage heating set point. On a call for third stage heating, the blower and electric heat of the next unit is energized. Third stage heating LED will light.

Fourth stage heating et point is 2.0 degrees colder than third stage heating set point. On a call for fourth stage heating, the blower and electric heat of the next unit is energized. Fourth stage heating LED will light.

#### **THREE UNIT MODE**

In three unit mode the TEC40 will control three air conditioners with or without economizers. Make connections per Figure 3 on Page 7.

#### **Sequence of Operation**

The cooling and heating sequence of operation are the same as four unit mode except that the fourth stage heating or cooling is not available.

#### TWO UNIT NON-ALTERNATING MODE

In two unit non-alternating mode the TEC40 will control two air conditioners with two speed or dual compressors. Make connections per Figure 5 on Page 9.

#### Sequence of Operation - Cooling

First stage cooling set point is determined by the position of the cooling set point potentiometer. On a call for first stage cooling, the blower and low speed or first compressor of the lead unit is energized. First stage cooling LED will light.

Second stage cooling set point is 2.0 degrees warmer than first stage cooling set point. On a call for second stage cooling, the high speed or second compressor of the lead unit will energize. Second stage cooling LED will light.

Third stage cooling set point is 2.0 degrees warmer than second stage cooling set point. On a call for third stage cooling the blower and low speed or first compressor of the lag unit will energize. Third stage cooling LED will light.

Fourth stage cooling set point is 2.0 degrees warmer than third stage cooling set point. On a call for fourth stage cooling, the high speed or second compressor of the lag unit will energize. Fourth stage cooling LED will light.

#### Sequence of Operation – Heating

First stage heating set point is determined by subtracting the dead bank setting from cooling set point setting. For example, if the cooling set point is 74 degrees and the dead band adjustment is set at 4 degrees the heating set point is 70 degrees. On a call for first stage heating, the blower and electric heat of the lead unit is energized. First stage heating LED will light.

Second stage heating set point is 2.0 degrees colder than first stage heating set point. On a call for second stage heating, the second electric heat (if equipped) of the lead unit is energized. Second stage heating LED will light.

Third stage heating set point is 2.0 degrees colder than second stage heating set point. On a call for third stage heating, the blower and electric heat of the lag unit is energized. Third stage heating LED will light.

Fourth stage heating set point is 2.0 degrees colder than third stage heating set point. On a call for fourth stage heating, the second electric heat (if equipped) of the lag unit is energized. Fourth stage heating LED will light

#### TWO UNIT ALTERNATING MODE

In two unit alternating mode the TEC40 will control two air conditioners with two speed or dual compressor or two air conditioners with economizers with full redundancy. For two air conditioners with economizers, make connections per Figure 4 on Page 8. For two air conditioners with two-speed or dual compressors, make connections per Figure 6 on Page 10.

# Sequence of Operation – Cooling with Economizers

First stage cooling set point is determined by the position of the cooling set point potentiometer. On a call for first stage cooling, the blower and either economizer or compressor of the lead unit is energized. The enthalpy control on the economizer will make the decision as to which is energized. First stage cooling LED will light.

Second stage cooling set point is 2.0 degrees warmer than first stage cooling set point. On a call for second stage cooling, the blower and either economizer or compressor of the lag unit is energized. The enthalpy control on the economizer will make the decision as to which is energized. Second stage cooling LED will light.

Third stage cooling set point is 2.0 degrees warmer than second stage cooling set point. On a call for third stage cooling, the compressor of the lead unit will energize and the economizer will return to minimum position if open. Third stage cooling LED will light.

Fourth stage cooling set point is 2.0 degrees warmer than third stage cooling set point. On a call for fourth stage cooling, the compressor of the lag unit will energized and the economizer will return to minimum position if open. Fourth stage cooling LED will light.

#### Sequence of Operation - Heating

First stage heating set point is determined by subtracting the dead and setting from cooling set point setting. For example, if the cooling set point is 74 degrees and the dead band adjustment is set at 4 degrees the heating set point is 70 degrees. On a call for first stage heating, the blower and electric heat of the lead unit is energized. First stage heating LED will light.

Second stage heating set point is 2.0 degrees colder than first stage heating set point. On a call for second stage heating, the electric heat of the lag unit is energized. Second stage heating LED will light.

Third stage heating set point is 2.0 degrees colder than second stage heating set point. On a call for third stage heating, the second electric heat (if equipped) of the lead unit is energized. Third stage heating LED will light.

Fourth stage heating set point is 2.0 degrees colder than third stage heating set point. On a call for fourth stage heating, the second electric heat (if equipped) of the lag unit is energized. Fourth stage heating LED will light.

#### INSTALLATION INSTRUCTIONS

#### **MOUNTING**

Included in the controller carton is the controller and installation instructions.

The controller should be installed on a vertical wall approximately four (4) feet above the floor away from drafts and outside doors or windows. Four (4) mounting holes are provided for mounting to the wall and holes for conduit connections are provided in both the base, side and top of the controller. The controller should not be mounted directly to a block wall; space away from wall with insulation or plywood.

Once mounted, slide the thermistor sensor down into the fitting on the bottom of the TEC40. Position the sensor so that 15/16 inch is protruding from the bottom of the fitting. Tighten the fitting to hold the sensor in position.

#### LOW VOLTAGE FIELD WIRING

The TEC40 is powered from the air conditioners that it is controlling, 24 VAC, 50/60 HZ, low voltage only.

Circuitry in the TEC40 isolate the power supplies of all connected air conditioners so that no back feeds or phasing problems can occur. Additionally if one or more air conditioners loose power the TEC40 and the other air conditioners are unaffected and will continue to operate normally.

Connect the low voltage field wiring from each unit per the low voltage field wiring diagrams in Figure 2, 3, 4 or 5 depending on the mode of operation desired.

#### FIRE SUPPRESSION CIRCUIT

To disable the TEC40 and shut down all air conditioners, terminal F1 and F2 may be used. The F1 and F2 terminals must be jumpered together for normal operation. A normally closed set of contacts may be connected across the terminals and the factory jumper removed for use with a field installed fire suppression system. The contacts must open if a fire is detected. Contacts should be rated for pilot duty operation at 2 amp 24 VAC minimum.

IMPORTANT NOTE: Bard models employ an electronic blower control that has a 60-second blower off-delay. In order to have immediate shutdown of the blower motor in addition to disabling the run function of the air conditions will require a simple wiring modification at the blower control located in the electrical control panel of the air conditioners being controlled by the lead/lag controller. To eliminate the 60- second blower off-delay disconnect and isolate the wire that is factory connected to the "R" terminal to the electronic blower control, and then connect a iumper from the "G" terminal on the blower control to the "R" terminal on the blower control. The electronic blower control will now function as an onoff relay with no off-delay, and the blower motor will stop running immediately when the F1-F2 fire suppression circuit is activated (opened).

#### **ADJUSTMENTS**

See Figure 1.

#### **COOLING SET POINT**

Set the cooling set point in degrees C° or F° as indicated on the front of the TEC40.

#### **DEAD BAND**

The dead band is the span between heating set point and cooling set point where no heating or cooling takes place. The cooling set point minus the dead band equals the heating set point. Adjustable from 4° to 20° F.

Turn the potentiometer fully counter clockwise for 4° dead band. Turn fully clockwise for 20° dead band. The arrow on top of the potentiometer does not indicate dead band setting.

#### **LEAD CHANGE PUSH-BUTTON**

Pushing the lead change push-button will immediately change the lead unit to the lag unit. It also resets the lead/lag changeover timer to zero and restarts the selected timing period.

#### ON/OFF SWITCH - UNDER COVER

This disables the TEC40. This switch must be ON for any heating or cooling to operate.

NOTE: Whenever the on/off switch is first turned ON, all 4 red LED's for lead unit indication will flash 4 or 5 times as the controller sequences itself, and then will revert to whichever unit was lead when on/off switch was turned OFF.

#### **CHANGING SELECTABLE FEATURES**

To change any selectable feature turn on/off switch OFF. Change jumpers as necessary and turn switch ON. Jumper changes do not take effect unless on/off switch is turned OFF, jumper plug moved, and on/off switch turned back ON.

### CHANGE OVER TIME JUMPER – UNDER COVER

The changeover period for the sequence can be adjusted to 0, 1, 3, 7, 14 or 28 days.

If the jumper is set to 7 days (or other selected choice), units will rotate upwards: first to second, second to third, third to fourth, and fourth to first place. If connected for three units then three will go to first, and fourth position is ignored.

The 0 day position is supplied in the event of a unit failure or if only one air conditioner is used with the TEC40. If the unit needs to run for a time and not switch to the lag unit, set the jumper to "0" and push the lead change push-button to make the functional or single unit the lead unit. When the jumper is in the 0 position the lead unit will never switch.

#### **TEST MODE JUMPER - UNDER COVER**

There is a test mode to accelerate the timing circuit from days to seconds. For example, if the timing selection jumper plug were set to the 7 day position, then utilizing the test mode feature the lead unit would advance in 7 seconds.

To use the test feature take the following steps:

- 1. Turn the on/off switch to OFF.
- 2. Place the jumper across the test mode pins.
- 3. Turn the on/off switch to ON.
- 4. The lead unit will now advance in upward sequence through the enabled unit positions.
- 5. To stop the accelerated sequence turn the on/off switch to OFF, remove the jumper, and then turn the on/off switch back ON.
- 6. After the 4 red LED's stop flashing the lead unit may be the one indicated at the time the on/off switch was turned OFF or it may be the next one up, depending on where the timer was in the accelerated sequence when switch was turned OFF.

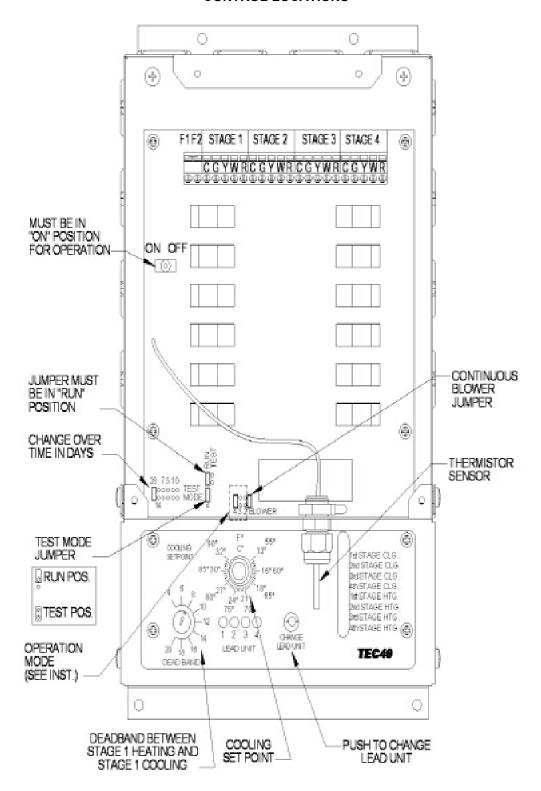
#### **OPERATION MODE JUMPER – UNDER COVER**

Position jumper across pins 4 for four unit mode. Position jumper across pins 3 for three unit mode. Position jumper across pins 2 for two unit non-alternating mode. Remove jumper for two unit alternating mode.

### CONTINUOUS BLOWER JUMPER – UNDER COVER

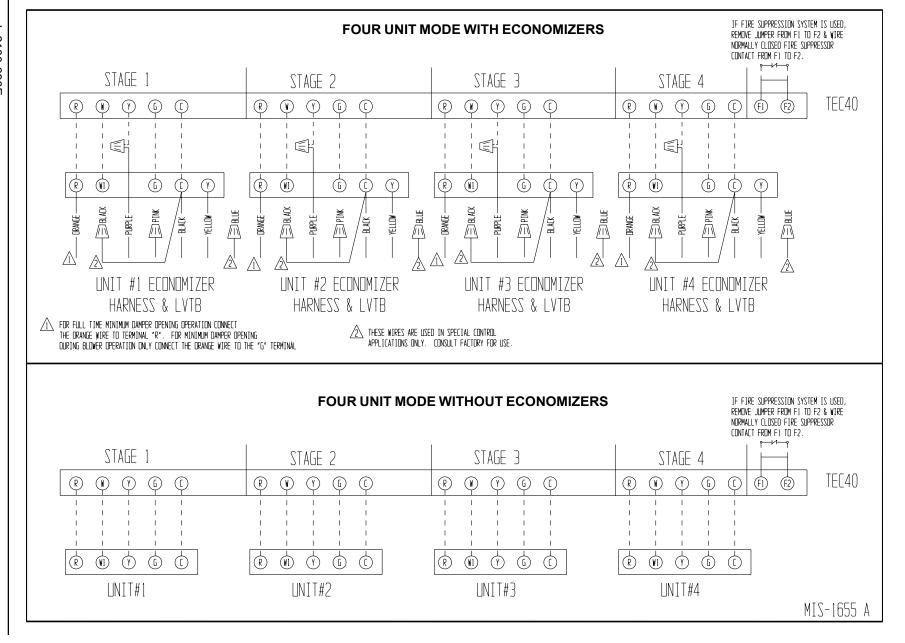
Position jumper across pins for continuous blower on the lead unit. Remove jumper to have the lead unit blower cycle with the compressor.

FIGURE 1
CONTROL LOCATIONS



7960-477

FIGURE 2



THREE UNIT MODE WITH ECONOMIZERS IF FIRE SUPPRESSION SYSTEM IS USED, REMOVE JUMPER FROM F1 TO F2 & WIRE NORMALLY CLOSED FIRE SUPPRESSOR CONTACT FROM F1 TO F2. STAGE 1 STAGE 3 STAGE 2 STAGE 4 TF(40  $(\mathsf{W})$ (j) (R)(i) (1) (R) $(\mathbf{W})$ (Y) (i) (1)  $(\mathsf{W})$ (Y) (i) (1) (FI) (F2) (R) 6 (R) (R) (j) (II) (6) (WI) (WI)(Y)(Y)BLACK ≥)BLACK ∭ PIM ∭ PIM · ORANGE · B.A.K BLACK YELLOW BEK / FOR FULL TIME MINIMUM DAMPER OPENING OPERATION CONNECT UNIT #1 ECONOMIZER UNIT #2 ECONOMIZER UNIT #3 ECONOMIZER THE DRANGE WIRE TO TERMINAL "R". FOR MINIMUM DAMPER OPENING DURING BLOWER OPERATION ONLY CONNECT THE DRANGE WIRE TO THE "G" TERMINAL HARNESS & LVTB HARNESS & LVTB HARNESS & LVTB THESE WIRES ARE USED IN SPECIAL CONTROL APPLICATIONS ONLY. CONSULT FACTORY FOR USE. IF FIRE SUPPRESSION SYSTEM IS USED, THREE UNIT MODE WITHOUT ECONOMIZERS REMOVE JUMPER FROM F1 TO F2 & WIRE NORMALLY CLOSED FIRE SUPPRESSOR CONTACT FROM F1 TO F2. STAGE 1 STAGE 2 STAGE 3 STAGE 4 TEC40 FI (R)(i) (R)(i)  $\mathbb{R}$ (Y) (i) (1)  $(\mathsf{W})$  $(\mathsf{W})$ (Y) $(\mathbf{V})$ (W) (R) (R) (1) (R) (i) (i) (WI) (Y)(WI) (Y)(G) (W1) (Y) UNIT#1 UNIT#3 UNIT#2 MIS-1656 A

FIGURE 3

FIGURE 4
TWO UNIT ALTERNATING MODE WITH ECONOMIZERS

IF FIRE SUPPRESSION SYSTEM IS USED, REMOVE JUMPER FROM F1 TO F2 & WIRE NORMALLY CLOSED FIRE SUPPRESSOR CONTACT FROM F1 TO F2.

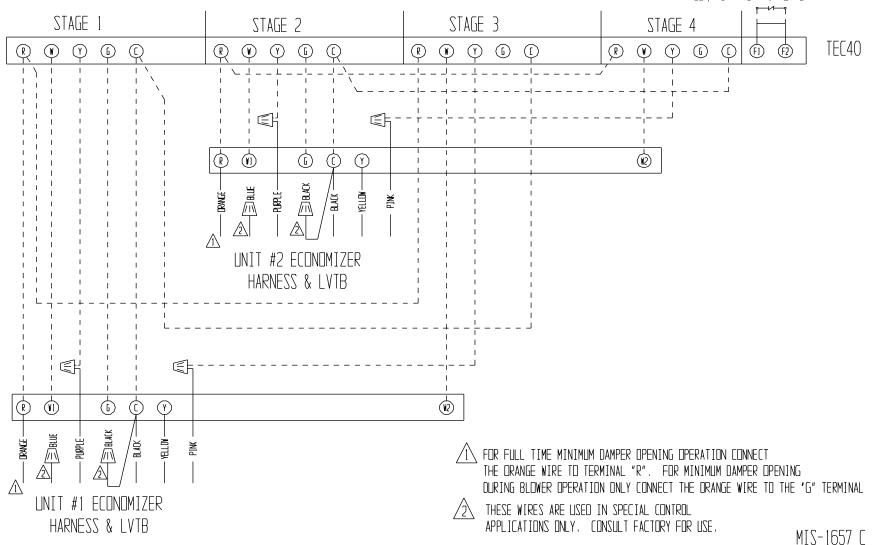


FIGURE 5
TWO UNIT NON-ALTERNATING MODE WITH 2-SPEED OR DUAL COMPRESSORS

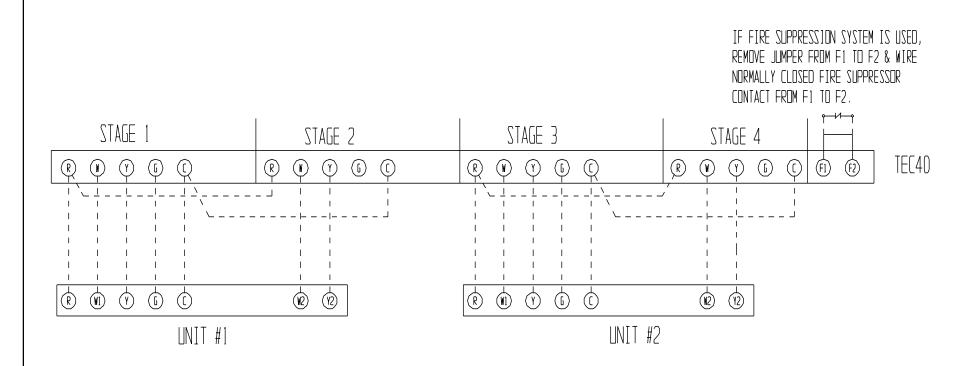
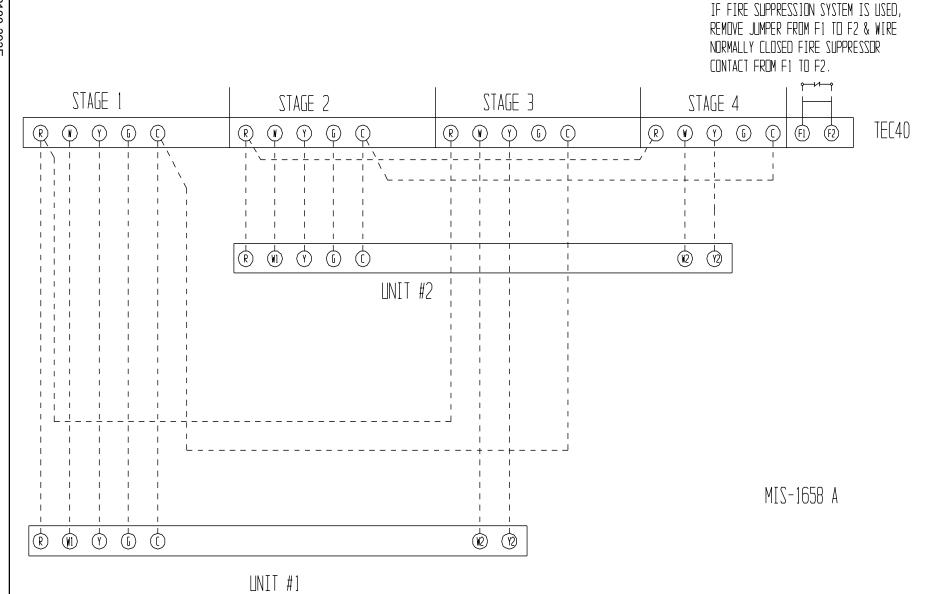


FIGURE 6
TWO UNIT ALTERNATING MODE WITH 2-SPEED OR DUAL COMPRESSORS





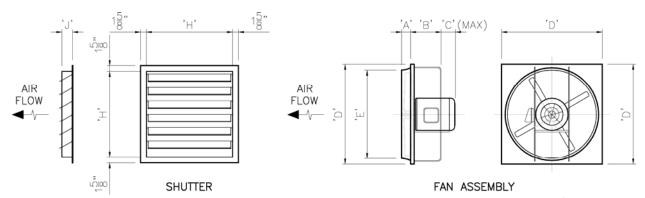
# MODEL ET PROPELLER FANS

Standard Airflow

| MODEL | Α    | В    | С  | D   | E     | Н   | J  |
|-------|------|------|----|-----|-------|-----|----|
| ET-12 | 2 ½" | 8 ½" | 4" | 16" | 12 ¾" | 12" | 3" |
| ET-16 | 2 ½" | 8 ½" | 4" | 20" | 16 ¾" | 16" | 3" |
| ET-20 | 2 ½" | 8 ½" | 4" | 24" | 20 ¾" | 20" | 3" |
| ET-24 | 2 ½" | 8 ½" | 4" | 28" | 24 ¾" | 24" | 3" |

| Project:      | Murphy Oil W28406/P12495 |
|---------------|--------------------------|
| Location:     |                          |
| Architect:    |                          |
| Engineer:     |                          |
| Contractor:   | WARWICK                  |
| Submitted By: | Ener-Tech Industries     |
| Date:         | July 30,2012             |

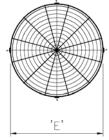
Dimensions given on this sheet are correct within limits suitable for normal installation requirements



#### **FEATURES**

ET FANS, designed for heavy-duty ventilation applications. Fans with explosion proof motors designed to exhaust atmospheres containing flammable, explosive vapors or gases. Explosion proof motors are CSA approved for Class I, Group D and Class II, Groups E, F and G hazardous locations. Air deliveries based on AMCA test code for exhaust systems. Heavy-duty venturi panel, fixed position motor base with rigid tubular supports. Fan blades are non-sparking cast or fabricated aluminium. Back guard is heavy gauge steel wire.

**STANDARD SHUTTERS**. For normal applications. Mill finish aluminum vanes with steel pivot pins. 19ga. welded steel frame. Gray enamel finish. Vanes counter-balanced for easy operation, steel reinforced, felted for quiet, weather tight closure. Tie rod attached to vanes on fan side. 9/32" Ø mounting holes.



REAR & FRONT FAN GUARD

| SPECIFICATIONS |     | FAN  |        |     |     |     | MOTOR    |      | OPTIONAL            |
|----------------|-----|------|--------|-----|-----|-----|----------|------|---------------------|
| Reference      | QTY | Size | Model  | CFM | SP  | HP  | Current  | Туре | ACCESSORIES         |
|                | 1   | 12″  | ET12-1 | 500 | .25 | 1/4 | 120/1/60 | TE   | Shutter & backgaurd |
|                |     |      |        |     |     |     |          |      |                     |
|                |     |      |        |     |     |     |          |      |                     |
|                |     |      |        |     |     |     |          |      |                     |

TE - totally enclosed WC - wall collar

EX - explosion proof motor BA - back (motor side) guard 2S - two speed motor FA - front guard

### INSTALLATION & MAINTENANCE INSTRUCTIONS

RECEIVING AND INSPECTION: Immediately inspect the fan and accessories noting any visible signs of damage on the delivery receipt. Report damage to the carrier within 15 days. Check to assure that impeller set screws are tight. Turn impeller by hand to see that it turns freely and does not bind. Whenever possible, fans should be stored indoors in clean, dry locations. If storage outdoors is necessary, fans should be protected against the elements and accumulation of dirt and moisture. Special care must be taken to keep motors and bearing assemblies dry and clean.

#### INSTALLATION

1. CAUTION! This unit has rotating parts and safety precautions should be exercised during installation, operation and maintenance.

2. WARNINGI DO NOT use in HAZARDOUS ENVIRONMENTS where fans electrical system could provide ignition to combustible or flammable materials, unless unit is specifically built for hazardous environments.

3. To install uncrated fan provide a square opening in the wall equal to the outside dimensions of the fan. It is preferable to frame in the opening with 2 X 4 material, or a metal frame in metal buildings.

4. Slide the fan into the framed opening in the wall. Securely fasten with bolts or screws provided by the installer.

5. When using an automatic shutter, be sure to position the shutter at least 6" from fan blades.

6. Guards must be installed when fan is within reach of personnel or within seven (7) feet of working level or when deemed advisable for safety.

 All wiring should be in accordance with local ordinances and the National Electric code.

8. Before starting, check all fasteners for tightness particularly in the propeller hub. Turn the propeller by hand to make sure it is in alignment with the orifice and fan blades do not strike.

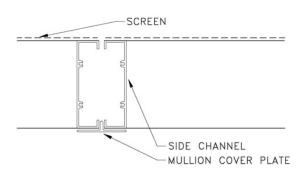
9. WARNING! Check voltage being supplied to the fan to see that it corresponds with the motor nameplate voltage; high or low voltage can seriously damage the motor. On multi-voltage motors check motor terminal connections to make sure motor is internally connected for voltage being supplied. Motor wiring diagram is located on the side of the motor. Extra care should be taken when wiring two speed motors since improper connections will damage motor and void motor warranty.

10. Operate under power and compare propeller rotation with directional arrow on fan. In the case of three phase motors, the direction can be changed by interchanging any two of the three motor leads. In the case of single phase motors, the reversing instructions will appear on the wiring diagram in the motor wiring compartment.

#### MAINTENANCE

1. REGULAR MAINTENANCE: Determined by the condition of the air passing through the fan, regularly scheduled inspection of all fan parts establishes a good maintenance routine. When the air is clean, maintenance can be as infrequent as once a year. When air is contaminated with grease vapors from cooking operations, maintenance may be required as often as once a week. Regular maintenance should include inspection and cleaning of all fan parts.

2. MOTORS: Motor bearings are prelubricated. Consult information printed on motor for lubrication instructions. If motor required replacement, a comparable one to the original with the same service factor and enclosure must be used.



### ALUMINUM LOUVER XC-445WXF-445W

westvent®

#### HORIZONTAL SECTION STANDARD SPECIFICATIONS



WELDED ASSEMBLY

- 4" X 1" X .081"(101.6MM X 25.4MM X 2.1MM) CHANNEL UP TO 48" (1219.2MM), 4" X 1.5" X .081" (101.2MM X 38.1MM X 2.1MM) OVER 48" (1219.2MM), BUTT FRAME

CORNERS

**BLADES** - 4" X .081" (101.6MM X 2.1MM) SET AT 45° 4.5" (114.3MM) SPACING, SUPPORTS AT 48" (1219.2) W CENTERS

- MILL ALUMINUM

**FINISH SCREEN** .5" X .5"(12.7MM X 12.7MM) X 18 GAUGE

GALVANIZED, SCREW FASTENED

- MINIMUM 12 "W" X 12 "H" (304.8MM X SIZE

304.8MM)

MAXIMUM SECTION WIDTH 144" (3657.6MM)
MAXIMUM SECTION HEIGHT 144" (3657.6MM)

MAXIMUM SECTION SIZE 72 SQ. FT.

### 4" (101.6MM) 4" (101.6MM) (25.4MM)2" (50.8MM) .69" (17.5MM)"H "H HEIGHT HEIGHT (114.3MM)BLADE OUVER

XC-445W

XF-445W

#### **OPTIONS**

- HEAVIER GAUGE, CONTINUOUS BLADES, CONST. ROUND, TRIANGULAR SHAPES, ETC.

XF-FLANGE FRAME 2" X .125" FRAME (50.8MM X 3.2MM), MITRED CORNERS

- AS PER REQUEST SCREEN

**FINISH** - BAKED ENAMEL, ANODIZED & OTHERS

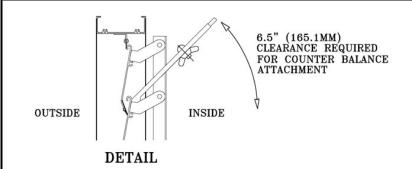
#### TECHNICAL NOTES

MAX. REC. INTAKE VEL. - 744 FPM THROUGH FREE AREA SHIPPING WEIGHT - APPROX. 5 LBS./SQ. FT.

LOUVERS ARE MANUFACTURED .5" (12.7MM) SMALLER THAN ORDERED SIZE UNLESS EXACT DIMENSIONS ARE STATED.

\* FOR MORE INFORMATION, CONTACT OUR FACTORY \*

|                   | NOTES                                                                                                         | APPROVAL |     |
|-------------------|---------------------------------------------------------------------------------------------------------------|----------|-----|
|                   | 45W fixed exterior louver with birdscreen mounted galv sleeve c/w Interior BDX-3C3-LB Barometric w 2" filter, |          |     |
| DATE:<br>PROJECT: | July 30/12<br>MURPHY OIL W28406/P12495                                                                        |          |     |
| ENGINEER:         | Werth 111 612 1126 165/1 12 166                                                                               |          | 55W |
| CUSTOMER:         | WARWICK                                                                                                       |          | 4   |
| DISTRIBUTOR:      | ENER-TECH INDUSTRIES                                                                                          |          | XC- |





### BACKDRAFT DAMPER BDX-3C3-LB

#### STANDARD SPECIFICATIONS

CONST. - EXTRUDED ALUMINUM, WELDED FRAME - 3" X 1" (76.2MM X 25.4MM) EXTRUDED FRAME

**ALUMINUM** 

- 3.5" X .06" (88.9MM X 1.5MM) TAPERED BLADES

EXTRUDED ALUMINUM, 3.06" (77.7MM) BLADE SPACING

- DUAL DUROMETER VINYL BLADE SEAL, -40° F.

SEALS TO +200° F.

- .19" X 1.25" (4.8MM X 31.8MM) PLATED STEEL SHAFTS

BEARINGS - .19" (4.8MM) NYLON BUSHINGS

LINKAGE - INSIDE AIRSTREAM, ON ENTERING SIDE

C.B. WTS. - AS REQUIRED FINISH - MILL ALUMINUM

- MINIMUM 12" W X 12" H (304.8MM X 304.8MM) - MAXIMUM 32" W X 60" H (812.8MM X 1524MM) SIZE

OPTIONS

- FLANGE, REVERSE FLANGE 3" X 1.5" 76.2MM FRAME

X 38.1MM)

- AS REQUIRED, BDX-3C3-LB, SCREEN IS ON FACE. WHEN SCREEN IS USED BLADES ONLY **SCREEN** 

FACE.

OPEN TO APPROX. 45°.

- ANODIZED, PRIME COAT, BAKED ENAMEL FINISH

TECHNICAL NOTES

CAUTION - DO NOT USE FOR INTAKE UNLESS

BDX-3C3-LB RECOMMENDED ON LARGER

DAMPERS BECAUSE OF LINKAGE WEIGHT

WITH OUTSIDE WEATHER COWL

MAX. RECOMMENDED VEL. - 3000 FPM

MAXIMUM TEMPERATURE 200° F.

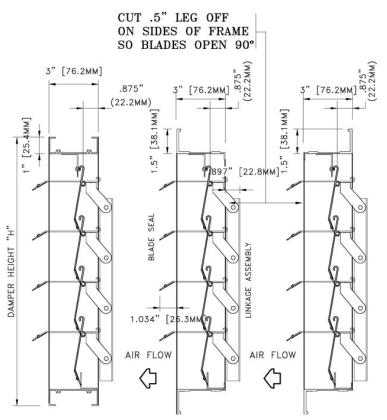
MAXIMUM WIDTH - 5.5" (139.7MM) WHEN BLADE IS

IN FULL OPEN POSITION PLUS CLEARANCE FOR COUNTER BALANCE WEIGHTS SEE ABOVE

SHIPPING WEIGHT - APPROX. 5 LB/SQ. FT.

DAMPERS 3F3 & 3RF ARE MANUFACTURED TO .5 (12.7MM) SMALLER THAN OPENING SIZE UNLESS EXACT DIMENSIONS ARE STATED AND 3C3 IS .25" (6.4MM) UNDERSIZED.

FOR MORE INFORMATION, CONTACT OUR FACTORY \*



BDX-3C3-LB SECTION

STANDARD

BDX-3F3-LB SECTION

OPTIONAL

BDX-3RF-LB

SECTION

OPTIONAL

REVERSE FLANGE

FRAME

CHANNEL FRAME FLANGED FRAME

NOTE: PLEASE SPECIFY WHETHER YOU WANT - CHANNEL FLANGE. OR REVERSE FLANGE AND WALL MOUNT OR CEILING MOUNT.

APPROVAL NOTES 1 - 24" X 24" Interior BDX-3C3-LB Barometric Intake Damper c/w 2" filter, mounted in common 20ga galv sleeve c/w XF445W fixed exterior louver with birdscreen July 30/12 DATE: Murphy Oil W28406/P12495 PROJECT: 3DX-3C3-LB **ENGINEER:** WARWICK CUSTOMER: DISTRIBUTOR: **Ener-Tech Industries** 



### CONTROL DAMPERS

### HANDLING, INSTALLATION & MAINTENANCE

#### HANDLING:

Because of the nature of control dampers, careful handling is the first step required for successsful operation and performance. Dampers must be handled with care to prevent bending or twisting of frames, blades and linkage control parts.

#### INSTALLATION:

Dampers must be installed in all cases, squarely, without twisting or bending of frames, blades or linkages. The protrusion of screws, bolts, angles or other fastening devices must not interfere with damper operation. Dampers should be installed with blades in a horizontal position unless ordered otherwise. Dampers with blades required in a vertical position shall be c/w ball bearings or thrust washers.

#### STRUCTURAL SUPPORTS:

Structural supports are not supplied with any Westvent product but will be required to support any multi-section dampers. Structural supports to be supplied and installed by others.

#### COMMISSIONING:

The effects of improper installation and operation are the responsibility of the customer and the installer. If there are any problems with the dampers, please advise 'Westvent' before system startup for correction. Western Ventilation Products Ltd. cannot and will not accept responsibility for selection of product or damage that may be caused by faulty installation or operation of system.

#### **MAINTENANCE:**

The severity of operating conditions will normally indicate the frequency of service maintenance. Severe and abrupt changes in temperature, humidity and/or dust particles in the air stream will require a seasonal maintenance check. The recommended minimum frequency for maintenance checks is once every three months, an industry standard.

#### A: LINKAGE

Clean and lubricate with a light lubricating oil. Concealed channel linkage may require complete removal of damper.

#### B: BLADE TIP SEALS

Check for damage and replace if necessary. No need to remove damper to service.

### C: BLADE END (JAMB) SEALS

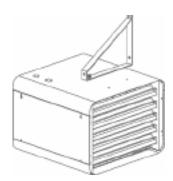
Clean and lubricate with a light lubricating oil. To replace the side seals, remove the bolts holding the pivot shaft pins to the blades, and install new seals if required.

IF YOU HAVE ANY FURTHER QUESTIONS PLEASE CONTACT "WESTVENT" AT PH (403) 250 3348 FX (403) 250 7786

## SERIES OAS

#### SUSPENDED UNIT HEATER

COMMERCIAL/INDUSTRIAL FORCED-AIR HEATER



#### Features

Colour Almond.

Finish Epoxy/polyester powder paint.

208, 240, 277\*, 347, 480\* or 600 Volts, 1 or 3-phase Voltage

Other voltages available upon request.

Some units may be field converted from 3 to 1-phase.

Construction 18 and 20-gauge steel.

Adjustable louvres to direct air flow.

High-limit temperature control with automatic reset.

Fan Motor mounted in cold compartment.

Thermally-protected motor.

Totally enclosed and factory-lubricated ball bearing motor (except for 15 to 25 kW at 208/240-volt). 58 dBA fan (2-10 kW), 67 dBA fan (15-30 kW) and 77

dBA fan (40-60 kW).

Fan over-ride purges heater of residual heat.

nt Durable tubular heating elements; stainless steel (2-10 kW); finned (15-60 kW). Concentric Heating element

disposition of heating elements.

All models have a factory-installed contactor. Control

240/208-Volt control circuit standard (with

transformer if necessary).

Also available with 24-Volt relay, with or without

transformer.

Optional built-in thermostat. 120-Volt control circuit available.

Installation Horizontal mounting from wall or from ceiling using 1 of

2 supplied brackets which allow 360° rotation\*\*

Vertical mounting using 4 threaded rods 1/2" X 13

UNC

(not included). Diffuser cones available.

Large and easily accessible control compartment. Maximum recommended height (horizontal): 2-10 kW: 2.4 m (8 ft); 15-30 kW: 3.0 m (10 ft); 40-60 kW: 4.5 m

(15 ft).

Protective screen allows lower mounting height

(except 40-60 kW).

Minimum height of 2.4 m (8 ft) for 40-60 kW heaters.

30°C (85°F) maximum operating temperature.

Warranty 1-year warranty against defects.

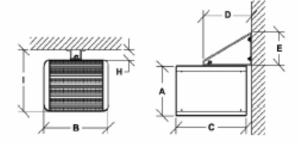
Applications Commercial hall, milk house, stair opening.

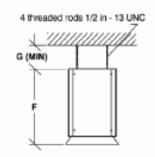
<sup>\* 277-</sup> and 480-Volt models available upon request.

<sup>\*\*</sup> Horizontal mounting only for 40, 50 and 60 kW secured by 4 hooks (ceiling only). Ouellet highly recommend using a wall thermostat for a greater comfort.



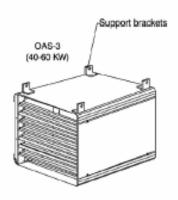












|        | 2-10  | kW   | 15-30 | ) kW | 40-60 kW |       |
|--------|-------|------|-------|------|----------|-------|
|        | mm    | in   | mm    | in   | mm       | in    |
| A.     | 305.0 | 12.0 | 444.0 | 17.5 | 585.0    | 23.0  |
| В      | 420.0 | 16.5 | 560.0 | 22.0 | 641.0    | 25.2  |
| С      | 432.0 | 17.0 | 572.0 | 22.5 | 870.0    | 34.3  |
| D      | 343.0 | 13.5 | 470.0 | 18.5 |          | -     |
| Е      | 285.0 | 11.2 | 393.0 | 15.5 | -        | ,     |
| F      | 490.0 | 19.3 | 630.0 | 24.8 | 930.0    | 36.6  |
| G      | 305.0 | 12.0 | 305.0 | 12.0 | 305.0    | 12.0  |
| H      | 127.0 | 5.0  | 152.0 | 6.0  | 305.0    | 12.0  |
| 1      | 433.0 | 17.0 | 572.0 | 22.5 | 900.0    | 35.0  |
| Walaha | kg    | Ibs  | kg    | lbs  | kg       | lbs   |
| Weight | 20.0  | 45.0 | 39.0  | 85.0 | 68.0     | 150.0 |

| Qty | Model and description<br>Other informations | Volts              | Phase              | Watts              | Length<br>mm / in  | Informations<br>Color/Installation |
|-----|---------------------------------------------|--------------------|--------------------|--------------------|--------------------|------------------------------------|
| 1   | OAS15034-T                                  | 480/3/60           | 3                  | 15000              | 22.5"              | c/w built in thermostat            |
|     |                                             |                    |                    |                    |                    |                                    |
|     |                                             |                    |                    |                    |                    |                                    |
|     |                                             |                    |                    |                    |                    |                                    |
|     |                                             |                    |                    |                    |                    |                                    |
|     |                                             |                    |                    |                    |                    |                                    |
|     |                                             |                    |                    |                    |                    |                                    |
|     |                                             |                    |                    |                    |                    |                                    |
|     |                                             |                    |                    |                    |                    |                                    |
|     |                                             | Other informations mm / in         |

Specifications may change without prior notice.

Project: Murphy Oil W28406/P12495

Engineer:

Contractor: Warwick

Distributor: Ener-Tech Industries

Date: July 30/12

**Shop Drawings** 

Approval Information



#### **APPLICATIONS**

- Parking lot lighting
- HVAC
- Display lighting
- Security lighting
- Lighted signage
- Storefront lighting



CALIFORNIA Title 24

ASHRAE 90.1

Model 2101 supplied with unit

#### **FEATURES**

#### **SCHEDULING:**

CIRCUIT 1: ON automatically at dusk, OFF at individual preset times each day, including skipping days when desired. Unit can be set to turn ON before dawn for early morning lighting.

**CIRCUIT 2:** ON at dusk, OFF at dawn automatically, daily.

CIRCUIT 3: Individual daily ON and OFF settings at desired times, including skipping any desired day or days Minimum ON is setting 1 hour with a minimum OFF setting of 2 hours. Minimum 8 hours between 2 OFF settings. 7 day calendar dial will accommodate up to 2 pairs of ON-OFF trippers per day — 7 pairs are supplied.

SKIP-A-DAY: Omit operations on any day.

MANUAL BY-PASS SWITCHES: Single pole, 20 Amps — one per circuit. Factory pre-wired to terminal strip. ON/OFF/AUTO positions for each circuit is independent — will not disturb automatic settings.

RESERVE POWER: Standard feature on all models keep dial on time up to 24 hours during power outage.

### **ORDERING INFO**

| CATALOG<br>NO.              | UPC<br>CODE                            | INPUT SUPPLY<br>(VAC) 60Hz | OUTPUT<br>CONTACTS | ENCLOSURE<br>TYPE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |
|-----------------------------|----------------------------------------|----------------------------|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| T920L                       | 41033                                  | 120                        | 2 SPDT             | Metal Indoor<br>NEMA 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
| T920L-E                     | 41034                                  | 120                        | 2 SPDT             | Metal Indoor NEMA 1 with switch access                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
| T920L-0                     | 41035                                  | 120                        | 2 SPDT             | Metal Indoor/outdoor<br>NEMA 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |
| T930L                       | 41055                                  | 120                        | 3 SPDT             | Metal Indoor<br>NEMA 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
| T930L-E                     | 41056                                  | 120                        | 3 SPDT             | Metal Indoor NEMA  1 with switch access                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |  |
| T930L-0                     | 41057                                  | 120                        | 3 SPDT             | Metal Indoor/outdoor<br>NEMA 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |
| Replacement<br>Trippers     |                                        | #P69 for 7 pair            | s of ON/OFF trip   | ppers.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
| Replacement<br>Motor        | #36 (120V)                             |                            |                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |
| Replacement<br>ypass Switch |                                        | #                          | 66061              | NO. 100 CO. 10 |  |  |
|                             | 15 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 |                            | STEED MANAGEMENT   | THE THE DESCRIPTION OF THE PARTY.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |

NOTE: All models are designed to control a contactor circuit and are not recommended for direct switching of most lighting loads.

ELECTROMECHANICAL CONTROLS

#### **SPECIFICATIONS**

INPUT VOLTAGE: 120 or 208-277VAC, 60 Hz,

varies by model.

TIMING ACCURACY: Line frequency.

TERMINAL RANGE: #8 - #14AWG.

OPERATING TEMPERATURE: -40° to 165°F (-40° to +74°C).

POWER CONSUMPTION: 5 watts maximum.

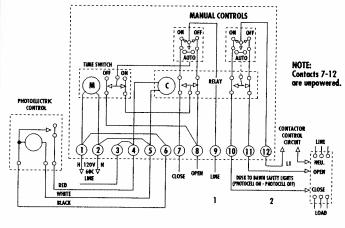
ENCLOSURE: Indoor NEMA 1 Metal with lockable hasp. Other enclosures include cover for access to by-pass switches with suffix "E" or Indoor/Outdoor NEMA 3 metal with suffix "O" (see page 153 for enclosure dimensions).

#### CONTACT RATINGS

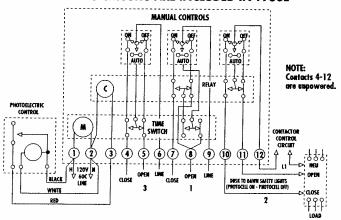
| TYPE            | VOLTAGE          | CONTACT<br>RATING |
|-----------------|------------------|-------------------|
| General Purpose | 120/277VAC       | 20A               |
| Motor           | 120VAC<br>240VAC | 1HP<br>2HP        |

#### WIRING DIAGRAMS

T920L
ONLY CIRCUITS 1 AND 2 ARE INCLUDED IN T920L



T930L
ALL 3 CIRCUITS ARE INCLUDED IN T930L



#### SPECIFICATION WRITER'S GUIDE

T900 SERIES — Furnish and install, where shown, a TORK Photo/Time Control of the 7 Day Calendar dial type, which shall be suitable to operate mechanically-held contactor(s). Photo/Time Control shall be pre-wired to a central terminal block which provides connecting terminals for Photocontrol and independent contactor control circuit(s). Time switch shall function to prevent energization of lighting for preset periods each day. Time switch dial shall permit different ON/OFF settings for each day of the week, with provision for omitting selected days. Control shall include pre-wired manual switching for each contactor circuit specified. Enclosure shall be NEMA 1 surface. Photocontrol to be remotely installed in appropriate outside location. It shall be fully temperature compensated and shall provide for time delay of at least 15 seconds to prevent false switching. Photocontrol shall operate control center to energize whenever natural lighting falls below 1.5 - 5.5 foot candles turn on. Spring driven reserve timing motor shall be provided sufficient to operate time switch controls at least 24 hours after power failure. On restoration of power, time switch shall transfer to synchronous motor drive and automatically rewind reserve power unit. FOR DUSK-TO-DAWN LIGHTS: Control shall provide additional contactor circuit to above specifications except that it shall be responsive to Photocontrol only. Tork Model T-920L or equal. FOR PRESET ON/PRESET OFF: Control shall provide for additional contactor circuit to above specification except that it shall be responsive to time switch only. Tork Model T-930L.

## Straight Blade Devices 15 and 20 Ampere, 125 Volts

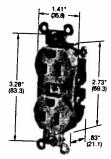
2 Pole, 3 Wire Grounding

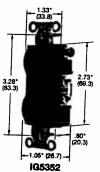


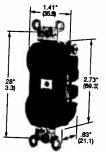


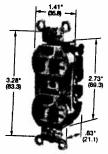




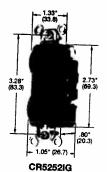








5362IWR



### Receptacles





Hubbell-Pro™ Heavy Duty, Specification Grade, Duplex, Back and Side Wired

| Description                                      | Color        | Ontole No. 1      |            |
|--------------------------------------------------|--------------|-------------------|------------|
| Smooth nylon face.                               |              | Catalog Numb      | er         |
| The carry to the tactor.                         | Almond       | 5252AAL           | 5352AAL    |
|                                                  | Black        | 5252ABLK          | 5352ABLK   |
|                                                  | Brown        | 5252AB            | 5352AB     |
|                                                  | Gray         | 5252AG            | 5352AG     |
|                                                  | -> Ivory     | 5252AI            | 5352AI     |
|                                                  | Light Almond | 5252ALA           | 5352ALA    |
|                                                  | Office White | 5252AOW           | 5352AOW    |
|                                                  | Red          | 5252AR            | 5352AR     |
| In-late at the second                            | White        | 5252AW            | 5352AW     |
| Isolated ground <sup>(1)</sup> ,<br>smooth face. | Almond       | IG5252AL          | IG5352AL   |
| Smooth face.                                     | Gray         | IG5252GY          | IG5352GY   |
|                                                  | Ivory        | IG5252I           | IG53521    |
|                                                  | Light Almond | IG5252LA          | IG5352LA   |
|                                                  | Orange       | IG5252            | IG5352LA   |
|                                                  | White        | IG5252W           | IG5352W    |
| inder groove nylon face.                         | Almond       | 5262AL            |            |
|                                                  | Black        | 5262AL<br>5262BLK | 5362AL     |
|                                                  | Blue         | JZUZBLK           | 5362BLK    |
|                                                  | Brown        | 5262B             | 5362BL     |
|                                                  | Gray         | 5262G             | 5362B      |
|                                                  | Ivory        | 5262G<br>5262I    | 5362G      |
|                                                  | Light Almond | 5262LA            | 53621      |
|                                                  | Office White | 5262CM            | 5362LA     |
|                                                  | Red          | 5262CW<br>5262R   | 5362OW     |
|                                                  | White        | 5262W             | 5362R      |
| /eather-Resistant,                               | Black        |                   | 5362W      |
| nder groove nylon face.                          |              | 5262BKWR          | 5362BKWR   |
| 5 - 1,7,0,1,14,00.                               | Brown        | 5262WR            | 5362WR     |
|                                                  | Gray         | 5262GYWR          | 5362GYWR   |
|                                                  | lvory        | 5262IWR           | 5362IWR    |
| plated ground(1),                                | White        | 5262WWR           | 5362WWR    |
| der groove face.                                 | Black        | CR5252IGBK        | CR5352IGBK |
| der Brooke INCE.                                 | Blue         | -                 | CR5352IGBL |
|                                                  | Gray         | CR5252IGGY        | CR5352IGGY |
|                                                  | Ivory        | CR5252IGI         | CR5352IGI  |
|                                                  | Orange       | CR5252IG          | CR5352IG   |
|                                                  | Office White | CR5252IGOW        | CR5352IGOW |
| e: (1) See Section J for complete line           | White        | CR5252IGW         | CR5352IGOW |

Note: (1) See Section J for complete line of isolated ground devices. See page A-46 for accessories. See page A-55 for technical information. Horsepower ratings listed above are AC only. See Section K for wallplates.



A-14



# **Bulletin 600** Single Phase NEMA Manual Starting Switches

# Product Overview/Product Selection



Type 1 General Purpose Enclosure with Neon Pilot Light

#### Bulletin 600

 Starting and overload protection of small 1Ø AC/DC motors used on unit heaters stokers refrigeration compressors fans pumps

Bulletin 600 manual switches consist of a snap switch combined with a thermal overload device operating on the solder-ratchet principle. The switch is designed to prevent being held closed under a sustained motor overload. To reset the overload mechanism, the switch lever is moved to the OFF position. The motor can be restarted by pushing the switch lever to the ON position. Applications include compressors,

Hazardous Location: UL Listed (File No. E10314) CSA (LR11924)

### **Table of Contents**

Accessories ...... 1-180 Modifications ..... 1-180 Approximate Dimensions ......1-180 Standards Compliance and Certifications UL Listed — Enclosed Products (File No. E14841; Guide No. NLRV) UL — Open Style Products (File No. E14841; Guide No. NLRV2) CSA Certified LR1234 American Bureau of Shipping CE Marked (Per 60947)

Your order must include: 1) Cat. No. of the switch, 2) Cat. No. of the heater element(s), and 3) if required, Cat. No. of any accessories.

Single Pole — 1 HP 115...230V AC, 1 HP 277V AC, Open Type without Enclosure or Type 1 General Purpose Enclosure Two Pole — 1 HP 115...230V AC, 1 HP 277V AC, Open Type without Enclosure or Type 1 General Purpose Enclosure, 3/4 HP 115...230V DC

Selector Switch — 1 HP 115...230V AC, 1 HP 277V AC, Open Type without Enclosure or Type 1 General Purpose Enclosure Heater Element — See page 1-151 for heater element selection

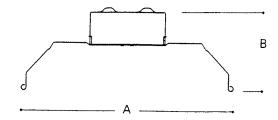
| De             | scription     | Open Type Without Enclosure Includes Legend Plate Cat. No. | Type 1<br>General Purpose<br>Enclosure<br>Surface Mounting | Type 1 General Purpose Enclosure Flush Mounting Includes Flush Plate but not Switch Box Stainless Steel Flush Plate | Type 4 Watertight Enclosure | Type 7 & 9 Enclosur<br>Class I, Groups C & I<br>Class II,<br>Groups E, F & G<br>– Divisions 1 & 2 – |
|----------------|---------------|------------------------------------------------------------|------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------|
|                |               | Odt. No.                                                   | Cat. No.                                                   | Cat. No.                                                                                                            | Cat. No.                    | Hazardous Locations                                                                                 |
| Toggle Type    | — 1-Pole      | 600-TOX4                                                   | Switch Only                                                |                                                                                                                     | Oat No.                     | Cat. No.                                                                                            |
|                | — 2-Pole      | 600-TOX5                                                   | 600-TAX4                                                   | 600-TQX4                                                                                                            |                             |                                                                                                     |
| Key Type       | - 2-Pole      |                                                            | 600-TAX5                                                   | 600-TQX5                                                                                                            | COO TOVE                    |                                                                                                     |
| Lever Type     | - 1-Pole      | 600-TOX49                                                  | 600-TAX49                                                  | 600-TQX49                                                                                                           | 600-TCX5                    | 600-TEX5                                                                                            |
|                |               | 600-TOX149                                                 | 600-TAX149                                                 |                                                                                                                     |                             |                                                                                                     |
| Toggle Type    | - 1-Pole      | Swi                                                        | tch with Neon Pilot Ligh                                   | t (115 or 230V)                                                                                                     |                             |                                                                                                     |
|                | - 2-Pole      | 000 TOX210                                                 | 600-TAX216                                                 | 600-TQX216                                                                                                          |                             |                                                                                                     |
| Key Type       | - 2-Pole      | 600-TOX109                                                 | 600-TAX109                                                 | 600-TQX109                                                                                                          | T                           |                                                                                                     |
|                | - 2-Pole      | 600-TOX110                                                 | 600-TAX110                                                 | 600-TQX110                                                                                                          |                             |                                                                                                     |
| Toppie Type    | 0.0.4         | S                                                          | witch with Incandescen                                     | Pilot Links                                                                                                         |                             |                                                                                                     |
|                | — 2-Pole 115V |                                                            |                                                            | r riot Light                                                                                                        |                             |                                                                                                     |
|                | - 2-Pole 230V |                                                            | -                                                          | _                                                                                                                   | 600-TCD7                    | 600-TED7                                                                                            |
| Toggle Type    |               | Switch and "Har                                            | nd-Off-Auto" Salastan O                                    | vitch (for use on AC only                                                                                           | 600-TCA7                    | 600-TEA7                                                                                            |
| .,,,,,         | - 2-Pole      |                                                            | 600-TAX9                                                   | vitch (for use on AC only                                                                                           |                             | 000-1EA/                                                                                            |
| Toggie Type    | Swi           | tch with Neon Pilot Light                                  | 000-1AX9                                                   | 600-TQX9                                                                                                            | 600-TCX9                    | 200                                                                                                 |
| Coy Type       | - 2-Pole      |                                                            | and "Hand-Off-Auto" S                                      | elector Switch (115 or 23                                                                                           | OV. AC onty)                | 600-TEX9                                                                                            |
| -ype           | - 2-Pole      |                                                            |                                                            | 600-TQX142                                                                                                          | ,                           |                                                                                                     |
|                |               |                                                            | 600-TAX145                                                 |                                                                                                                     |                             | -                                                                                                   |
| type           | - 2-Pole      | Tw                                                         | vo Switch Units in One E                                   | nclosure                                                                                                            |                             | _                                                                                                   |
| 56             |               |                                                            | 600-TAY10                                                  |                                                                                                                     |                             |                                                                                                     |
| type Type      | - 2-Pole      | Two Switch Units in One                                    | Enclosure Neon Pilot Li                                    | oht on Both Units (145                                                                                              | 600-TCX10                   | 600-TEX10                                                                                           |
|                | 2-7010        |                                                            | 600-TAX144                                                 | 600 TOXALL                                                                                                          | 230V)                       |                                                                                                     |
| уре Туре       |               |                                                            | Two Speed Switch                                           | 600-TQX144                                                                                                          |                             |                                                                                                     |
| Q for a        | - 2-Pole      |                                                            | 600-TAX298                                                 |                                                                                                                     |                             |                                                                                                     |
| Type           |               | Two Speed S                                                | witch with At                                              |                                                                                                                     |                             |                                                                                                     |
| BROKE .        | - 2-Pole      |                                                            | witch with Neon Pilot Li                                   | ghts (115 or 230V)                                                                                                  |                             |                                                                                                     |
| Type           | -             |                                                            | 600-1AX293                                                 | 600-TOY202                                                                                                          |                             |                                                                                                     |
| Sulfict)       | -2-Pole       | Separ                                                      | ate Cover and Switch A                                     | ssembly *                                                                                                           |                             |                                                                                                     |
| -00-A-4-       |               |                                                            |                                                            |                                                                                                                     |                             |                                                                                                     |
| -Uto           |               | _                                                          | -                                                          |                                                                                                                     |                             |                                                                                                     |
| William Buller | in 800H T     | 9, Series C or later bases.                                |                                                            |                                                                                                                     | <del></del>                 | 600-N12                                                                                             |
|                | ype 7 and     | 9 Series C L.                                              |                                                            |                                                                                                                     |                             | 600-N14                                                                                             |

### COOPER LIGHTING - METALUX®

DESCRIPTION

The IA Series is an energy efficient family of light duty industrials that features premium performance and durability. The series incorporates sturdy embossed reflectors that precisely direct and effectively control light. The IA Series can be installed using various mounting methods and numerous options and accessories are available. The series is available with both Apertured (IA) and Closed Top (IC) reflector combinations. The IA Series can be utilized in

DIMENSIONS



**NOMINAL LENGTH** 12 365mm 458 -117mm 4 HO.8 HO 12 · 305mm 5.3.8 :137mm;

### IA, ICSERIES

 $\Xi_{i}$   $B_{j}$ 

4' or 8' Industrial 2 Lamps

INDUSTRIAL

- Equipped with energy Saving ballasts/complies with federal energy efficiency standards
- Die formed channels
- Heavy gauge apertured, (IA) or closed top, (IC) reflector
- Baked white enamel finish
- Pressure lock lampholders (RS), spring loaded lampholders (SL, HO)
- Wire guards available for special application
- SilverLining Reflector Finish available (3)
- Apertured reflector (IA) standard with 8% uplight
- Also available in tandem 8' lengths
- UL/CUL Listed. Suitable for damp locations.

#### ORDERING INFORMATION

simple task and area lighting

and industrial applications.

SAMPLE NUMBER: IA-232-120V-EB81-U

Tandem Blank=4' Length 8T=8 Length

Series

IA=Apertured Reflector IC=Closed Top Reflector ICW=Extra Wide Channel Reference STW Series With

Symmetric

Reflector

Silver Reflector SS=Silver Lining Reflector (3)

Wattage (Length) 40=34/40W T12 (48") 32=32W T8 (48") 48≈40W T12 (48") SL 48HO=60W T12 (48") HO 48HO=44W T8 (48") HO 96=60-75W T12 (72") SL 96=59W T8 (96") SL 96HO=95/110W T12 (961) HO

96HO=86W T8 (96") HO

Number

of Lamps

2 Lamps (Not included)

Voltage (1) 120V≈120 Volt 277V=277 Volt 347V=347 Volt UNV=Universal Voltage 120-277<sup>(2)</sup>

Options GL=Single Element Fuse GM=Double Element Fuse Emergency - for EM installed, see EM options table

Options (See Options Packarang U . 4B

Blank=Standard Magnetic Ballast LE3=T12 Magnetic Energy Saving LEOC8=T8 Magnetic Energy Saving EB8 = T8 Electronic Instant Start. Total Harmonic Distortion < 20% No. of Ballast 1, 2 or 3 EB8 \_/PLUS= T8 Electronic Instant Start.

High Ballast Factor >1.13. Total No. of

Harmonic Distortion < 20% Ballast ER8\_ = T8 Electronic Program Rapid Start. Total Harmonic Distortion < 10°

No. of Ballast 1, 2 or 3 TEB8 \_= T8 Electronic Instant Start. Total

Harmonic Distortion < 10° No. of Ballast 1.2 or 3

Ballast Type (1)

EB2 \_=T12 Electronic Rapid Start. No. of Ballast 1 or 2

For complete details on generic or to specify manufactorer's barast seeing 291

NOTES  $^{(1)}$ Products also available in non-US voltages and frequencies for international markets  $^{(2)}$ Not available when specifying emergencies, voltage must be  $z_i$   $^{(3)}$ Silver liming not available on fixtures with HO.



180, 3rd Avenue, L'Islet, Ouebec, GOR 2C0, CANADA Phone: (418) 247-3947/1 800 463-7043 Fax: (418) 247-7801/1 800 662-7801 www.ouellet.com

#### INSTRUCTIONS

For installation of the suspended unit heater «OAS Series»

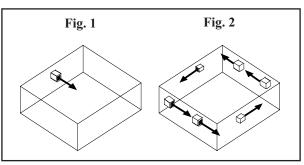
#### LOCATION OF HEATERS AND REMOTE **THERMOSTATS**

1- For best results, do not exceed mounting heights as per table below:

#### Maximum recommended mounting height:

| 2 - 10 kW  | 2.4 m (8 ft)  |
|------------|---------------|
| 15 - 30 kW | 3.0 m (10 ft) |
| 40 - 60 kW | 4.5 m (15 ft) |

- 2- Direct discharge air streams:
  - Away from room occupants.
  - Away from columns, posts, machinery and partitions.
  - Parallel to outside walls.
  - Along the windward side of buildings exposed to prevailing winds.
- 3- Locate thermostats on interior partitions, walls or posts (insulate from cold steel posts). Install thermostats away from cold drafts, internal heat sources and from heater discharge.
- 4- Small rooms require only one unit heater. In large rooms, arrange multiple units to provide perimeter circulation as illustrated in fig. 1 and 2.



#### POWER SUPPLY CONNECTIONS

The power supply may be single or three phase as shown on the nameplate. The wiring diagram is on the inside of the terminal compartment cover. Wire heater in accordance with local and national codes.

#### **TEST**

- To test the unit heater, temporarily set thermostat to maximum temperature.
- Make sure that the fan rotates in the correct direction; airflow should be in the direction of the arrow such as indicated on the fig. 4.

#### WARNING

- Disconnect all power supplies before working on circuit.
- Do not heat air containing combustible materials.
- Mount heater out of reach.
- Install at least 61 cm (2 ft) from floor except 40 - 60 kW at least 2.4 m (8 ft) from floor.

#### Minimum clearance from walls and ceiling are:

| 2 - 10 kW  | 10 cm (4 in.)  |
|------------|----------------|
| 15 - 30 kW | 15 cm (6 in.)  |
| 40 - 60 kW | 30 cm (12 in.) |

#### OVERTEMPERATURE PROTECTION

The motor and the electric heating elements are protected against overtemperature by automatic reset thermal high-limits.

Cycling of either high-limit is an indication of abnormal operation and should be corrected at once.

#### **LUBRIFICATION OF MOTOR**

The motor includes sealed lubrification-free bearings.

#### **MAINTENANCE**

Once a year, remove the dust accumulation inside the heater using a vacuum cleaner or compressed air. Cleaning should be done while the heater is disconnected from the supply circuit.

A qualified technician should perform any other servicing.

#### ATTENTION

Basic precautions should always be followed to reduce the risk of fire, electric shock, and injury to persons.

- Read all instructions before using this heater.
- Disconnect all power supplies before working on circuit.
- Do not heat air containing combustible materials.
- Mount heater out of reach.
- Install at least 61 cm (2 ft) from floor except 40 - 60 KW at least 2.4 m (8 ft) from floor.
- Do not use outdoors.
- Do not insert or allow foreign objects to enter any ventilation or exhaust opening as this may cause an electric shock or fire, or damage the heater.
- Do not block air intakes or exhaust in any manner.
- Heater contains arcing and sparking parts. Do not use it in areas where gasoline, paint, or flammable liquids are used or stored.
- Use this heater only as described in this manual. Any other use not recommended by the manufacturer may cause fire, electric shock, or injury to persons.

#### WARRANTY

OUELLET CANADA INC. warrants the electric heating element of the **OAS** series for a one (1) year period; and their component parts against defects in material and workmanship for a one (1) year period following the date of purchase, under normal use and service, when proof of purchase of such is provided to the manufacturer. The obligation of Ouellet Canada Inc., under the terms of this warranty, will be to supply a new unit and this omits the manufacturer to bear the installation costs or other secondary charges linked to replacing the unit or the component part(s).

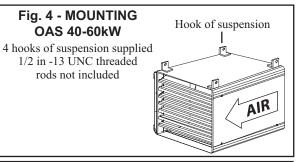
#### KEEP THIS INSTRUCTION PAMPHLET FOR THE USER INS09-200311-03

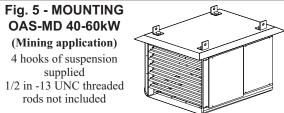




# **OAS 2-30kW** Horizontal wall or ceiling mounting using 1 of 2 supplied brackets which allow 360° rotation. Ceiling mounting using the U-shaped bracket \_\_\_\_\_ Wall mounting using the triangular braket. How to mount it. Vertical mounting using 4 threaded rods 1/2 in - 13 UNC not included Diffuser cone available

Fig. 3 - MOUNTING





# **OAS-MD 40-60kW**

(Mining application)

1/2 in -13 UNC threaded



### **INSTALLATION OF ELECTRICAL EQUIPMENT & CABLES**

PAGE: 1 OF 5

| process with the contract of t |                                |                                  |                                      |
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| Project# : BM0001117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Project Description: BU - 1100 | Murphy Reference #: AFE-54115177 | ITP Reference #: BM000117-10.12.2012 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Murphy Oil MCC Building        |                                  |                                      |

| Activity # | Activity<br>Description        | Inspection/Test<br>Requirements | Reference Document                                                  | Inspection<br>Requirements                                      | Inspection/Acceptance<br>Initial Date |         |        | Report Ref No. |
|------------|--------------------------------|---------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------|---------|--------|----------------|
|            |                                |                                 |                                                                     |                                                                 | Ber-Mac                               | Warwick | Murphy |                |
| 1.0        | Pre job<br>Meeting             | Purchase Order<br>Review        | P.O. Customer Requirements Specs                                    | IP Ber-Mac<br>IP Warwick<br>IP Kent Steel<br>IP/HP Murphy       |                                       | `       |        |                |
| 1.1        | P.O.'s to<br>Subcontractor     | Purchase Order<br>Review        | P.O. Customer<br>Requirements<br>Spec                               | IP Ber-Mac IP Warwick IP Kent Steel A – Murphy                  |                                       |         |        |                |
| 1.2        | Drawing<br>Received Building   | Visual & dimensional checks     | Customer requirements National Building Code/ Alberta Building code | HP Ber-Mac<br>HP Warwick<br>A - Murphy                          |                                       |         |        |                |
| 1.3        | Drawing Received<br>Structural | Visual & dimensional checks     | Customer requirements<br>CSA W59/47.1                               | HP – Ber-Mac<br>HP Warwick<br>A - Murphy                        |                                       |         |        |                |
| 1.4        | ITP Review<br>Building         | Verification of<br>Compliance   | P.O./Customer Requirements specs<br>Warwick QA sheet                | A – Murphy<br>IP – Murphy<br>HP – Ber-Mac<br>HP Warwick         |                                       |         |        |                |
| 1.5        | ITP Review<br>Structural       | Verification of<br>Compliance   | P.O./Customer Requirements Specs Kent Steel ITP                     | A – Murphy IP – Murphy HP – Ber-Mac HP- Warwick HP – Kent Steel |                                       |         |        |                |



### **INSTALLATION OF ELECTRICAL EQUIPMENT & CABLES**

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| Project# : BM0001117 |                                   | Project Description: BU - 1100                                                                                                                                                                                                                                                                                                                              | Murphy Reference #: AFE-54115                                                                                                  | 177                          | ITP Re                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ITP Reference #: BM000117-10.12.2012                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                           |  |
|----------------------|-----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------|--|
|                      |                                   | Murphy Oil MCC Building                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                |                              | School and the school |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                           |  |
| Activity<br>No.      | Activity<br>Description           | Inspection/Test<br>Requirements                                                                                                                                                                                                                                                                                                                             | Reference Document                                                                                                             | Inspection<br>Requirement(s) | Inspection/<br>Initial                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Report Reference No.:                                                                                                                     |  |
|                      |                                   |                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                | ſ                            | Ber-Mac QC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Murphy Rep                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                                                                                                           |  |
| 2.0                  | Codes and<br>Standards            | Have applicable Codes and Standard been identified                                                                                                                                                                                                                                                                                                          | CEC 22.1,<br>OHS Code Alberta                                                                                                  | AR                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | And the second s |                                                                                                                                           |  |
| 3.0                  | Grounding                         | All Grounding in accordance to CEC     All Grounding installed in accordance with approved drawings and specifications.     The use of ground wells and lids     Size of grounding conductors     Updated Red Line Drawings (As-builts)                                                                                                                     | CEC 22.1 Approve drawings and specifications Customer specifications Manufacturer specifications FSM Section 18 FSM Section 20 | IP-Ber-Mac<br>IP- Murphy     | 1780-6<br>Nov. V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                           |  |
| 4.0                  | Cable trays                       | Inspect for external or shipping damage before installation. Ensure hold-downs are properly installed. Expansion joints are properly installed and grounding rqmts Grounding of tray as per approved drawings and spec Location for conflicts with other systems. All braces and supports are mechanically sound Update drawings with red lines (As-builts) | CEC 22.1 Approve drawings and specifications Customer Specifications Manufacturer specifications Field Services Manual         | IP-Ber-Mac<br>IP- Murphy     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | على                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Cable Tray Inspection Checklist FSM05007  Day 1780-69-  006-1  Control Wiring/Device Checkout Records FSM05002                            |  |
| 5.0                  | Cables, Conduits, &<br>Conductors | Continuity tests are completed as required Meggar tests are completed on 480V or greater Ensure all cables and conduits are tagged in accordance with approved drawings and specifications Termination test (pull tug method) and record Complete point to point test                                                                                       | CEC 22.1 Approve drawings and specifications Customer Specifications Manufacturer specifications FSM Section 11                | IP-Ber-Mac<br>IP- Murphy     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1750 / 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Control Wiring/Device Checkout Records FSM05002 Insulation Resistance & Continuity Test Report FSM11001 Megohm Meter Test Record FSM11002 |  |

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68-001-1-2-3.



### **INSTALLATION OF ELECTRICAL EQUIPMENT & CABLES**

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| Project# : BM0001117                |                                     | Project Description: BU - 1100                                                                                                                                                                     | Murphy Reference #: AFE-5411:                                                                                          | 5177                         | ITP R                                | ITP Reference #: BM000117-10.12.2012 |                                                                  |  |  |
|-------------------------------------|-------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|------------------------------|--------------------------------------|--------------------------------------|------------------------------------------------------------------|--|--|
|                                     |                                     | Murphy Oil MCC Building                                                                                                                                                                            |                                                                                                                        |                              |                                      |                                      |                                                                  |  |  |
| Activity<br>No.                     | Activity<br>Description             | Inspection/Test<br>Requirements                                                                                                                                                                    | Reference Document                                                                                                     | Inspection<br>Requirement(s) | Inspection/Acceptance Initial & Date |                                      | Report Reference No.:                                            |  |  |
| Volski vistovako i Micrimo proprome |                                     |                                                                                                                                                                                                    |                                                                                                                        |                              | Ber-Mac QC                           | Murphy Rep                           |                                                                  |  |  |
| 6.0                                 | Lighting<br>Transformer             | Polarity and phase relationship test Over current protection Setting verification Check all connections Panel board circuit schedule filled out                                                    | CEC 22.1 Approve drawings and specifications Customer Specifications Manufacturer specifications Field Services Manual | IP-Ber-Mac<br>IP- Murphy     |                                      |                                      | Lighting Transformer Installation Checklist FSM16003 FSM 16004   |  |  |
| 7.0                                 | Lighting Panel<br>Board             | Tagged accordingly to approved drawings Covers and doors installed correctly Grounding –internal and external as per Electrical Code Check all connections Panel board circuit schedule filled out | CEC 22.1 Approve drawings and specifications Customer Specifications Manufacturer specifications Field Services Manual | IP – Ber-Mac<br>IP- Murphy   | 1780<br>1780<br>005                  | -68-                                 | Lighting Panel Board<br>Installation Checklist<br>FSM16002       |  |  |
| 8.0                                 | Battery & Battery<br>Charger System | Battery voltage test     Terminals and battery connectors checked     Battery and charger polarity checked                                                                                         | CEC 22.1 Approve drawings and specifications Customer Specifications Manufacturer specifications Field Services Manual | IP-Ber-Mac<br>IP- Murphy     |                                      |                                      | Battery & Battery Charger<br>System Checklist<br>FSM16008        |  |  |
| 8.1                                 | Uninterruptible<br>Power System     | Check for shipping damage All covers and doors Grounding requirements Sizing of main disconnect Point to point External connections                                                                | CEC 22.1 Approve drawings and specifications Customer Specifications Manufacturer specifications Field Services Manual | IP-Ber-Mac<br>IP- Murphy     |                                      |                                      | Uninterruptible Power System<br>Acceptance Checklist<br>FSM16007 |  |  |



### **INSTALLATION OF ELECTRICAL EQUIPMENT & CABLES**

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| Project# : BM0001117              |                                 | Project Description: BU - 1100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Murphy Reference #: AFE-54115177                                                                                                                         |                                     |                                                             | ITP Reference #: BM000117-10.12.2012 |                                                                                                                        |  |  |
|-----------------------------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------------------------------|--|--|
| Activity Activity No. Description |                                 | Murphy Oil MCC Building Inspection/Test Requirements                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Reference Document                                                                                                                                       | Inspection<br>Requirement(s)        | Inspection/Acceptance Initial & Date  Ber-Mac QC Murphy Rep |                                      | Report Reference No.:                                                                                                  |  |  |
| 9.0                               | Motor Control<br>Centres        | Verify rating of all motor starter, fuses and circuit breakers in accordance with drawings Verify and/or torque anchorage, all bus connections, required area clearances and proper alignment Equipment checkout includes the inspection and testing of the operating mechanisms, contacts arc chutes, and auxiliary devices and adjustments as necessary Test phasing of busses visually, continuity check and resistance test Verify proper barrier and shutter installation and operation. Check for construction dust on phase barriers, cell walls and insulators | CEC 22.1 Approve drawings and specifications Customer Specifications Manufacturer specifications Field Services Manual                                   | IP-Ber-Mac<br>IP- Murphy            |                                                             |                                      | Motor Control Centre<br>Acceptance Checklist<br>FSM16014                                                               |  |  |
| 10.0                              | Motor Starters                  | Record and verify nameplate data, circuit breakers, fuses, overloads, contactors in accordance with approved drawings Verify and/or torque base attachments, equipment mounting hardware, and terminal lugs Check for shipping damage, missing parts, cracked or2 broken arc boxes All grounding requirements Verify phases for motor rotation Resistance test (Megger) on motor leads Point to point checks Check alignment of the contactor                                                                                                                          | CEC 22.1 Approve drawings and specifications Customer Specifications Manufacturer specifications Field Services Manual 1780-69-040-1 1780-69-041-1 Rev O | IP-Ber-Mac<br>IP- Murphy            |                                                             |                                      | Motor Starter Acceptance<br>Checklist<br>FSM16017<br>Torque Sheet<br>FSM16022                                          |  |  |
| 11.0                              | Assemble<br>Turnover<br>Package | Assemble all components of turnover package prior to shipping                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Customer specifications                                                                                                                                  | HP - Ber-Mac<br>IP/HP/DR-<br>Murphy |                                                             |                                      | Ship Loose Packing List FSM06001 Project Turnover Notice FSM17001 Punch List FSM18001 Signature & Initial Log FSM16020 |  |  |





### **INSTALLATION OF ELECTRICAL EQUIPMENT & CABLES**

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| Project# : BM0001117 |                         | Project Description: BU - 1100                       |                          |                              | ITP Reference #: BM000117-10.12.2012                     |                       |  |
|----------------------|-------------------------|------------------------------------------------------|--------------------------|------------------------------|----------------------------------------------------------|-----------------------|--|
| Activity<br>No.      | Activity<br>Description | Murphy Oil MCC Building Inspection/Test Requirements | Reference Document       | Inspection<br>Requirement(s) | Inspection/Acceptance Initial & Date  Ber-Mac Murphy Rep | Report Reference No.: |  |
| 12.0                 | Package<br>Loading      | Review Package Loading                               | Customer<br>Requirements | HP Ber-Mac<br>HP/IP- Murphy  |                                                          |                       |  |
| 13.0                 | Shipping Release        | Release Package for Shipment                         | Customer Requirements    | HP Ber-Mac<br>HP- Murphy     |                                                          |                       |  |
| 14.0                 | Packing Slip            | Bill of Lading<br>Manual                             | Customer Requirements    | HP Ber-Mac<br>IP/A- Murphy   |                                                          |                       |  |
| 15.0                 | QA Data Package         | Quality Documents                                    | Customer Requirements    | HP/DR- Murphy                |                                                          |                       |  |



# GROUNDING SYSTEM INSPECTION CHECKLIST

PAGE: 1 OF 2

| Project No.: BM-117 Project Location: Murphy Oil Cadotte                                                                         | Pilot C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ,55                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Completed By: Owner Representative:                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                       |
|                                                                                                                                  | (Signa                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ture)                                                                                                                 |
| Answer questions with a "✓". If answer is "No", provide comments below.                                                          | Yes No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Date & Initials                                                                                                       |
| <ol> <li>Conformance to specification and drawings?</li> <li>Conductor is correct size and type?</li> </ol>                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <u> </u>                                                                                                              |
| <ul><li>3. Thermal connections checked. (No cold joint or burnout.)?</li><li>4. Thermal connection insulation checked?</li></ul> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                       |
| 5. Ground conductor routing per drawings/specifications?                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 30                                                                                                                    |
| <ul><li>6. Location, type and size of equipment taps per drawings?</li><li>7. Taps protected during construction?</li></ul>      | Ø 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                       |
| <ul><li>8. Ground continuity checked?</li><li>9. Resistance readings recorded on proper Field Inspection Record?</li></ul>       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20                                                                                                                    |
| <ul><li>10. All field revisions recorded on as-built drawings?</li><li>11. Compression connections checked?</li></ul>            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 33                                                                                                                    |
| 12. Glyptol (or equivalent anti-corrosion coating) applied to connections?                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 30                                                                                                                    |
| Comments and/or Deficiencies: No thermal connections,                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                       |
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|                                                                                                                                  | DOSPOLIA IIII III. AAN AAN AAN AAN AAN AAN AAN AAN AAN AA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | det Mariennyn a skaan tel med an de systematik en de skriver de de Novemberen sen skaat de Labour de systematik       |
|                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                       |
|                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ntherworkship war processes described a black which, Can described a black of construction has been recovered to be a |
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|                                                      |                                       | A CONTRACTOR OF THE PROPERTY O |  |  |  |  |  |



### **CABLE TRAY INSPECTION CHECKLIST**

PAGE: 1 OF 2

| Project No.: BM-117 Project Location: Murphy Oil Cadotte                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Pilot CS                                                                                                                                         | ŜŚ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
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| Completed By: Owner Representative:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | (Signa                                                                                                                                           | ture)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Answer questions with a "✓". If answer is "No", provide comments below.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <u>Yes</u> <u>No</u>                                                                                                                             | Date & Initials                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <ol> <li>Conformance to specification and drawings?</li> <li>Expansion joints properly installed?</li> <li>All braces and supports adequate to handle weight of tray and cable?</li> <li>Hold-downs properly installed?</li> <li>Tray anchored only in location shown on drawings?</li> <li>No sharp edges to cut cable?</li> <li>No obstruction to pulling of cable?</li> <li>All covers and partitions installed?</li> <li>All firestops (if applicable) installed?</li> <li>All bonding jumpers installed?</li> <li>All tray grounded per drawings?</li> <li>Checked for conflicts with aboveground piping?</li> </ol> |                                                                                                                                                  | \$0<br>\$0<br>\$0<br>\$0<br>\$0<br>\$0<br>\$0<br>\$0<br>\$0<br>\$0<br>\$0<br>\$0<br>\$0<br>\$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| No expansion points for tray inside building.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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# CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: <u>1</u> OF <u>24</u>

| Project No.: BM-117 Pan | el/Bldg/Device D |                    | Installa   | ation                | Continuity / Loop<br>Check |                    |
|-------------------------|------------------|--------------------|------------|----------------------|----------------------------|--------------------|
| Cable / Tag Number      | Completed?       | Approved (Initial) | Completed? | Approved (Initial)   | Completed?                 | Approved (Initial) |
| CPNL100-C1              |                  |                    | N/A        |                      |                            |                    |
| BFY7005-A               | YES              | 2                  | YES        | Ca                   | YES                        | $\mathcal{Q}$      |
| BFY7005-B               | YES              | 50                 | UES        | (S)                  | YES.                       | 8                  |
| BFS7005-A               | YFS              | 90                 | YES        | 30                   | 45                         | 90                 |
| BFS-7005-B              | YFS              | 50                 | 975        | (2)                  | YES                        | 8                  |
| BFY4000-A               | YES              | SA                 | YES        | 30                   | YES                        | 8                  |
| BFY4000-B               | YFC              | (0)                | YES        | (Q)                  | YES                        | 8                  |
| BFS4000-A               | YEC              | (0)                | YES        | (2                   | YES                        | SO                 |
| BFS-4000-B              | YES              | 50                 | YE         | S                    | YES                        | SD                 |
| BFY6000-A               | YES              | (0)                | YES        | 8                    | YES                        | $\leq 0$           |
| BFY6000-B               | YES              | (A)                | VES        | 80                   | YES                        | 0                  |
| BFS6000-A               | YES              | (0)                | YES        | 30                   | YEC                        | 30                 |
| BFS6000-B               | YES              | \$0                | VE (       | 9                    | UFC                        | 80)                |
| BFY7000-A               | YFS              | \$6)               | YES        | $\widetilde{\omega}$ | JES                        | 30                 |
| BFY7000-B               | YES              | (0)                | JES        | 30                   | YES                        | (a)                |
| BFS7000-A               | YFS              | CO                 | YES        | Se                   | YES                        | 50                 |
| BFS7000-B               | YES              | ŠŽ                 | 455        | 02                   | YES                        | SO                 |
| BFY1100A-A              | YK               | (0)                | YES        | SD)                  | YFS                        | 90)                |
| BFY1100A-B              | YES              | <u>(92</u>         | 47         | \$                   | YES                        | 80                 |
| BFY5030-A               | YFC              | Q(2)               | YES        | (C)                  | YEC                        | 10                 |
| BFY5030-B               | 位了               | 500                | 724        | \$                   | VEC                        |                    |
| BFS5030-A               | YES              | 90                 | YES        | SS                   | YES                        | 50                 |
| BFS5030-B               | YES              | (02                | YES        | 50                   | YES                        | 8                  |
| SPARE-1                 | ÜES              | 70                 | YES        | Sel                  | YES                        | \$                 |
| SPARE-2                 | YES              | 301                | YES        | (e) I                | TES                        | \$                 |
| SPARE-3                 | YES              | (2)                | YET        | Te l                 | YES                        | <b>R</b>           |
| SPARE-4                 | YES              | 92                 | YET        | 80                   | ンなり                        | Se                 |
| SPARE-5                 | YES              | TV.                | VES        | 85)                  | VA                         | SI                 |
| SPARE-6                 | YK.5             | 50)                | TES        |                      | VET                        | <b>X</b>           |
| SPARE-7                 | YES              | Se                 | YES        | (名)                  | 43                         | GO                 |

SPARE-7
SPARE-8
Completed By:
(Signature)

Owner Representative:
(Signature)

(Signature)



CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 2 OF 24

| Project No.: BM-117 Pan  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Bldg/Device Description:<br>Location Verified |            | Installation       |            | / / Loop<br>ck                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|--------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|------------|--------------------|------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Cable / Tag Number       | Completed?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Approved (Initial)                            | Completed? | Approved (Initial) | Completed? | Approved (Initial)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| )P100-P2A                | - out of the long to compare and our special contract to the description of the descripti |                                               | - N/A -    |                    |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| DP100- 4H                | 400                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | AC)                                           | 485        | 7                  | yes        | 247                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| DP100- 4N                | Xes.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 4                                             | ves        | 1                  | Y-25       | æ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DP100- 8H                | Ves                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 100                                           | -100       | <b>AF</b>          | 105        | 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| DP100- 8N                | 1000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 18                                            | 705        | AS                 | 1-00       | A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DP100- 10H               | 105                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | (C)                                           | VPG.       | ম্ব                | Se 5       | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| OP100- 10N               | 125                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10                                            | 489        | D                  | 405        | A)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| OP100- 16H               | 425                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 14                                            | 405        | Ä                  | yes        | A S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| OP100- 16N               | 125                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 70                                            | 405        | <b>*</b>           | -185       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| OP100- 18H               | 4.05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1907                                          | 705        | A P                | 4e5 =      | T.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| DP100- 18N               | 489                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 22                                            | 465        | 2                  | 405        | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DP100- 20H               | 405                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 18/                                           | 405        | <b>3</b>           | ye5 .      | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| OP100- 20N               | 1,65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (2)                                           | y e 5      |                    | yes .      | WEST OF THE SERVICE O |
| OP100- 22H               | 125                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -                                             | 405        | X >>               | yes        | 24=                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| DP100- 22N               | ye6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 4                                             | y e5       | *                  | yes        | X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DP100- 24H               | Ve4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 2                                             | 4 es       | 3                  | yes '      | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DP100- 24N               | -100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 7                                             | 405        | 25                 | Yes        | H                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DP100- 26H               | 126                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 743                                           | 405        | 200                | yes 5      | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| OP100- 26N               | 729                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                               | V e5       | 810                | Yes        | A P                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| DP100- 28H               | 727                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <b>A</b>                                      | 405        | 259                | 405        | ***                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| DP100- 28N               | 709                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 8                                             | v es       | <u>a</u>           | Ves        | ME CONTRACT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| DP100- 30H               | 103                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | X                                             | 1405       |                    | yes        | A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DP100- 30N               | yes (                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | <b>REP</b>                                    | Ye5        | (49)               | yes <      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| DP100- 32H               | 7.85                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                               | yes e      |                    | yes        | H                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DP100- 32N               | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | H2                                            | V 25       | 8                  | 41es .     | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| DP100- 52H               | 7.65                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | (4)                                           | 1965       | 80                 | Yes        | OST -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| DP100- 52N               | 1/05                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                               | 402        |                    | 465        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| DP100- 52N<br>DP100- 58H | 149                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | -20                                           | 1,04       |                    | 465        | 94                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| DP100-58N                | 1785                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                               | Toc.       |                    | 753        | 45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| DP100- 56N<br>DP100- 60H | 7/25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                               | 1 3 C      |                    | 132        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |



CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 3 OF 24

| Project No.: BM-117 Panel/ | Location Verified |                    | :CPNL-100<br>Installation |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Continuity / Loop<br>Check |                    |
|----------------------------|-------------------|--------------------|---------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------|--------------------|
| Cable / Tag Number         | Completed?        | Approved (Initial) | Completed?                | Approved (Initial)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Completed?                 | Approved (Initial) |
| DP100-P2A SEE PAGE 2       |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 4H                  |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            | /_                 |
| DP100- 4N                  |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 8H                  |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            | /                  |
| DP100- 8N                  |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 10H                 | \                 |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | /-                         |                    |
| DP100- 10N                 |                   |                    | _                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 16H                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 16N                 |                   |                    |                           | /                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                            |                    |
| DP100- 18H                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 18N                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 20H                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 20N                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 22H                 |                   |                    | X                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 22N                 |                   |                    |                           | a proposation of the second                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                            |                    |
| DP100- 24H                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 24N                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 26H                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 26N                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 28H                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 28N                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 30H                 |                   |                    |                           | 100 C C C C C C C C C C C C C C C C C C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                            |                    |
| DP100- 30N                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 32H                 |                   |                    |                           | Part   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100   100 |                            |                    |
| DP100- 32N                 | 1/                |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 52H                 | X                 |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | \                          |                    |
| DP100- 52N                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 58H                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 58N                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100- 60H                 |                   |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |
| DP100-60N                  | . /               |                    |                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                    |



CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 4 OF 24

|                    | Location   | Verified                              | Installa   | ation              | Continuit<br>Che |                      |
|--------------------|------------|---------------------------------------|------------|--------------------|------------------|----------------------|
| Cable / Tag Number | Completed? | Approved (Initial)                    | Completed? | Approved (Initial) |                  | Approve<br>(Initial) |
| DP100-P2           |            | \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ | - N/A -    |                    |                  | (mitter)             |
| DP100-1H           | 409        | D                                     | -lac       | 4                  |                  |                      |
| DP100-1N           | 400        | A)                                    | /5>        | A SEP              | 785              | T                    |
| DP100-5H           | 75         | A)                                    | 765        | CA CA              | 785              |                      |
| DP100-5N           | 70         | d                                     | 705        | X 2                | 75               |                      |
| DP100-17H          | 7 eg       | (D)                                   | 7.5        | (F)                | 705              | 1                    |
| DP100-17N          | 469        | (20)                                  | 405        | 250                | 75               | 1                    |
| DP100-21H          |            |                                       | 705        |                    | Ye5 (            | 7                    |
| DP100-21N          | 1 4 2 5    | 20                                    | 755        | 13                 | X=5 =            | 35                   |
| DP100-23H          | 725        | 001                                   | 755        |                    | Yes 9            | To the               |
| DP100-23N          | 1 4 65     | 20                                    | Ye5        |                    | 405              |                      |
| DP100-25H          | 109        | (20)                                  | 75         |                    | 7-5              |                      |
| DP100-25N          | 4-25       | 2                                     | 705        | A D                | Ye5              |                      |
| DP100-29H          | 105        | 2                                     | 455        |                    | 709              |                      |
| DP100-29N          | 409        | 20                                    | 400        | 4                  | 409              |                      |
| P100-35H           | 400        | 2                                     | 405        |                    | Ye5              | U_                   |
| P100-35N           | 425        | 9                                     | 405        |                    | 759              |                      |
| P100-39H           | 409        | 90                                    | Yes (      |                    | 4-25             |                      |
| P100-39N           | 105        | 20                                    | 705        |                    | 4e5 6            | 7                    |
| PP100-41H          | 4.65       | 733                                   | y 25       |                    | Yes (            |                      |
| P100-41N           | 485        | ES OF                                 | +05        | 42                 | yc5 *            |                      |
|                    | 465        | (AX)                                  | 105        | 42                 | Yes              | 42_                  |
| P100-53H           | 405        | 2                                     | yes =      |                    | 705              | <b>P</b>             |
| P100-53N           | 40         | 9/2                                   | 75         | 42                 | Ye5 "            |                      |
| P100-55H           | 400        | 250                                   | 75 4       | 2                  | 405              | <b>1</b>             |
| P100-55N           | 700        | Ø/                                    | 75         | <b>3</b>           | yes !            | (45)                 |
| PARE-1             | YES        | 90                                    | YES        | 30                 | YES !            | 90)                  |
| PARE-2             | YES        | 50                                    | YES (      |                    | YES              | (0)                  |
| PARE-3             | YES        | 50)                                   | YES        | 32                 | YES              | <b>&amp;</b> )       |
| PARE-4             | YES        | 501                                   | YES        | 8                  | YES              | SQ.                  |
| PARE-5             | YES        | \$0                                   | VES        | 8)                 | YES              | 迟                    |
| PARE-6             | 1 5        | 30                                    | YES        | 50                 | 435              | <i>42)</i>           |

| B     | E    | R   | -/    | $\bigvee$ | 1  | 4   | <u>C</u> |
|-------|------|-----|-------|-----------|----|-----|----------|
| ELECT | RICA | Œ   | ) INS | TRU       | ME | NTA | TION     |
| AME   | EMBE | ROF | THE   | 488       | GR | OUP |          |

CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 5 OF 24

| Project No.: BM-117 Pan | el/Bldg/Device [ | escription                                            | :CPNL-100  |                                                   |                   | ( )                |
|-------------------------|------------------|-------------------------------------------------------|------------|---------------------------------------------------|-------------------|--------------------|
|                         | Location         | Verified                                              | Installa   | ation                                             | Continuity<br>Che |                    |
| Cable / Tag Number      | Completed?       | Approved (Initial)                                    | Completed? | Approved (Initial)                                | Completed?        | Approved (Initial) |
| CPNL100-P1              | YES              | 90                                                    | YES        | 50                                                | 465               | 90                 |
| DP100-5H                | 45               | -                                                     | 485        | OD.                                               | 405               |                    |
| DP100-5N                | 725              | <b>4</b>                                              | jes e      | E S                                               | 705               | A)                 |
| CPNL100-P1A             |                  |                                                       | NIA        | MICHIGANIA AND AND AND AND AND AND AND AND AND AN |                   |                    |
| CPNL100P1A-1            | YES              | 30                                                    | YES        | 50                                                | YES               | VA                 |
| CPNL100P1A-2            | YES              | 50                                                    | YES        | SA                                                | YES               |                    |
| CPNL100P1A-3            | YES              | 50                                                    | YES        | 20                                                | YES               | 8                  |
| EFB1100-P1              | YES              | 50                                                    | YES        | 8)                                                | YES               | 6                  |
| DP100-17H               | YES              | 50                                                    | YES        | SA                                                | 725               | 3                  |
| DP100-17N               | YES              | 80                                                    | YES        | 20                                                | YES               | 80                 |
| EFB1100-C1              |                  | 200/2010117i2monalemmentasyun-oppropriesesyuutungs ca | N/A        | N/A                                               |                   |                    |
| FB1100-A                | UES              | 50                                                    | YES        | 50                                                | tes               | 82                 |
| EFB1100-B               | ŸES              | 80                                                    | YES        | 8)                                                | 755               | 8                  |
|                         |                  |                                                       |            |                                                   |                   |                    |
|                         |                  |                                                       |            |                                                   |                   |                    |
|                         |                  |                                                       |            |                                                   |                   |                    |
|                         |                  |                                                       |            |                                                   |                   |                    |

| Completed By: | Owner Representative: |
|---------------|-----------------------|
| (Signature)   | (Signature)           |
|               |                       |



# CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 6 OF 24

|                    | Location Verified                                         |                    | Installation |                    | Continuity / Loop<br>Check                                                                                     |                       |
|--------------------|-----------------------------------------------------------|--------------------|--------------|--------------------|----------------------------------------------------------------------------------------------------------------|-----------------------|
| Cable / Tag Number | Completed?                                                | Approved (Initial) | Completed?   | Approved (Initial) | Completed?                                                                                                     | Approved (Initial)    |
| DP100-P1           |                                                           |                    | N/A-         |                    |                                                                                                                |                       |
| DP100P1-LN1        | PES                                                       | (0)                | YES          | 8                  | YES                                                                                                            | @5                    |
| DP100P1-LN2        | YES                                                       | 8                  | YES          | 50                 | YES                                                                                                            | SQ                    |
| DP100P1-LN3        | YES                                                       | 80                 | YES          | 80                 | YES                                                                                                            | 20                    |
| DP100-P3           | Marie Constitution and the American Association (Act 400) |                    | N/A ·····    |                    | na nagana sandan manana na nagana sandan n | and the second second |
| DP100-3H           | 405                                                       | $\mathcal{S}$      | YES          | 80                 | YES                                                                                                            | (S)                   |
| DP100-3N           | YES                                                       | 80                 | YES          | 50                 | YES                                                                                                            | 2)                    |
| DP100-P4           |                                                           |                    | - N/A -      |                    |                                                                                                                |                       |
| DP100-11H          | YES                                                       | 50                 | YES          | 40                 | 8E5                                                                                                            | 73                    |
| DP100-11N          | YES                                                       | \$                 | YEZ          | 80                 | 4E5                                                                                                            |                       |
| DP100-P5           |                                                           |                    | N/A -        |                    |                                                                                                                |                       |
| DP100-7H           | 465                                                       | 80)                | SES          |                    | 455                                                                                                            | 20                    |
| DP100-7N           | YES                                                       | (3)                | YES          | 80)                | res                                                                                                            | 80                    |
| DP100-P6           |                                                           |                    | N/A-         |                    |                                                                                                                |                       |
| DP100-9H           | YES                                                       | 30                 | YES.         | 9                  | YES                                                                                                            | (35)                  |
| DP100-9N           | YES                                                       | (QE)               | TES          | SC)                | 765                                                                                                            | 8                     |
| DP100-P7           |                                                           |                    | N/A ·        |                    |                                                                                                                |                       |
| DP100-13H          | 45                                                        |                    | YES          |                    | YES                                                                                                            | X                     |
| DP100-13N          | 455                                                       | D)                 | YES          | 20)                | 45                                                                                                             | 20                    |
| DP100-P8           |                                                           |                    | N/A.         |                    |                                                                                                                |                       |
| DP100-15H          | 185                                                       | 40                 | 455          | 10                 | 485                                                                                                            |                       |
| DP100-15N          | YÉS                                                       | 8                  | 163          | <b>3</b> 0         | XE2                                                                                                            | (B)                   |

| DP100-15H               | YCS                                                                                                            |                                                                                                                 | 40)           | (Q) | 467         |                                                           |
|-------------------------|----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|---------------|-----|-------------|-----------------------------------------------------------|
| DP100-15N               | YES                                                                                                            | 0                                                                                                               | YES           | 100 | 485         | (Q)                                                       |
|                         |                                                                                                                |                                                                                                                 |               |     |             |                                                           |
| Completed By: (Signatur | e)                                                                                                             | Owner Re                                                                                                        | presentative: |     | (Signature) |                                                           |
| FSM05002/080605         | noon ay Magazin periodi salah kara kalah salah salah salah salah kara kalah kara kalah salah salah salah salah | ugu sa Aga ag an mara an mara ag mara an mara a |               |     |             | waxaanii shahii da ka |



CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 7 OF 24

| Project No.: BM-117 Pan | el/Bldg/Device D                                                                    |                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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|-------------------------|-------------------------------------------------------------------------------------|----------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------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|                         | Location '                                                                          | Verified                                                 | Installa                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    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                                                                                                                                                                                                                                                                                                                                                                      |
| Cable / Tag Number      | Completed?                                                                          | Approved (Initial)                                       | Completed?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Approved (Initial)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Completed? 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| DP100-P9                | a distribution and the file one unimain extension as a second property and a second |                                                          | N/A:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        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(Signature)

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# CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 8 OF 24

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| DP100-P2                      | Á Stagnista a tita a anno ann ann ann ann ann ann ann ann |                                         | N/A-          |                    |                            |                               |
| DP100-1H                      | YES                                                       | 5                                       | 1/2           | 5                  | /                          | $\langle \mathcal{O} \rangle$ |
| DP100-1N                      | YES                                                       | 90                                      |               | 90                 |                            | <b>(D)</b>                    |
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| DP100-5N                      | YES                                                       | 1                                       |               | 50                 | /                          | 50)                           |
| DP100-17H                     | YES                                                       | (0)                                     |               | 50                 | /                          | 00                            |
| DP100-17N                     | FES                                                       | 30                                      |               | (0)                | /                          | (0)                           |
| DP100-21H                     | YES                                                       | 0                                       |               | 10                 | V                          | 50                            |
| DP100-21N                     | 4ES                                                       | 0                                       | /             | 50                 | /                          | 30                            |
| DP100-23H                     | 9,55                                                      | <b>Q</b> )                              |               | (7)                |                            | 60                            |
| DP100-23N                     | VES                                                       | 80)                                     | ~             | 80                 | 1/                         | 02                            |
| DP100-25H                     | 250                                                       | 9                                       |               | 80)                |                            | (Sd)                          |
| DP100-25N                     | 1 JES                                                     | 10                                      |               | (2)                | V                          | SU                            |
| DP100-29H                     | 460                                                       | <b>S</b>                                |               | $\circ$            |                            | 9                             |
| DP100-29N                     | YES                                                       | 70                                      | <u> </u>      | (2)                |                            | (0)                           |
| DP100-35H                     | SES                                                       | (0)                                     |               | 30                 |                            | (27)                          |
| DP100-35N                     | YES                                                       | 50                                      |               | 50                 | <i></i>                    | (1)                           |
| DP100-39H                     | YES                                                       | 0                                       |               | (0)                | 1                          | 4                             |
| DP100-39N                     | YES                                                       | $\langle \rangle$                       | 1             | (20)               | 2                          | $(\mathcal{I})$               |
| DP100-41H                     | YES                                                       | 80                                      | W.            | 50                 | <i>V</i>                   | 50                            |
| DP100-41N                     | YES                                                       | (A)                                     | ·/            | 0                  | \                          | \$0                           |
| DP100-53H                     | YES                                                       | 20                                      |               | 0                  | t production of the second | 90                            |
| DP100-53N                     | YES                                                       | (8)                                     |               | (8)                | <i>V</i>                   | $\mathcal{Q}$                 |
| DP100-55H                     | 4ES                                                       | A                                       | 1/            | 0                  | V                          | 80                            |
| OP100-55N                     | YES                                                       | 30                                      |               | 0                  |                            | \$                            |
| SPARE-1                       | TES                                                       | 80                                      |               | SO                 | V                          | 0                             |
| SPARE-2                       | YES                                                       | 9                                       |               | 82                 |                            | 30                            |
| SPARE-3                       | YE C                                                      | 8                                       |               | 8)                 |                            | 90.                           |
| SPARE-4                       | YEC                                                       |                                         |               | 8                  |                            | 50                            |
| SPARE-5                       | YES                                                       | Sei                                     |               | 80                 |                            |                               |
| SPARE-6 Completed By: (Signat | #                                                         | Owner Rep                               | presentative: |                    | (Signature)                |                               |



CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 9 OF 24

| Project No.: BM-117 | Panel/E                                                                                                         | Bldg/Device D<br>Location                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          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| Cable / Tag Num     |                                                                                                                 | Completed?                                                          | Approved (Initial)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Completed? 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| Completed By:  | (Signature) | Owner Re                                | presentative: | <u></u> | (Signature) |  |
| FSM05002/08060 | 15          |                                         |               |         |             |  |

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CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 11 OF 24

(Signature)

Panel/Bldg/Device Description: MCC-100 BM-117 Project No.: Continuity / Loop Installation Location Verified Check Approved Approved Approved Completed? Completed? Completed? Cable / Tag Number (Initial) (Initial) (Initial) MCC100-C1 01012-A Ye5 yes 409 Ye5 res 01012-B Ye5 4 e 5 105 yeo 01013-A y e5 4e5 ye5 01013-B 705 yes res 01020-A 189 405 01020-B 109 01019-A 01019-B 100 YES SPARE-1 405 100 SPARE-2 185 MIA MCC100-C2 405 R-01304-13 40.5 R-01304-14 405 405 01504-1 400 400 01504-2 400 400 01129-1 NIA 01129-2 R-01301-13 R-01301-14 400 01503-1 400 01503-2 400 NIA 01122-1 NIA 01122-2 405 R-01254-13 7 05 R-01254-14 409 01055-1 105 429 01055-2 125 01500-1 01500-2 Owner Representative: Completed By:

(Signature)

BER-MAC
ELECTRICAL INSTRUMENTATION
A MEMBER OF THE ABB GROUP

FIELD SERVICES
CABLE / CONTROL WIRING / DEVICE
CHECKOUT RECORD

PG: 12 OF 24

| A MEMBER OF THE ABB GROUP | CHECKU           | OT TIECO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | IID           | Market Zin         | THE STATE OF      |                   |
|---------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|--------------------|-------------------|-------------------|
| Project No.:BM-117        | Panel/Bldg/D     | evice Des                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | cription: MCC | C-100              |                   |                   |
|                           | Location         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Installa      | ation              | Continuity<br>Che |                   |
| Cable / Tag Number        | Completed?       | Approved (Initial)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Completed?    | Approved (Initial) | Completed?        | Approv<br>(Initia |
| MCC100-C2                 |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | - N/A -       |                    |                   |                   |
| R-01261-13                |                  | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 425           | -A-5               |                   | *                 |
| R-01261-14                | 700              | ( The state of the | 405           | 50                 | 753               |                   |
| 01067-1                   | Ye5              | <b>4</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ye5           |                    | 425               | 45                |
| 01067-2                   | 400              | <del>(2)</del>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 705           |                    | 7-2-5 (           |                   |
| 01501-1                   | des              | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 405           |                    | 485               | 考                 |
| 01501-2                   | 425              | تتكليب                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 405           | 10                 | 405               |                   |
| R-01269-13                | Yes .            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 105 2         |                    | •                 |                   |
| 01080-1                   |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | W/A-          |                    | 705 5             |                   |
| 01080-2                   | *                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | N/A-          |                    |                   |                   |
| 01502-1                   | 405              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 405           |                    |                   |                   |
| 01502-2                   | 400              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4eg e         | **                 |                   |                   |
| R-01314-13                | ves 3            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 105           | -                  | ye5 &             |                   |
| R-01314-14                | Ves              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 757           |                    |                   |                   |
| 2151/j-n 1510-1           | Y 25             | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 425           |                    | 419 9             |                   |
| 91519-2 1510-2            | 7-25             | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 465           | 4                  | 4.65              |                   |
| 01162-1                   |                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7/X I         |                    | -105 e            |                   |
| 01162-2                   | <u> </u>         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | W//A +        |                    |                   |                   |
| 91127-1                   | 405              | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | SIDE.         |                    | 405 7             |                   |
| 51127-7                   | 122              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 762           |                    | /                 |                   |
| 01070-1                   | 7.05             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7.63          |                    | 405               |                   |
| 01079-2                   | 1/26             | 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 405           | ~<br>~             | 19                |                   |
| 1156-1                    | 7 65 6           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                    | 705               |                   |
| 71156-2                   | 4e5 +            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 7e3 7         |                    | 405 7             |                   |
| R-1551-13                 | 4                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |               |                    | YES .             |                   |
| Q=(551-14                 | y e5             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 752           | AP)                | YES               |                   |
| R-1552-13                 | 765              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 765           |                    |                   |                   |
| 8-1552-14                 | 405              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 705           |                    | YES YES           | 一                 |
| R - 15 53 - 13            | 7-85 2<br>4-85 2 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 700           |                    | 153<br>Væ         | 3                 |
| 2-1553 - 14               | 725 8            | 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 400 0         |                    | YES               |                   |
| 2-1269-14                 | 462 5            | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 700           |                    | Ye S              | 4                 |
| ompleted By:              | 3/               | )wner Reni                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | resentative:  |                    | t com.            | 1.00              |
| Signature                 |                  | o. 1 top1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | JOURNALIVO.   |                    | (Signature)       | <del></del>       |

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CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 13 OF 24

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| MCC100-C3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | - 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| R-01307-13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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| R-01307-14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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| R-01557-13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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| R-01557-14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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| )1506-1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                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| )1506-2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                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| R-01306-13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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| R-01306-14                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             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| Completed By:(Si | gnature)                                        | Owner Representative | gnature)       |
|                  | PROJECT AND |                      | <br><b>,</b> , |

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CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD PG: 14 OF 24

(Signature)

| Project No.:BM-117 | Location Verified |                    | ription: MCC<br>Installa |                    | Continuity / Loop<br>Check |                       |
|--------------------|-------------------|--------------------|--------------------------|--------------------|----------------------------|-----------------------|
| Cable / Tag Number | Completed?        | Approved (Initial) | Completed?               | Approved (Initial) | Completed?                 | Approved<br>(Initial) |
| MCC100-A1          |                   |                    | NA                       | -                  |                            |                       |
| 02055-1            | V.                | 0                  |                          | 0                  |                            | 49                    |
| 02055-2            |                   | 80                 |                          | (6)                |                            | 59                    |
| MCC100A1-28        |                   | 0                  |                          | 0                  |                            | 2                     |
| MCC100A1-29        |                   | 30-                | /                        | 80                 |                            | 20                    |
| MCC100A1-7         |                   | 50                 |                          | 90                 |                            | 20                    |
| MCC100A1-8         |                   | (5)                | V                        | 50                 |                            | 2                     |
| 02004-1            | V ,               | 50                 |                          | 9                  | 1                          | X                     |
| 02004-2            | V                 | 80                 |                          | 50                 |                            | 20                    |
| MCC100A1-16        | 1                 | 0                  | V                        | 0                  |                            | 50                    |
| MCC100A1-17        |                   | 30                 | /_                       | 80                 | V                          | 8/                    |
| 01901-1            |                   | 50                 |                          | 20                 | V                          | 80                    |
| 01901-2            |                   | 50                 | V_                       | 76)                | V                          | 9                     |
| MCC100A1-1         | //                | 50                 | /_                       | 50                 | V                          | SCA                   |
| MCC100A1-2         |                   | 50                 |                          | 0                  |                            | 20                    |
| 01905-1            |                   | 8                  | V                        | 50                 |                            | 52                    |
| 01905-2            |                   | 50                 | /                        | 50                 | V                          | Sex                   |
| MCC100A1-23        | 1/                | 0                  |                          | SQ                 |                            | 80                    |
| MCC100A1-22        |                   | 50                 |                          | 8)                 | V                          | 8                     |
| 01951-2            |                   | 2                  | V                        | (2)                |                            | 20                    |
| 01951-1            | V                 | 92)                |                          | 50                 | -                          | De la                 |
| 02105-2            | //                | 190                | /                        | 50)                | 1                          | 12                    |
| 02105-1            | V                 | SZ                 | V_                       | 50                 | /                          | D                     |
| MCC100A1-28        |                   | 80                 | 1/                       | 80                 | 1/                         | 26                    |
| MCC100A1-29        |                   | 50                 | V                        | 6                  |                            | 2                     |
|                    |                   |                    |                          |                    |                            |                       |
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(Signature)



# CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 15 OF 24

|                    | Location                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Location Verified                                                                        |                | ation              | Continuity / Loop<br>Check |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| Cable / Tag Number | Completed?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Approved (Initial)                                                                       | Completed?     | Approved (Initial) | Completed?                 | Approved (Initial)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| KM0010A-P1         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | and the second                                                                           | NIA            |                    |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| KM0010AP1-LN1      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 50                                                                                       | 1              | SOL                | 1                          | 40)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| KM0010AP1-LN2      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 5/2                                                                                      |                | 5                  |                            | \$2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
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# FIELD SERVICES CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 18 OF 24

| Project No.:BM-11 | 7 Panel/Bldg/D       | evice Desi                             | Inplion. FINE                           | -FEC-100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Canting it                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| MCC100-C3SEE PAGE | =13                  |                                        | NIA                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| R-01307-13        |                      |                                        |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            | /                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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| R-01557-13        |                      |                                        |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| R-01557-14        |                      |                                        |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | /                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| 01506-2           |                      |                                        |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| R-01556-13        |                      | /                                      |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| 01505-1           |                      |                                        |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 01505-2           |                      |                                        |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| R-01309-13        |                      |                                        |                                         | /                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
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| R-01310-13        |                      |                                        | / · · · · · · · · · · · · · · · · · · · | \                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                            | ES VIII SE MASSELLES ANN ELEVANORIS DE SERVE SE PROPERTIES. PR                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| R-01310-14        |                      | /                                      |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| R-01581-13        |                      |                                        |                                         | 000 miles (100 miles ( |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| R-01581-14        |                      |                                        |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| )1510-1           |                      | /                                      |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 01510-2           |                      |                                        |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            | allocation and and sentence of all the file of the analysis of the file of the sentence of the |
| R-01253-13        |                      |                                        |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| R-01253-14        |                      |                                        |                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            | \                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
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| Completed By: | Alle        | Owner Representative: |             |
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| ,             | (Signature) | ,                     | (Signature) |

| Project No.: BM-117                                                                                                                                                                         | Installa                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Continuity                        |                                                                                                                                                                                                                               |
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| 02055-1 02055-2  M@C100A1-28 MCC100A1-29 MCC100A1-7 MCC100A1-8 02004-1 02004-2 MCC100A1-16 MCC100A1-17 01901-1 01901-2 MCC100A1-1 MCC100A1-2 01905-1 01905-2 MCC100A1-22 01951-2            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Approved (Initial)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                   | Approved<br>(Initial)                                                                                                                                                                                                         |
| 02055-1 02055-2  M@C100A1-28 MCC100A1-29 MCC100A1-7 MCC100A1-8 02004-1 02004-2 MCC100A1-16 MCC100A1-17 01901-1 01901-2 MCC100A1-1 MCC100A1-2 01905-1 01905-2 MCC100A1-22 01951-2            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                   |                                                                                                                                                                                                                               |
| MGC100A1-28  MCC100A1-29  MCC100A1-7  MCC100A1-8  02004-1  02004-2  MCC100A1-16  MCC100A1-17  01901-1  01901-2  MCC100A1-1  MCC100A1-2  01905-1  01905-2  MCC100A1-23  MCC100A1-22  01951-2 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                   |                                                                                                                                                                                                                               |
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| MCC100A1-16  MCC100A1-17  01901-1  01901-2  MCC100A1-1  MCC100A1-2  01905-1  01905-2  MCC100A1-23  MCC100A1-22  01951-2                                                                     | The second secon |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                   |                                                                                                                                                                                                                               |
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| BER-MA( ELECTRICAL INSTRUMENTATI A MEMBER OF THE ABB GROUP | FIELD SE CABLE / CHECKO                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CONTRO                         | L WIRING / | DEVICE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | PG: <u>20</u> OF <u>24</u> |                                                     |  |
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| Project No.: BM-117                                        | Panel/Bldg/D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Continuity                 | //Loop                                              |  |
|                                                            | Location                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Location Verified Installation |            | Che                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ck                         |                                                     |  |
| Cable / Tag Number                                         | Completed?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Approved (Initial)             | Completed? | Approved (Initial)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Completed?                 | Approved (Initial)                                  |  |
| KM0010A-C1 SEE PAGE                                        | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                     |  |
| R-01308-13                                                 | A SAN TO MARKET A TO THE SAN THE SAN TO THE SAN THE SAN TO THE SAN THE SAN TO THE SAN TO THE SAN TO THE SAN T |                                |            | e of the description of the desc |                            |                                                     |  |
| R-01308-14                                                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                     |  |
| 01007-A                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                     |  |
| 01007-B                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                     |  |
| 01009-A                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                     |  |
| 01009-B                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                     |  |
| PIT0010-A1                                                 | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | N/A                            | N/A        | NIK                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | NIA                        | N/A                                                 |  |
| PIT0010-A                                                  | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | N/A                            | NJA        | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | NA                         | NA                                                  |  |
| PIT0010-B                                                  | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | N/A                            | N/A        | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <i>N</i> /A                | N/A                                                 |  |
|                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            | an amanana — hinthe or a 10 million hint plantania. |  |
|                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                     |  |
|                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                     |  |
|                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                     |  |
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|                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                |            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                            |                                                     |  |

| Completed By:  | (Signature) |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Owner Re                                                                                                         | presentative: |                                                                                                                | (Signature) |  |
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| FSM05002/08060 |             | supplication in the feet in the feet of th | n en menengungan melandakan bahada sebebah di Arba di sebahan beberapa da sebebah di sebahan di sebahan di sebah |               | i austria na spira advini de del ricino i altri e del ricino del ricino del ricino del ricino del ricino del r |             |  |

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# FIELD SERVICES CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 21 OF 24

|                    | Location '                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Verified                                                  | Installa   | ation              | Continuity<br>Che |          |
|--------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|------------|--------------------|-------------------|----------|
| Cable / Tag Number | Completed?                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Approved (Initial)                                        | Completed? | Approved (Initial) | Completed?        | Approved |
| ASH1100A-C1        | * rhinconferrimentanean-aucusanian-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-aucusan-auc |                                                           | - N/A -    |                    |                   |          |
| 01003-A            | ~                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Se                                                        | V          | 50)                | U.                | (0)      |
| 01003-B            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 50                                                        |            | 50                 |                   | \$0      |
| ASH1100B-C1        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                           | W/A -      |                    |                   |          |
| 01004-A            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | K()                                                       |            | 9                  |                   | (1)      |
| 01004-B            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 50                                                        |            | 50                 |                   | 90       |
| ASH1100C-C1        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                           | N/A-       |                    |                   |          |
| 01005-1            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p)< td=""><td></td><td>50</td><td></td><td>90</td></p)<> |            | 50                 |                   | 90       |
| 01005-2            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 20                                                        |            | 20                 |                   | 0        |
| AH1100-C1          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                           | N/A        |                    |                   |          |
| AH1100-A           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 50                                                        |            | 10)                |                   | (1)      |
| AH1100-B           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 50                                                        |            | 50                 |                   | 2        |
| AL1100A-C1         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                           | N/A -      |                    |                   |          |
| AL1100A-A          | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 42                                                        |            | 42                 | /                 | 4        |
| AL1100A-B          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | SI.                                                       | /          | 50                 |                   | 50       |
| AL1100B-C1         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ***************************************                   | NA-        |                    |                   |          |
| \L1100B-A          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 80/2                                                      | /          | 50                 |                   | (2)      |
| L1100B-B           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4/                                                        |            | 50)                |                   | \$       |
| L1100C-C1          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                           | NA -       |                    |                   |          |
| L1100C-A           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 90                                                        | 7          | 50                 |                   | <02      |
| L1100C-B           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 50                                                        |            | 80                 |                   | 91       |
|                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                           |            |                    |                   |          |

Owner Representative:

(Signature)

FSM05002/080605

Completed By:



# FIELD SERVICES

CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 22 OF 24

| Project No.: BM-117 Pan | el/Bldg/Device D<br>Location |                    | Installa       |                    | Continuity                                                                                                     | y / Loop |
|-------------------------|------------------------------|--------------------|----------------|--------------------|----------------------------------------------------------------------------------------------------------------|----------|
| Cable / Tag Number      | Completed?                   | Approved (Initial) | Completed?     | Approved (Initial) | i                                                                                                              | Approved |
| ESD1100A-C1             |                              |                    | N/A-           |                    |                                                                                                                |          |
| ESD1100A-A              |                              | 99                 |                | Se                 | 7                                                                                                              | 90       |
| ESD1100A-B              |                              | 50                 |                | 50                 | J                                                                                                              | 80       |
| ESD1100B-C1             |                              |                    | -N/A=          |                    |                                                                                                                |          |
| ESD1100B-A              |                              | 70                 | 7              | 5)                 |                                                                                                                | 80       |
| ESD1100B-B              |                              | 80                 |                | \$                 |                                                                                                                | 50       |
| HY1100-C1               |                              |                    | NA             |                    | Makehir makkawa 1922 yi kuru ya ka sagalan Salahari ka ka ka ka ka ka ka saga wa ka saga wa ka saga wa ka saga |          |
| HVY1100-A               |                              | 92                 | 6              | 8                  |                                                                                                                | 5        |
| HVY1100-B               |                              | 7                  |                | <i>y</i> ()        |                                                                                                                |          |
|                         |                              |                    |                |                    |                                                                                                                |          |
|                         |                              |                    |                |                    |                                                                                                                |          |
|                         |                              |                    |                |                    |                                                                                                                |          |
|                         |                              |                    |                |                    |                                                                                                                |          |
|                         |                              |                    |                |                    |                                                                                                                |          |
| Completed By: (Signatu  |                              | Owner Rep          | resentative: _ |                    | (Signature)                                                                                                    |          |



# FIELD SERVICES CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: <u>23</u> OF <u>24</u>

|                        | Location                                                                     | Verified           | Installa       | ation              | Continuity<br>Che |                    |
|------------------------|------------------------------------------------------------------------------|--------------------|----------------|--------------------|-------------------|--------------------|
| Cable / Tag Number     | Completed?                                                                   | Approved (Initial) | Completed?     | Approved (Initial) | Completed?        | Approved (Initial) |
| CPNL100-C1             | gilliochdalaith comhnilleanngaic e Guardes, e mphagagainn e ann e de charach |                    | -N/A-          | *                  |                   |                    |
| BFY7005-A              | V 85                                                                         | <b>ED</b>          | 409            | <b>(2)</b>         | 409               | 4                  |
| BFY7005-B              | 705                                                                          | 7                  | 405            | (4)                | 400               | 2                  |
| BFS7005-A              | Yes .                                                                        | A >                | 405            | <b>感</b>           | 409               | 4                  |
| BFS-7005-B             | 405                                                                          |                    | Y 65           | (6)                | 425               | 42                 |
| BFY4000-A              | 485                                                                          | 3                  | 700            |                    | 400               | (F)                |
| BFY4000-B              | 786                                                                          | <b>AP</b>          | 405            | <del>4</del> 3     | 460               |                    |
| BFS4000-A              | 400                                                                          |                    | ye5            | A)                 | 405               | 430                |
| BFS-4000-B             | 129                                                                          | 1                  | 485            | 1960               | 105               | 4                  |
| BFY6000-A              | 400                                                                          | D                  | 785            | 28                 | 125               | 每                  |
| BFY6000-B              | 465                                                                          | (47)               | 455            | A)                 | 469               | 2                  |
| BFS6000-A              | 485                                                                          | 1                  | , ,            |                    | 405               |                    |
| BFS6000-B              | 125                                                                          | C213               | 105            |                    | 405               | (D)                |
| BFY7000-A              | 405                                                                          | (4)                | 4 05           | /200               | 405               | (A)                |
| BFY7000-B              | 4 23                                                                         | <del>\</del>       | 400            |                    | 4 95              |                    |
| 3FS7000-A              | Ye5                                                                          |                    | 425            |                    | 105               |                    |
| 3FS7000-B              | 486                                                                          | (4)                | yes            |                    | 7 = J<br>4 = S    | 15                 |
| 3FY1100A-A             | 125                                                                          | 100                | yes            |                    | 7 e S             | 4                  |
| 3FY1100A-B             | 425                                                                          |                    | Yes            |                    | 105               |                    |
| 3FY5030-A              | 400                                                                          | <del>(</del>       | 405            | 10                 | 185               | A)                 |
| 3FY5030-B              | 425                                                                          | (2)                | 425            | 2                  | 105               | (F)                |
| 3FS5030-A              | 125                                                                          |                    | 4.25           |                    | 705<br>105        | 1                  |
| 3FS5030-B              | 305                                                                          | (R)                | 405            | (B)                | 106               | (B)                |
| SPARE-1                |                                                                              | 601                | 7//            | \$/                | 17                | 30                 |
| SPARE-2                |                                                                              | 2                  |                | 67                 |                   | 501                |
| SPARE-3                |                                                                              | cl)                |                | (6)                |                   | SOF                |
| SPARE-4                |                                                                              | <b>2</b>           |                |                    |                   | 941                |
| SPARE-5                |                                                                              | 80                 |                | 85                 |                   | 7                  |
| PARE-6                 |                                                                              | 80                 |                | 劲士                 |                   | <b>50</b>          |
| PARE-7                 |                                                                              | 21)                |                |                    |                   | 5/)                |
| PARE-8                 | 71                                                                           | <del></del>        |                | <del></del>        |                   |                    |
| Completed By: (Signatu | <u> </u>                                                                     | Owner Rep          | resentative: _ |                    |                   |                    |

| B     | E     | R-    | -N     | $\Lambda$ | 1     |
|-------|-------|-------|--------|-----------|-------|
| ELFCI | RICA  | 1     | INSTR  | JMENT     | ATION |
| 5.845 | CARDE | OF TH | IF ARR | GROU      | ED.   |

# FIELD SERVICES CABLE / CONTROL WIRING / DEVICE CHECKOUT RECORD

PG: 24 OF 24

| Project No.: BM-117 Panel/E | Location                                         |                       | I:DP-UPS-100<br>Installa |                    | Continuity  |                                                                                 |
|-----------------------------|--------------------------------------------------|-----------------------|--------------------------|--------------------|-------------|---------------------------------------------------------------------------------|
| Cable / Tag Number          | Completed?                                       | Approved<br>(Initial) | Completed?               | Approved (Initial) | Completed?  | Approved<br>(Initial)                                                           |
| DPUPS100-P6                 |                                                  |                       | N/A.                     |                    |             |                                                                                 |
| DP-UPS100-4H                | 1./                                              | 520                   | V,                       | 50                 | V           | 50                                                                              |
| DP-UPS100-4N                |                                                  | 50                    |                          | 50                 |             | 80                                                                              |
| DPUPS100-P1                 |                                                  |                       | NA                       |                    |             | an filosophi da kimana-dapida selember de da kiman filosophi and kima kima kima |
| DP-UPS100-1H                | 125                                              | <b>1</b>              | 465                      | <b>6</b>           | 405         | 2                                                                               |
| DP-UPS100-1N                | 425                                              | 3                     | 400                      |                    | 400         | (F)                                                                             |
| DPUPS100-P7                 | - Франция на |                       | EN/A-                    |                    |             |                                                                                 |
| DP-UPS100-2H                |                                                  | 80                    |                          | (A)                | V           | 50                                                                              |
| DP-UPS100-2N                |                                                  |                       |                          |                    |             |                                                                                 |
|                             |                                                  |                       |                          |                    |             |                                                                                 |
|                             |                                                  |                       |                          |                    |             |                                                                                 |
| Completed By: (Fignature)   |                                                  | Owner Rep             | oresentative:            |                    | (Signature) |                                                                                 |

| R     | F | R.    | -/    | 1    | Δ   |     |
|-------|---|-------|-------|------|-----|-----|
| ELECT | _ | ER OF | INSTR | NUM! | KIA | ION |

## FIELD SERVICES MANUAL

# MEGOHM METER TEST RECORD

PAGE. 1 OF 1

| Date: Project #: Project Name: | DCT 1 2012<br>BM-117<br>Mushy Cadotte P. | Location: Bu 1100 A Technician Name: Stuart (Print N. | old   |       |        |
|--------------------------------|------------------------------------------|-------------------------------------------------------|-------|-------|--------|
|                                |                                          | Insulation Resistance (Megohms)                       | Cable | Equip | Tech's |

| Cable, Equipment # or Description                       |          | Insulati | ion Resist | ance (Meg | ohms)   |          | Cable<br>Rated<br>Volts | Equip<br>-ment<br>Temp<br>(°C) | Tech's<br>Initials |
|---------------------------------------------------------|----------|----------|------------|-----------|---------|----------|-------------------------|--------------------------------|--------------------|
|                                                         | Ø A to G | ØBtoG    | Ø C to G   | Ø A to B  | ØBtoC   | Ø C to A |                         |                                |                    |
| T 1 10 111 / TT 20 20 212                               | 21 M DL  |          |            | ~ ~ M//<  | >1/M52  | >11M +2  | 600V                    | 20                             | 88                 |
| Teck. 10c14/05001-09-010                                |          |          |            |           |         |          | 300V                    | 20                             | Đ                  |
| Inst. 16PR 16/03-9326-1616-19<br>Teck. 3C6/05018-11-010 | ZIMAL    | 711N-52  | >1/µ.52    | >11MD_    | >1/M-52 | 2MIL     | IKV                     | 20                             | SØ                 |
| Teck. 306/05018-11-010<br>Teck. 8014/05001-07-010       |          |          |            | RMIK      | >11U.SE | >  M-R   | 600V                    | 20                             | 30                 |
| Teck. 4014/05001-03-010                                 | >IIM.F2. | >llM.sz. | とこくい       | 2   M.Q.  | >1/M32  | >1/Use   | 600V                    | ZO                             | 20                 |
| Teck 30,14/05001-29-010                                 | NMV.     | >1(M.SZ. | >UMS       | >1/W 22-  | ZMIC    | >1/MIS   | 600V                    | 20                             | 20                 |
| Teck (Inst) 4PR 6/1604-19                               |          |          |            |           |         |          | 300V                    | 20                             | 10                 |
| Teck 2c14/05001-01-010                                  | >11M52   | >1/M-52- | 2 MM       | SMIK      | MAR     | 2MIC     | 600Y                    | 20                             | (X)                |
| Teck 2010/05001-01-010                                  | >UMDZ    |          |            | ZW]/<     | a. 8.5  | >(MX     | 6001                    | 20                             | 20                 |
|                                                         | >1/M32   | >//W2F   | >llma      | >1/M25    | >/W2    | >[[Wx    | 6001                    | 20                             | 20                 |
| Teck 208/05018-02-010                                   | ZMIK     | >1/MR    | >\m2       | > M2      | 7//N x  | > Me     | <u> </u>                | 20                             | 120                |
| Teck 4c250/05020-04-010                                 | MW25     | >/[M.R.  | >//M57     | >1/M5C    | >/\M5c  | > M = 3  | TKA                     | 20                             | (X)                |
| Teck 25c14/03001-24-010                                 | >/(M2    | >(11,52  | > (W25     | >   M ×   | > Msr   | > (K×    | 1000V                   | 20                             | 8                  |
| Teck 4c10                                               |          | > M2     | 2112       | > NA      | >1/Mr   | MMR      | 000V                    | 1/0                            | 20                 |
| Inst IPRIG                                              |          |          |            |           |         |          | 300V                    | 10                             | 80                 |
| Teck 40c10                                              | >1(W2L   | NIKS     | >  WX      | 2/11/5    | >1/Msr  | SINR     | 1600V                   | 10                             | 20                 |
|                                                         |          |          |            |           |         |          |                         |                                |                    |
|                                                         |          |          |            |           |         |          |                         |                                |                    |

| Ambient Conditions         | □ Wet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ☑Dry                                                     |
|----------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------|
| LENGTH OF TEST: 3 SECONDS. | emperore and proper part and an incident control and a part of an incident company and an assessment and an incident control and a second control and a seco |                                                          |
| Test Equipment Used:       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                          |
| Make: Fluke                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | s/N: 17900292                                            |
| Model: 1507                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Last Cal.: 2012 Jul 19 CALIBRATION DUE DATE: 2013 Jul 19 |



## FIELD SERVICES

# INSULATION RESISTANCE AND CONTINUITY TEST REPORT

PAGE: 1 OF 1

## (Power Control Wire and Cable)

| Location: Murphy Oil BU-1100 MCC | Job No: RM 117 | Test No: 1    |      |    |
|----------------------------------|----------------|---------------|------|----|
| Warwick Industries 4207 Glanmon  | Date: ~ · · /  | Test Voltage: | 1000 | MC |
| Ber-Mac Rep: Stuat Old           | Customer Rep:  |               |      |    |
| Stuat Oct                        | Tests          |               |      |    |

| Panel No<br>Circuit No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Wire<br>Tagging | Voltage | C                               | ire or<br>able | Continuity<br>Check | Megohm   | Supervisor<br>Approval |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------|---------|---------------------------------|----------------|---------------------|----------|------------------------|
| Feeder No                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                 |         | No                              | Size           | (/)                 |          | (sign)                 |
| TNS UPS-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | TNSUPS-         | 600V    | 2                               | 10             | J                   | 660 MSZ  | SOO                    |
| UPS100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | UPS100-         | 600V    | 3                               | 10             | <b>V</b>            | 660M2    | 500/                   |
| WS-100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | TNS 100-        | lkV     | 3                               | Н              | <b>V</b>            | 660 Ma   | SOU                    |
| DP-100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | DP100-          | 1 KV    | H                               | 250            | J                   | 660MA    | 800                    |
| HVACI∞                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | HVACIOO-        | 600 V   | 3                               | 10             | 1                   | 660 M-SE | SORY,                  |
| HVAC 101                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | HVACIOI-        | 600V    | 3                               | 10             | V                   | 660Mz    | SOU                    |
| HTRB                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | HTR BIOLA       | 600V    | H                               | 10             | $\checkmark$        | 660 WE   | Sol                    |
| KM ∞ IOA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | KMOOIOA-        | lkV     | 3                               | 6              | <b>V</b>            | 660M2    | Sell,                  |
| KM0010B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | KM0010B-        | IKV     | 3                               | 6              | /                   | 660M2    | SOU                    |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |         |                                 |                |                     |          |                        |
| Tennis and color |                 |         | Annual and the Party Hotelstein |                |                     |          |                        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                 |         |                                 |                |                     |          |                        |



16975 Leslie Street Newmarket, ON L3Y 9A1

Tel: (905) 952-3750 Fax: (905) 952-3751

### MONTRÉAL

20800 Boul. Industriel Ste-Anne-de-Bellevue, QC H9X 0A1

Tel: (514) 457-7280 Fax: (514) 457-4329

**Calibration Certificate** 

#### CALGARY

10505 48th St SE, Suite #101 Calgary, AB T2C 2B7

Tel: (403) 272-9332 Fax: (403) 248-5194

#### **EDMONTON**

3452 91st St. NW. Edmonton, AB T6E 5R1

Tel: (780) 409-9278 Fax: (780) 409-9279 ww.itm.com - information@itm.com

# 

Customer: ABB Ber-mAC

Certificate: 567941-00-1

UNIT IDENTIFICATION

Manufacturer: Fluke

Model: 1507

Description: Insulation Tester

CALIBRATION DATE

Calibration Date: 2012-Jul-19

Due Date: 2013-Jul-19

Serial: 17900292

ID: NA

CALIBRATION CONDITIONS

Temperature: 22.6 °C Humidity: 55 %

Barometric Pressure: N/A

GENERAL INFORMATION

Procedure: Fluke 1507: (1 year) CAL VER /5500, HVR, DMM

Rev: SRevision: 1.1 S

As Received: Within Specifications As Returned: Within Specifications

Data Type: As Found-As Left

Adjusted: No

Remark:

#### STANDARDS USED

| -         |                     |        |             |             |
|-----------|---------------------|--------|-------------|-------------|
| <u>ID</u> | <u>Manufacturer</u> | Model  | Cal Date    | Due Date    |
| 0001      | Fluke               | 5500A  | 2012-Jun-27 |             |
| 0104      | Fluke               | 867    |             | 2013-Jun-27 |
| 0114      |                     | 807    | 2012-Feb-27 | 2013-Feb-27 |
| 0114      | Fluke               | 80K-40 | 2011-Aug-11 | 2013-Aug-11 |

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted instrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

Calibrated by: Barry Armer

Certificate: 567941-00-1

Calibration Certificate

Approved by



16975 Leslie Street Newmarket, ON L3Y 9A1 Tel: (905) 952-3750

Tel: (905) 952-3750 Fax: (905) 952-3751

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| Test Results            |                    |                 |             |             |              |          |                 |
|-------------------------|--------------------|-----------------|-------------|-------------|--------------|----------|-----------------|
| Test Description        | True Value         | Reading         | Lower limit | Upper limit | <u>Units</u> | Test Sta | tus Exp Uncer   |
| Root Difference Squar   | e guardbanding met | hod used        |             |             |              |          |                 |
| UUT IDENTIFICATION      | ON                 |                 |             |             |              |          |                 |
| Firmware Level: 1.02    |                    |                 |             |             |              |          |                 |
| BATTERY TEST            |                    |                 |             |             |              | Pass     |                 |
| DISPLAY TEST            |                    |                 |             |             |              |          |                 |
| Result of Operator Eval | luation            |                 |             |             |              | Pass     |                 |
|                         |                    |                 |             |             |              |          |                 |
| BACKLIGHT TEST          |                    |                 |             |             |              | Pass     |                 |
| KEYPAD TEST             |                    |                 |             |             |              | Pass     |                 |
| OLTAGE ACCURAC          | EY TESTS           |                 |             |             |              |          |                 |
| 500 V Range             |                    |                 |             |             |              |          |                 |
| 3.0 V                   |                    | 3.0             | 2.6         | 3.4         | V            | Pass     | 5.77e-002V      |
| 8.0 V                   |                    | 8.0             | 7.5         | 8.5         | V            | Pass     | 5.77e-002V      |
| AC Annunciator          |                    |                 |             |             |              | Pass     |                 |
| 50,0 V                  |                    | 50.1            | 48.7        | 51.3        | V            | Pass     | 5.78e-002V      |
| 100.0 V                 |                    | 100.1           | 97.7        | 102.3       | V            | Pass     | 5.79e-002V      |
| 250.0 V                 |                    | 249.8           | 244.7       | 255.3       | V            | Pass     | 5.84e-002V      |
| 500.0 V                 |                    | 500.0           | 489.7       | 510.3       | V            | Pass     | 6.07e-002V      |
| 120.0 V @ 60 Hz         |                    | 120.0           | 117.3       | 122.7       | V            | Pass     | 7.16e-002V      |
| 230.0 V @ 50 Hz         |                    | 229.9           | 225.1       | 234.9       | V            | Pass     | 9.58e-002V      |
| 600.0 V @ 400 Hz        |                    | 599.6           | 587.7       | 612.3       | V            | Pass     | 2.55e-001V      |
| SCHARGE CIRCUIT         | TEST               |                 |             |             |              | Pass     |                 |
| SULATION RESISTA        | NCE ACCURACY       | TESTS           |             |             |              |          |                 |
| GOhm Range              |                    |                 |             |             |              |          |                 |
| 2.10 GOhm               | 2.156              | 2.00            | 1.64        | 267         | 00           |          | Tarabourus page |
| ificate: 567941-00-1    |                    | ion Certificate | 1,04        | 2.67        | GΩ           | Pass     | 3.06e+007Ohm    |



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| Test Results                                                                                                                                                                      |             |                 |             |             |       |             |                                |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------|-------------|-------------|-------|-------------|--------------------------------|
| Test Description                                                                                                                                                                  | True Value  | Reading         | Lower limit | Upper limit | Units | Test Status | Exp Uncer                      |
| 200 MOhm Range                                                                                                                                                                    |             |                 |             |             |       |             |                                |
| 1.0 MOhm 20.0 MOhm 100.0 MOhm 20 MOhm Range 0.50 MOhm 0.20 MOhm 0.10 MOhm 0.10 MOhm 0.06 MOhm EXTERNAL SENSE  SOURCE VOLTAGE ACC "R" Nominal 1000 V 500 V 250 V 250 V 100 V 100 V |             | 1.0             | 0.5         | 1.5         | MΩ    | Pass        | 5.77e+004 Ohm                  |
| 20.0 MOhm                                                                                                                                                                         |             | 19.9            | 19.2        | 20.8        | MΩ    | Pass        | 7.02e+004 Ohm                  |
| 100.0 MOhm                                                                                                                                                                        |             | 99.3            | 98.0        | 102.0       | MΩ    | Pass        | 5.03e+005 Ohm                  |
| 20 MOhm Range                                                                                                                                                                     |             |                 |             |             |       |             |                                |
| 0.50 MOhm                                                                                                                                                                         |             | 0.50            | 0.44        | 0.56        | MΩ    | Pass        | 5.80e+003 Ohm                  |
| 0.20 MOhm                                                                                                                                                                         |             | 0.19            | 0.15        | 0.25        | MΩ    | Pass        |                                |
| 0.10 MOhm                                                                                                                                                                         |             | 0.10            | 0.05        | 0.15        | MΩ    | Pass        | 5.78e+003 Ohm<br>5.77e+003 Ohm |
| 0.06 MOhm                                                                                                                                                                         |             | 0.06            | 0.01        | 0.11        | Wo    | Pass        | 5.77e+003Ohm<br>5.77e+003Ohm   |
| EXTERNAL SENSE                                                                                                                                                                    |             |                 |             |             |       | Pass        |                                |
| SOURCE VOLTAGE ACC                                                                                                                                                                | URACY TESTS | S               |             |             |       |             |                                |
| "R" Nominal                                                                                                                                                                       |             |                 |             |             |       |             |                                |
| 1000 V                                                                                                                                                                            |             | 1047.0          | 800.0       | 1200.0      | V     | Pass        | 1.00e+001V                     |
| 500 V                                                                                                                                                                             |             | 523.0           | 400.0       | 600.0       | V     |             | 5.03e+000V                     |
| 500 V                                                                                                                                                                             |             | 519.0           | 400.0       | 600.0       | V     |             | 5.03e+000V                     |
| 250 V                                                                                                                                                                             |             | 275.0           | 200.0       | 300.0       | V     |             | 2.57e+000V                     |
| 250 V                                                                                                                                                                             |             | 268.0           | 200.0       | 300.0       | V     |             | 2.57e+000V                     |
| 100 V                                                                                                                                                                             |             | 110.0           | 80.0        | 120.0       | V     |             | 1.15e+000V                     |
| 100 V                                                                                                                                                                             |             | 106.0           | 80.0        | 120.0       | V     |             | .15e+000V                      |
| 50 V                                                                                                                                                                              |             | 56.0            | 40.0        | 60.0        | V     |             | 7.64e-001V                     |
| 50 V                                                                                                                                                                              |             | 53.0            | 40.0        | 60.0        | ٧     |             | 7.64e-001V                     |
| OURCE VOLTAGE ACCU                                                                                                                                                                | JRACY TESTS |                 |             |             |       |             |                                |
| pen Circuit                                                                                                                                                                       |             |                 |             |             |       |             |                                |
| 1000 V                                                                                                                                                                            |             | 1049.0          | 800.0       | 1200.0      | V     | Pass 1      | 00e+001V                       |
| 500 V                                                                                                                                                                             |             | 525.0           | 400.0       | 600.0       | V     |             | 03e+000V                       |
| 250 V                                                                                                                                                                             |             | 275.0           | 200.0       | 300.0       | v     |             | 57e+000V                       |
| 100 V                                                                                                                                                                             |             | 111.0           | 80.0        | 120.0       | V     |             | 15e+000V                       |
| rtificate: 567941-00-1<br>set: 17900292 1507                                                                                                                                      |             | ion Certificate | eft         |             |       |             | D3-64                          |



16975 Leslie Street Newmarket, ON L3Y 9A1

Tel: (905) 952-3750 Fax: (905) 952-3751

### MONTRÉAL

20800 Boul. Industriel Ste-Anne-de-Bellevue, QC H9X 0A1

Tel: (514) 457-7280 Fax: (514) 457-4329

#### **CALGARY**

10505 48th St SE, Suite #101 Calgary, AB T2C 2B7

Tel: (403) 272-9332 Fax: (403) 248-5194

#### **EDMONTON**

3452 91st St. NW, Edmonton, AB T6E 5R1

Tel: (780) 409-9278 Fax: (780) 409-9279

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| Test Description            | True Value      | Reading | Lower limit | Upper limit | <u>Units</u> | Test Status | Exp Uncert    |
|-----------------------------|-----------------|---------|-------------|-------------|--------------|-------------|---------------|
| 50 V                        |                 | 56.0    | 40.0        | 60.0        | V            | Pass        | 7.64e-001 V   |
| I NOMINAL/LIMIT T           | ESTS            |         |             |             |              |             |               |
| 1000V into 1Mohm To         | est             |         |             |             |              | Pass        |               |
| 500V into 500kohm T         | est             |         |             |             |              | Pass        |               |
| 250V into 200kohm To        | est             |         |             |             |              | Pass        |               |
| 100V into 100kohm To        | est             |         |             |             |              | Pass        |               |
| 50V into 60kohm Test        |                 |         |             |             |              | Pass        |               |
| EARTH RESISTANC             | E ACCURACY TEST | ΓS      |             |             |              |             |               |
| 2000 Ohm Range<br>810.0 Ohm |                 |         |             |             |              |             |               |
|                             |                 | 818.0   | 797.4       | 822.6       | Ω            | Pass        | 1.07e-001 Ohm |
| 990.0 Ohm                   |                 | 992.0   | 974.8       | 1005.2      | Ω            | Pass        | 1.16e-001 Ohm |
| 20 kOhm Range               |                 |         |             |             |              |             |               |
| 18.00 kOhm                  |                 | 18.05   | 17.70       | 18.30       | kΩ           | Pass        | 5.95e+000 Ohm |
| ? Ohm Output Current        | Test            |         |             |             |              | Pass        |               |
| PEN CIRCUIT VOL             | TAGE TEST       |         |             |             |              |             |               |
| Output Voltage Test         |                 |         |             |             |              | Pass        |               |

Certificate: 567941-00-1

Asset: 17900292\_1507

Calibration Certificate DEGENERALES

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3452 91st St. NW, Edmonton, AB T6E 5R1

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# 

# **Calibration Certificate**

Customer: ABB Ber-mAC

Certificate: 567604-00-1

#### UNIT IDENTIFICATION

Manufacturer: Fluke

Model: 1577

Description: Insulation Multimeter

#### CALIBRATION DATE

Calibration Date: 2012-May-22

Due Date: 2013-May-22

Serial: 99470047

ID: na

#### CALIBRATION CONDITIONS

Temperature: 22.1 °C

Humidity: 33 %

Barometric Pressure: N/A

#### GENERAL INFORMATION

Procedure: Fluke 1577: (1 year) CAL VER /5520,DMM

Rev: 1.3

As Received: Within Specifications As Returned: Within Specifications

Data Type: As Found-As Left

Adjusted: No

Remark:

#### STANDARDS USED

| 4    |              |          |                 |             |
|------|--------------|----------|-----------------|-------------|
| ĪD   | Manufacturer | Model    | <u>Cal Date</u> | Due Date    |
| 0092 | Fluké        | 5520A    | 2011-Oct-27     | 2012-Nov-27 |
| 0104 | Fluke        | 867      | 2012-Feb-27     | 2013-Feb-27 |
| 0113 | N-Tech       | HVR 2000 | 2012-May-15     | 2013-Jan-15 |
| 0114 | Fluke        | 80K-40   | 2011-Aug-11     | 2013-Aug-11 |

The calibration was performed using measurement standards traceable to the National Measurement Institute Standards (NMIS) part of the National Research Council of Canada (NRC) or the National Institute of Standards and Technology (NIST), or to accepted instrinsic standards or measurement, or is derived by ratio type self-calibration techniques. Measurement uncertainties given in this report are based on a coverage factor of k=2 corresponding to a confidence level of approximately 95%.

Approved

Calibrated by: Andrew Atton

Certificate: 567604-00-1

Calibration Certificate

Page 1 of 3



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| Test Results          |            |                |                                        |             |       |             |                             |
|-----------------------|------------|----------------|----------------------------------------|-------------|-------|-------------|-----------------------------|
| Test Description      | True Value | Reading        | Lower limit                            | Upper limit | Units | Test Status | Franklin                    |
| C VOLTAGE TESTS       |            |                | 23311 01 111112                        | Сърст пин   | Cints | rest status | Exp Uncer                   |
| 00mV Range            |            |                |                                        |             |       |             |                             |
| 30.0 mV @ 60 Hz       |            | 30.0           | 29.4                                   | 30.6        | mV    | D           | r o oomii                   |
| V Range               |            | 5519           | II. 0 , "Y                             | 30.0        | mv    | Pass        | 5.8e-005V                   |
| 3.000 V @ 60 Hz       |            | 3.001          | 2.937                                  | 3.063       | V     | Dann        | 7.000414                    |
| 50V Range             |            |                | 2.007                                  | 0,000       | V     | Pass        | 7.0e-004V                   |
| 60.00 V @ 50 Hz       |            | 59.95          | 58.77                                  | 61.23       | V     | Pass        | 1 2 - 0001/                 |
| 00V Range             |            |                | 20117                                  | 01.20       | V     | Pass        | 1.2e-002V                   |
| 600.0 V @ 50 Hz       |            | 599.4          | 587.7                                  | 612.3       | V     | Dana        | 4.0 00414                   |
| 000V Range            |            |                | ************************************** | U 1 k U     | ٧     | Pass        | 1.6e-001 V                  |
| 1000 V @ 50 Hz        |            | 997            | 977                                    | 1023        | V     | Pass        | 6.20.0041/                  |
| OC VOLTAGE TESTS      |            |                | <del></del>                            | 1020        | ٧     | F 855       | 6.3e-001V                   |
| 5V Range              |            |                |                                        |             |       |             |                             |
| 0.300 V               |            | 0.300          | 0.298                                  | 0.302       | V     | Pass        | 5.8e-004V                   |
| 6.000 V               |            | 5.999          | 5.986                                  | 6.014       | v     | Pass        | 5.8e-004 V                  |
| 0V Range              |            |                |                                        | 5.5 , ,     | ·     | 1 033       | 3.06-004 V                  |
| 60.00 V               |            | 59.99          | 59.86                                  | 60.14       | V     | Pass        | 5.9e-003V                   |
| 00V Range             |            |                |                                        | 00.11       | •     | 1 055       | 5.96-005 V                  |
| -600.0 V              |            | -599.9         | -601.4                                 | -598.6      | V     | Pass        | 5.9e-002V                   |
| 000V Range            |            |                |                                        |             | •     | 1 033       | J.36-002 V                  |
| 1000 V                |            | 1000           | 996                                    | 1004        | V     | Pass        | 5.8e-001V                   |
| C MILLIVOLT TEST      |            |                |                                        | , ,         | ď     | 1"435       | 3.08-001 V                  |
| 00mV Range            |            |                |                                        |             |       |             |                             |
| 3.0 mV                |            | 3.0            | 2.9                                    | 3.1         | mV    | Pass        | 5.8e-005V                   |
| 30.0 mV               |            | 30.0           | 29.9                                   | 30.1        | mV    | Pass        | 5.8e-005 V                  |
| -600.0 mV             |            | -599.9         | -601.3                                 | -598.7      | mV    | Pass        | 5.8e-005 V                  |
| ESISTANCE TESTS       |            |                |                                        |             | 1014  | 1 033       | J.06-003 V                  |
| 00 Ohm Range          |            |                |                                        |             |       |             |                             |
| 0.0 Ohm               |            | 0.2            | -0.2                                   | 0.2         | Ω     | Pass        | 5.8e-002 Ohm                |
| 600.0 Ohm             |            | 600.1          | 592.6                                  | 607.4       | Ω     | Pass        | 6.0e-002Ohm                 |
| kOhm Range            |            |                |                                        |             |       | 1 233       | V.VGTOUZ UTIIH              |
| 6.000 kOhm            |            | 6.001          | 5.926                                  | 6.074       | kΩ    | Pass        | 6.0e-001 Ohm                |
| kOhm Range            |            |                |                                        |             | 14    | 1 033       | 0.0 <del>0-</del> 00   Onin |
| 60.00 kOhm            |            | 60.00          | 59.26                                  | 60.74       | kΩ    | Pass        | S 00+000 0                  |
| 0 kOhm Range          |            |                |                                        | www.r.y     | 15.77 | F d 3 3     | 3.0e+000 Ohm                |
| 600.0 kOhm            |            | 599.9          | 592.6                                  | 607.4       | kΩ    | Pass 6      | S 00+001 Ob                 |
| tificate: 567604-00-1 | O.V.       | on Certificate |                                        | ~ *** * * * | 34    | F 455 (     | 3.0e+001 Ohm                |



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State of the state

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| Test Results           |            |         |             |             |            |             |                        |
|------------------------|------------|---------|-------------|-------------|------------|-------------|------------------------|
| Test Description       | True Value | Reading | Lower limit | Upper limit | Units      | Test Status | Exp Unce               |
| 6 MOhm Range           |            |         |             |             |            |             | EXP ONCE               |
| 6.000 MOhm             |            | 6.003   | 5.926       | 6.074       | MΩ         | Pass        | 8.6e+002 Ohn           |
| 50 MOhm Range          |            |         |             |             |            | , 400       | 0.00.002.011           |
| 50.00 MOhm             |            | 50.01   | 48.97       | 51.03       | MΩ         | Pass        | 2.2e+004 Ohn           |
| CONTINUITY TESTS       |            |         |             |             |            | . 400       | L.20.004 OIR           |
| Beeper Off Test        |            |         |             |             |            | Pass        |                        |
| Beeper On Test         |            |         |             |             |            | Pass        |                        |
| AC MILLIAMP TESTS      |            |         |             |             |            | . 433       |                        |
| 60mA Range             |            |         |             |             |            |             |                        |
| 3.00 mA @ 45 Hz        |            | 3.01    | 2.92        | 3.08        | m <b>A</b> | Pass        | 6.3e-006A              |
| 600mA Range            |            |         |             |             | ****       | 1 033       | 0.36-000A              |
| 400.0 mA @ 60 Hz       |            | 400.2   | 391.8       | 408.2       | mA         | Pass        | 2.4e-004A              |
| DC MILLIAMP TESTS      |            |         |             |             | ,,,,,      | 1 000       | 2.46-004A              |
| 60mA Range             |            |         |             |             |            |             |                        |
| 60.000 mA              |            | 60.000  | 59.380      | 60.620      | mA         | Pass        | 6.6e-006A              |
| 600mA Range            |            |         |             |             | ,,,,       | , 400       | 0.06-000A              |
| 400.0 mA               |            | 400.2   | 395.2       | 404.8       | mA         | Pass        | 1.1e-004A              |
| Discharge Circuit Test |            |         |             |             |            | Pass        | 1.16-004A              |
| NSULATION TESTS        |            |         |             |             |            | 7 033       |                        |
| 500V                   |            |         |             |             |            |             |                        |
| 0.500 MOhm             |            | 0.500   | 0.000       | 1.000       | MΩ         | Pass        | 7.6e+002 Ohm           |
| 500 MOhm               | 529.3      | 526     | 516         | 542         | MΩ         |             | 7.5e+002 Ohm           |
| Overrange Test         |            |         |             | -           | ** t       | Pass        | 7.Je+000Onm            |
| 000V                   |            |         |             |             |            | 1 033       |                        |
| 600 MOhm               | 629.3      | 626     | 615         | 643         | MΩ         | Pass        | 9.0e+006Ohm            |
| xternal Sense Test     |            |         |             |             |            | Pass        | J.VETUUO UIIM          |
| UTPUT VOLTAGES         |            |         |             |             |            | : ଘଟନ       |                        |
| 500 V                  |            | 526.0   | 500.0       | 600.0       | V          | Pass (      | 2.000,000              |
| 1000 V                 |            | 1050.0  | 1000.0      | 1200.0      | V          |             | 6.0e+000V<br>1.1e+001V |

Certificate: 567604-00-1

Calibration Certificate

Page 3 of 3

| B     | F    | R- | - //    | Δ    | (    |
|-------|------|----|---------|------|------|
| ELECT | RICA | 1  | INSTRUM | enia | TION |

### FIELD SERVICES

# TRANSFORMER INSTALLATION CHECKLIST

| PAGE: 1 OF | P | A | G | E | 1 | C | F | i |
|------------|---|---|---|---|---|---|---|---|
|------------|---|---|---|---|---|---|---|---|

| PROJECT: BM-117                                     |                                                                                                                 | LOCATION: BU 1100           | *******************************                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ***************************************        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|
| P&ID TAG #: TNS-100                                 |                                                                                                                 | MANUFACTURER: Hamm          | . 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | nger S                                         | 111                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| TYPE: Single Phase D                                | y Type                                                                                                          | SERIAL #: 8 03423 040       | 748                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | pages as                                       | LUT DA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |
| VOLTAGE: 480-120/240                                | PHASE: 1                                                                                                        | FREQUENCY: 60 HZ            | 0610                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| SIZE: 50 KVA                                        | PRIMARY AMPS: 04A                                                                                               | INS: N/A                    | <del></del>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ***************************************        | ~~~~                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
|                                                     |                                                                                                                 | <del></del>                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ***                                            | ***************************************                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| 250050 4410                                         |                                                                                                                 |                             | Υ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | N                                              | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| RECORD AND VERIFY NAMEPLATE DA                      | ATA IN ACCORDANCE WITH AP                                                                                       | PROVED DRAWINGS AND SPECS   | M                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| VERIFY INSTALLATION OF BASE ATTA                    |                                                                                                                 |                             | 図                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| INSPECT FOR EXTERNAL OR SHIPPIN                     |                                                                                                                 |                             | Ø                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| INSPECT CABLES AND CONNECTIONS                      |                                                                                                                 |                             | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| CHECK OIL LEVELS, GASKETS, & FITT                   | 図                                                                                                               |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| CHECK ALL GROUNDINGS IN ACCORD                      | CHECK ALL GROUNDINGS IN ACCORDANCE WITH SPECIFICATIONS, INCLUDING CORE GROUNDING                                |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| CHECK ROATION AND/OR FREEDOM (                      | OF MOVEMENT ON EQUIPMENT                                                                                        | T, FAN, TAP CHANGER, ETC.   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                | B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| CHECK ALL NEUTRAL INSTALLATION S                    |                                                                                                                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                | Ø                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| ALL HOLES ARE PLUGGED AND TIGHT                     |                                                                                                                 |                             | ×                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| TERMINATIONS ARE COMPLETE AND V                     | VERIFIED IN ACCORDANCE WI                                                                                       | TH APPROVED DWG'S AND SPECS | B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| ALL CONDUCTORS ARE LABELED AND                      |                                                                                                                 |                             | Z.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | П                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| ALL SPARE CONDUCTORS ARE ISOLATION                  | TED AND IDENTIFIED                                                                                              |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | П                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| CASE AND GROUNDING RESISTORS A                      | RE CORRECTLY INSTALLED TO                                                                                       | MAIN GROUND SYSTEM No Grown | ) B.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| CORRECT PHASE ROTATION AND POL                      | ARITY                                                                                                           | Resister                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                | X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| SETTING VERIFICATION OF OUTPUT PO                   |                                                                                                                 |                             | 128.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| FUSE PROTECTION IN ACCORDANCE V                     | WITH MANUFACTURER'S SPEC                                                                                        | IFICATIONS                  | <del>                                     </del>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                | X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| POINT-TO-POINT CHECKS                               |                                                                                                                 |                             | <u> </u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| PULL & TUG METHOD COMPLETED AFT                     | ER TERMINATION                                                                                                  |                             | Image: square of the point of | 급귀                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| VERIFY PROPER OPERATIONS OF FAN                     | INDICATORS, PROTECTIVE DE                                                                                       | VICES, AND TAP CHANGERS     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| LIQUID FILL MUST SIT FOR >6 HOURS E                 | SEFORE APPLYING POWER                                                                                           |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                | N N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |  |
| GENERAL AREA CLEANLINESS                            |                                                                                                                 |                             | Ø                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| CHECK TRANSFORMER BUSHINGS FOR                      | R CRACKS AND CHIPS                                                                                              |                             | M                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                | 님                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| COMMENTS:                                           |                                                                                                                 |                             | <del> </del>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| 1) TEMPERATURE OF TRANSFORMER (                     | DURING TEST: 4 oc:                                                                                              | AMBIENT CONDITIONS:   DRY   | han                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | IID a V                                        | , , , , , , , , , , , , , , , , , , , ,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |  |
| 2) TEST VOLTAGE: 1000 VDC; LEN                      |                                                                                                                 | AMBIENT CONDITIONS.   DAT   | # HUIV                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | IID a W                                        | E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |
| EI L. LEN                                           |                                                                                                                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| 3) MEGOHM METER Fluke 150                           | ; SERIAL # _/                                                                                                   | 7900 292; CALIBRATION DUE   | DATE: J                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | VL. 10                                         | 1/13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| VERIEV PRIMARY & SECONDAR                           |                                                                                                                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ***************************************        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| VERIFY PRIMARY & SECONDAR PHASE/GROUND (READINGS IN | CUMC).                                                                                                          | NCE FROM PHASE/PHASE AN     | VD.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| H1-G: >1 1.062 H2-G:>11.06=                         | H3-G: 71.062 H1-                                                                                                | H2: O M.S. H2-H3: O M.S     | ∟ Н3-Н                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1: ()                                          | ч.г.]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |
| X1-G:> 11.0GE X2-G:>11.0G=                          | X3-G:>/1.06= X1-                                                                                                | X2: O M.S. X2-X3: O M.S     | X3-X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1: 0                                           | M.G.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |  |
| BER-MAC REPRESENTATIVE:                             | umanya kapi - musuwaana pilapiliga ana promonoga. Liida aa aa ah ango aana ah yelepunnoo oo ah ah aa aa ah aa a |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| NAME: V                                             | SIGNATURĘ: /                                                                                                    | DATE                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ***************************************        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| XINACY                                              | Shurest                                                                                                         | - OLA DATE:                 | 1/2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                | on any other states of the sta |  |
|                                                     |                                                                                                                 | -Old Oct. 1                 | 6/ LS                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 116                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| CLIENT ŘEPRESENTATIVE:<br>NAME:                     |                                                                                                                 |                             | ***************************************                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ***************************************        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| 1.47 MAIL                                           | SIGNATURE:                                                                                                      | DATE:                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
|                                                     |                                                                                                                 |                             | *************************************                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Neticial desired and paragraphy and the second |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |
| FSM16004/080611                                     |                                                                                                                 |                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |

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### FIELD SERVICES

### TRANSFORMER INSTALLATION CHECKLIST

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| PROJECT: BM-117         |                    | LOCATION: BUL 1100                    |
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| P&ID TAG #: TNS-UPS-100 | )                  | MANUFACTURER: Hammon's Power Solution |
| TYPE: Single Phase Do   | y Type             | SERIAL #: 432138                      |
| VOLTAGE: 480-120/240    | PHA'SE: 1          | FREQUENCY: 60 HZ                      |
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# BER-MAC FIELD SERVICES FIELD SERVICES BATTERY & BATTERY CHARGER SYSTEM CHECKLIST PAGE: 1 OF 1

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| Project                                                     | BM-117                                                               | Location                                                                                                                                                                                                                          | BU 1100                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |     |                    |       |
| Tag #                                                       | UPS-100                                                              | Manufacturer                                                                                                                                                                                                                      | Hayley Indust                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ria | Elect              | ronic |
| Model                                                       | CCBC120H75F24H60A                                                    | Serial#                                                                                                                                                                                                                           | 18359A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     |                    |       |
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| Voltage                                                     | See Comments                                                         | HP                                                                                                                                                                                                                                | - 1/4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |     |                    |       |
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| Any def                                                     | iciency on installation or acceptance m                              | ust have a non-confe                                                                                                                                                                                                              | ormance report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |                    |       |
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| Record and                                                  | d verify nameplate data in accordance with approved                  | drawings and specification                                                                                                                                                                                                        | S.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Z   |                    |       |
|                                                             | /erify and/or torque in accordance with manufacturer specifications. |                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |                    |       |
| Inspect for                                                 | external or shipping damage.                                         |                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ②   |                    |       |
| Verify prop                                                 | er installation of battery racks, anchoring, earthquake              | braces, and cells.                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 风   |                    |       |
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| Check all c                                                 | overs and doors are installed correctly.                             |                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Ø   | 10                 |       |
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| Print & Sign                                                | Stuart Old God<br>Ber-Mac Representative<br>Oct 17/12                | Signature<br>Date                                                                                                                                                                                                                 | Owner Representative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |                    |       |
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| Check term                                                  | inations are complete & verified in accordance with a                | pproved drawings and spec                                                                                                                                                                                                         | cifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Ż   | Ö                  |       |
| Check all co                                                | onductors are labeled & identified.                                  | ikkulankankaka kalmananan megangangan pangangan pangangan kendulan dan birika dan birika dan birika dan birika<br>Birika kalmanan kalmanan mengangan pangangan pangangan birika dan birika dan birika dan birika dan birika dan b |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Ø   |                    |       |
| Check all sp                                                | pare conductors are isolated and identified.                         |                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Ø   |                    |       |
| Check all ex                                                | demal connections.                                                   |                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Ø   |                    |       |
| Check the p                                                 | rotective devices.                                                   | 00% желде бай желде бай                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Ø   |                    |       |
| Check the b                                                 | attery terminals for tightness and general appearance                | 9 -                                                                                                                                                                                                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | B   |                    |       |
| Compare the                                                 | e battery and charge polarity.                                       |                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     | X                  |       |
| Check batte                                                 | ry voltage as per specifications.                                    |                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |                    | П     |
| Check termi                                                 | nals and battery connections are covered with protec                 | tive coating.                                                                                                                                                                                                                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Ø   |                    | П     |
| Complete po                                                 | pint to point.                                                       |                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |                    | П     |
| Pull, tug met                                               | thod completed after termination.                                    | -000000000 EL kiloliki jalikka kilolion kilon oma osalda ya magain. Manga ya ya usuntaki ya mada da kana a mada da k                                                                                                              | **************************************                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |     | H                  |       |
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| Comments:                                                   | Battery voltage to be ass                                            | essed in the fi                                                                                                                                                                                                                   | eld.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |                    |       |
| Print & Sign                                                | Stuart OU SHA<br>Ber-Mac Representative                              | Signature                                                                                                                                                                                                                         | Owner Representative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |     |                    |       |
| Date                                                        | OCT 17/12                                                            | Date                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |                    |       |
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# BER-MAC ELECTRICAL INSTRUMENTATION A MEMBER OF THE ABB GROUP

### **FIELD SERVICES**

# UNINTERRUPTIBLE POWER SYSTEM ACCEPTANCE CHECKLIST

PAGE: 1 OF 1

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# BER-MAC

#### FIELD SERVICES

# MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST

PAGE: 1 OF 1

| Project         | BM-117                                    | Location                                 | MCC-100-F1H          |            | /                                                | (m)                                              |
|-----------------|-------------------------------------------|------------------------------------------|----------------------|------------|--------------------------------------------------|--------------------------------------------------|
| Tag #           | KM-0010A                                  | Manufacturer                             | Eater                | Eaton      |                                                  | 13/                                              |
| Туре            | BREAKER                                   | Serial#                                  | 37BA 2490            | ) <b>(</b> | June                                             |                                                  |
| Size            | MAL HED                                   | HZ                                       | 60 HZ                |            |                                                  |                                                  |
| Voltage         | 480 V                                     | НР                                       |                      |            |                                                  |                                                  |
| AMPS            | ***************************************   | ne                                       | 30                   |            |                                                  |                                                  |
| AWP3            | 100 A                                     |                                          |                      |            |                                                  |                                                  |
| Any defic       | iency on installation or acc              | eptance must have a non-confe            | ormance report.      |            |                                                  |                                                  |
| Installatio     | on                                        |                                          |                      | Υ          | N                                                | N/A                                              |
| Record and      | verify nameplate data in accordance       | with approved drawings and specification | S.                   |            | $+\Box$                                          | IV/A                                             |
| 1               | torque anchorage and all buss conn        |                                          |                      |            | 0                                                |                                                  |
| Verify require  | ed area clearances and proper alignn      | nent.                                    |                      |            |                                                  | $+\overline{\Box}$                               |
| Inspect for ex  | xternal or shipping damage.               |                                          |                      |            | $+\overline{\Box}$                               | $+\Box$                                          |
| Check all nar   | meplate data of cubical to drawing an     | nd specifications.                       |                      | X          | $\frac{1}{\Pi}$                                  | 16                                               |
| Fill out QA/Q   | C sheet on each starter.                  |                                          |                      |            |                                                  | 1                                                |
| Check phasir    | ng of busses visually, and /or with cor   | ntinuity check.                          |                      |            | <del>                                     </del> | Ø                                                |
| Check all gro   | undings in accordance with the speci      | ifications.                              |                      |            | <u> </u>                                         |                                                  |
| Check for cle   | anliness.                                 |                                          |                      |            | <del>                                     </del> |                                                  |
| Print & Sign    | Ber-Mac Representative Oct. 12/1          | FOLL Signature                           | Owner Representative |            |                                                  |                                                  |
| Acceptance      | e Testing                                 |                                          |                      | Υ          | N                                                | N/A                                              |
|                 |                                           | ordance with approved drawings and spec  | ifications.          | Ø          |                                                  |                                                  |
|                 | ductors are labeled & identified.         |                                          |                      | Ø          |                                                  |                                                  |
|                 | re conductors are isolated and identif    | led.                                     |                      |            |                                                  | X                                                |
|                 | mal connections.                          |                                          |                      | Ø          |                                                  |                                                  |
| Check the mai   | in breaker is of proper size, type and    | ratings.                                 |                      | Ø          |                                                  |                                                  |
|                 | and phase relation.                       |                                          |                      |            | 図                                                |                                                  |
| Check for over  | r current protection as per specification | ons.                                     |                      | X          |                                                  |                                                  |
| Complete poin   | t to point.                               |                                          |                      | Ø          |                                                  |                                                  |
| Pull, tug metho | od completed after termination.           |                                          |                      | X          |                                                  | F                                                |
| Check barriers  | or shuttles if applicable.                |                                          |                      |            | $\overline{\Box}$                                | Ø                                                |
| Perform resista | ance test on each bus section, phase      | to phase and phase to ground.            |                      | Ø          | H                                                |                                                  |
| Check for clear | nliness; wipe down barriers, cell walls   | and insulators from construction dust.   |                      | Ø          |                                                  |                                                  |
| Comments:       | Polarity and phase of                     | elation to be verific                    | ed on site (f        | તેરાત્ર    | <u> </u>                                         | manda sida da d |
| Print & Sign    | Start Old Siller-Mac Representative       | Signature _                              | owner Representative |            |                                                  | haveadura il munt il in mun advantados           |
| Date            | Oct 17/12                                 | Date                                     | , mor representative |            |                                                  |                                                  |
| SM16014/060     | 510                                       |                                          |                      |            |                                                  |                                                  |

FSM16014/060510

#### FIELD SERVICES

# MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST PAGE: 1 OF 1

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| Tag #           | KM-0010B                        | Manufacturer                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Eaton                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                         | -<br>-            |                                              |
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| Print & Sign _  | Street Old                      | Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                         |                   |                                              |
|                 | Ber-Mac Representative          | Signature —<br>Own                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ner Representative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                         | **********        |                                              |
| Date            | Oct. 17/12                      | Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | ON PARTICULAR DE L'ARTINITATION DE L'ARTINITATIO |                         |                   |                                              |

# BER-MAC ELECTRICAL (\*\*) INSTRUMENTATION

#### **FIELD SERVICES**

#### MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST

| A MEMBER OF THE   | ABB GROUP                                | OL CENTRE                                                                                                      | ACCEPTANCE              | CHECKLIST            | PAGE:                                   | 1 OF                                             | 1                                                                                                               |
|-------------------|------------------------------------------|----------------------------------------------------------------------------------------------------------------|-------------------------|----------------------|-----------------------------------------|--------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|
| Project           | BM-117                                   | Loca                                                                                                           | tion                    | MCC-100              | )-F1ML                                  |                                                  |                                                                                                                 |
| Tag #             | HVAC-101                                 | Manu                                                                                                           | ıfacturer               | Ector                | New.                                    |                                                  |                                                                                                                 |
| Туре              | BREAKER                                  | Seria                                                                                                          | <b>!#</b>               | 37 BA 24             | 901                                     |                                                  |                                                                                                                 |
| Size              | HED                                      | HZ                                                                                                             |                         | 60 HZ                |                                         |                                                  |                                                                                                                 |
| Voltage           | 480 V                                    |                                                                                                                |                         |                      |                                         |                                                  |                                                                                                                 |
| •                 |                                          | HP                                                                                                             |                         | <u> </u>             | *************************************** |                                                  |                                                                                                                 |
| AMPS              | 30 A                                     |                                                                                                                |                         |                      |                                         |                                                  |                                                                                                                 |
| Any defic         | iency on installation or acc             | ceptance must                                                                                                  | have a non-con          | formance report.     |                                         |                                                  |                                                                                                                 |
| Installatio       | on                                       |                                                                                                                |                         |                      | Υ                                       | N                                                | N/A                                                                                                             |
| Record and        | verify nameplate data in accordance      | with approved dra                                                                                              | wings and specification | ins.                 | 8                                       |                                                  | IV/A                                                                                                            |
| Verify and/or     | torque anchorage and all buss conr       | nections.                                                                                                      |                         | <del> </del>         |                                         | $\vdash \overline{\sqcap}$                       | 一团                                                                                                              |
| Verify require    | ed area clearances and proper aligni     | ment.                                                                                                          |                         |                      | T S                                     | $\vdash \overline{\Box}$                         |                                                                                                                 |
| Inspect for ex    | xternal or shipping damage.              |                                                                                                                |                         |                      | 团                                       |                                                  | $+\Box$                                                                                                         |
| Check all nar     | meplate data of cubical to drawing a     | nd specifications.                                                                                             |                         |                      | 図                                       | H                                                | $+ \overline{\Box}$                                                                                             |
| Fill out QA/Q     | C sheet on each starter.                 |                                                                                                                |                         |                      |                                         |                                                  | $+\Box$                                                                                                         |
| Check phasir      | ng of busses visually, and /or with co   | ontinuity check.                                                                                               |                         |                      |                                         | <del>                                     </del> |                                                                                                                 |
| Check all gro     | undings in accordance with the spec      | cifications.                                                                                                   |                         |                      | 8                                       | H                                                |                                                                                                                 |
| Check for cle     | anliness.                                |                                                                                                                |                         |                      |                                         |                                                  | $+ \Box$                                                                                                        |
| Comments:         | Vendor tested near                       |                                                                                                                |                         |                      |                                         |                                                  |                                                                                                                 |
| Print & Sign Date | Ber-Mac Representative  Oct 12/12        |                                                                                                                | Signatu<br>Date         | Owner Representativ  | /e                                      |                                                  |                                                                                                                 |
| Acceptance        | e Testina                                |                                                                                                                |                         |                      | Y                                       | NI NI                                            | NI/A                                                                                                            |
|                   | ations are complete & verified in acc    | ordance with appro                                                                                             | oved drawings and spe   | ecifications.        | <b>B</b>                                | N                                                | N/A                                                                                                             |
| Check all con-    | ductors are labeled & identified.        | demandent demandent demande y de de de groein far groein de demandent de demandent de de de de de de de de des |                         |                      | 图                                       |                                                  | 1                                                                                                               |
| Check all spar    | re conductors are isolated and identi    | ified.                                                                                                         |                         |                      |                                         |                                                  | 8                                                                                                               |
| Check all exte    | rnal connections.                        |                                                                                                                |                         |                      | N                                       | $\overline{\Box}$                                |                                                                                                                 |
| Check the ma      | in breaker is of proper size, type and   | d ratings.                                                                                                     |                         |                      | 8                                       | $\overline{\Pi}$                                 |                                                                                                                 |
| Verify polarity   | and phase relation.                      |                                                                                                                |                         |                      | 図                                       | H                                                |                                                                                                                 |
| Check for over    | r current protection as per specificat   | ions.                                                                                                          |                         |                      | 13                                      |                                                  | П                                                                                                               |
| Complete poin     | it to point.                             |                                                                                                                |                         |                      |                                         |                                                  |                                                                                                                 |
| Pull, tug metho   | od completed after termination.          |                                                                                                                |                         |                      |                                         |                                                  |                                                                                                                 |
| Check barriers    | or shuttles if applicable.               | openasi. Si may ayi may middidd en safarini ddiddiddiad a bu turraran ar san ay ay c safa ddigaelddiad a glyg  |                         |                      |                                         | $\overline{\Box}$                                | Ø                                                                                                               |
| Perform resista   | ance test on each bus section, phas      | e to phase and pha                                                                                             | ise to ground.          |                      | T M                                     |                                                  | F                                                                                                               |
| Check for clea    | nliness; wipe down barriers, cell wal    | is and insulators fr                                                                                           | om construction dust.   |                      | <b>X</b>                                |                                                  |                                                                                                                 |
| Comments: U       | Init tested at 480V                      | and fully                                                                                                      | functional              | (heating o           | rud co                                  | لمحملا                                           |                                                                                                                 |
| Print & Sign      | Shuart OU Sall<br>Ber-Mac Representative | 1                                                                                                              | Signature               | Owner Representative |                                         |                                                  | armanistististaminististaminististaminististaminististaminististaminististaminististaminististaminististaminist |
| Date (            | CT 17/12                                 |                                                                                                                | Date                    |                      |                                         |                                                  |                                                                                                                 |

FSM16014/060510

FSM16014/060510

#### **FIELD SERVICES**

#### MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST

PAGE: 1 OF 1 Project BM-117 Location MCC-100-F4D B-6000 Tag# Manufacturer Type **BREAKER** Serial# Size HZ 60 HZ 480 V Voltage HP **AMPS** 150 A Any deficiency on installation or acceptance must have a non-conformance report. Installation N/A N Record and verify nameplate data in accordance with approved drawings and specifications. B Verify and/or torque anchorage and all buss connections. M Verify required area clearances and proper alignment. X П Inspect for external or shipping damage. X Check all nameplate data of cubical to drawing and specifications. Fill out QA/QC sheet on each starter. Check phasing of busses visually, and /or with continuity check.  $\square$ Check all groundings in accordance with the specifications. N Check for cleanliness. K Comments: Print & Sign Signature Owner Representative Date Date **Acceptance Testing** Y N N/A Check terminations are complete & verified in accordance with approved drawings and specifications. П Ø Check all conductors are labeled & identified. Ø Check all spare conductors are isolated and identified. 図 Check all external connections. K Check the main breaker is of proper size, type and ratings. 卤 Verify polarity and phase relation. П Ø Check for over current protection as per specifications. X Complete point to point. M Pull, tug method completed after termination. N П Check barriers or shuttles if applicable. X Perform resistance test on each bus section, phase to phase and phase to ground. Check for cleanliness; wipe down barriers, cell walls and insulators from construction dust. M Comments: Print & Sign Signature Mac Representative Owner Representative Date Date

# BER-MAC ELECTRICAL INSTRUMENTATION A MEMBER OF THE ABB GROUP

FSM16014/060510

#### FIELD SERVICES

## MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST

PAGE: 1 OF 1

| Project         | BM-117                             | Location                                         | MCC-100-F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 4HL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Mine over 1-                                         |            |
|-----------------|------------------------------------|--------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------|------------|
| Tag #           | HTR-B-7001A                        | Manufacturer                                     | Eaton                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      |            |
| Туре            | BREAKER                            | Serial#                                          | 37BA 249                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 02                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                      |            |
| Size            | HAD                                | HZ                                               | 60 HZ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      |            |
| Voltage         | 480 V                              | НР                                               | w/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      |            |
| AMPS            | 15 A                               |                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      |            |
| ماکسان باسفان   |                                    |                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      |            |
| Any defic       | iency on installation o            | acceptance must have a non-conform               | mance report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      |            |
| Installatio     |                                    | fance with approved drawings and specifications. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Y                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | N                                                    | N/A        |
|                 | torque anchorage and all bus       |                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      |            |
|                 | ed area clearances and proper      |                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <del>     </del>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ᆜ                                                    |            |
|                 | xternal or shipping damage.        | angriment.                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <u> </u>                                             |            |
|                 | meplate data of cubical to drav    | ing and annifortion                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      |            |
|                 | C sheet on each starter.           | ring and specifications.                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 図                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                      |            |
|                 |                                    | 24.                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      | N.         |
|                 | ng of busses visually, and /or v   |                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <u> </u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                      | 8          |
|                 | oundings in accordance with th     | e specifications.                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Ш                                                    |            |
| Check for cle   | aniiness.                          |                                                  | N Nobel designate all administration dated an administration appropriate property and the second property and consequences of the consequences of  | N.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                      |            |
| Comments:       | Vendor fested                      | gear.                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      |            |
| Print & Sign    | Struct-OU & Ber-Mac Representative | Signature                                        | wner Representative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <del></del>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                      |            |
| Date            | Oct 12/12                          | Date —                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      |            |
| Acceptano       | ce Testing                         |                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Υ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | N                                                    | N/A        |
|                 |                                    | n accordance with approved drawings and specific | ations.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ΤĠΙ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                      | <b>1</b>   |
| Check all con   | ductors are labeled & identifie    | 1.                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      | Ø          |
| Check all spa   | re conductors are isolated and     | identified.                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                      | X          |
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# BER-MAC

#### FIELD SERVICES

## MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST

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#### FIELD SERVICES

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# BER-MAC ELECTRICAL INSTRUMENTATION A MEMBER OF THE ABB GROUP

#### **FIELD SERVICES**

## MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST

PAGE: 1 OF 1

| Project         | BM-117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Location                                         | MCC-100-R1C                              | ***          |                                    |
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| AMPS            | 150 A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                  |                                          |              |                                    |
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| Any defici      | iency on installation or                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | acceptance must have a non-conform               | nance report.                            |              |                                    |
| Installatio     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                  |                                          | N            | N/A                                |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ance with approved drawings and specifications.  | B                                        |              |                                    |
|                 | torque anchorage and all buss                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                  |                                          |              | 図                                  |
|                 | d area clearances and proper a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | dignment.                                        | E                                        | 3 0          |                                    |
|                 | ternal or shipping damage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                  | 2                                        | <b>3</b>   D |                                    |
| Check all nan   | neplate data of cubical to drawi                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ng and specifications.                           | E                                        | 1   0        |                                    |
| Fill out QA/Q0  | C sheet on each starter.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                  | E                                        |              | K                                  |
| Check phasin    | g of busses visually, and /or wit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | th continuity check.                             |                                          |              |                                    |
| Check all grou  | undings in accordance with the                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | specifications.                                  |                                          |              | $+\overline{\mathbf{n}}$           |
| Check for clea  | anliness.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                  |                                          |              |                                    |
| Print & Sign _  | Stuated & Stuate | Signature Ow                                     | vner Representative                      |              |                                    |
| Date -          | OCT 12/12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Date —                                           | 90-100-100-100-100-100-100-100-100-100-1 |              |                                    |
| Acceptanc       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                  | Y                                        | N            | N/A                                |
|                 | ductors are complete & verified in                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | accordance with approved drawings and specifical | ations.                                  |              | Ø                                  |
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|                 | e conductors are isolated and id                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | dentified.                                       |                                          |              | Ø                                  |
|                 | rnal connections.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                  |                                          |              | <b>B</b> .                         |
|                 | n breaker is of proper size, type                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | and ratings.                                     |                                          |              | N                                  |
|                 | and phase relation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                  |                                          |              | A                                  |
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| Complete point  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                  |                                          |              | A                                  |
| Pull, tug metho | d completed after termination.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                  |                                          |              | 图                                  |
| Check barriers  | or shuttles if applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                  |                                          |              | B                                  |
| Perform resista | ince test on each bus section, p                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | hase to phase and phase to ground.               |                                          |              | Ø                                  |
| Check for clear | nliness; wipe down barriers, cell                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | walls and insulators from construction dust.     | 4                                        |              | <del>-</del> 6                     |
| Comments:       | TNS-EHT-20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 00 feeders to be instr                           |                                          |              | field.                             |
|                 | Stuart Old Ser-Mac Representative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Signature Own                                    | er Representative                        |              | operations and an absolute viscosy |
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FSM16014/060510

#### FIELD SERVICES

# MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST PAGE: 1 OF 1

| Project                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | BM-117                              | Location                                      | MCC-100-R4BL          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |
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| Туре                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | BREAKER                             | Serial#                                       | 37BA 24902            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |     |
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| the same of the sa |                                     | nce with approved drawings and specifications |                       | ]                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |     |
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# BER-MAC ELECTRICAL INSTRUMENTATION A MEMBER OF THE ABB GROUP

FSM16014/060510

### FIELD SERVICES

## MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST PAGE: 1 OF 1

| Project                                                                                                                                                                         | BM-117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Location                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | MCC-100-R4DR              |                          |              |          |
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| RFR-M                                                                            | △ FIELD SERV                                          | FIELD SERVICES                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |             |                                      |  |  |
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| ELECTRICAL (*) INSTRUM<br>A MEMBER OF THE ABI                                    | MOTOR CON                                             | MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST P       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |             | PAGE: 1 OF 1                         |  |  |
| Project                                                                          | BM-117                                                | Location                                          | MCC-10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 0-R4FL       |             |                                      |  |  |
| Tag #                                                                            | UPS-100                                               | Manufacturer                                      | Enton                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |              |             |                                      |  |  |
| Type                                                                             | BREAKER                                               | Serial#                                           | 278A 1U                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 907          |             |                                      |  |  |
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| Voltage                                                                          | 480 V                                                 | нР .                                              | <u> </u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |              |             |                                      |  |  |
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| Any deficie                                                                      | ncy on installation or                                | acceptance must have a non-conform                | nance report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ,            |             |                                      |  |  |
| Installation                                                                     |                                                       |                                                   | -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Y            | N           | N/A                                  |  |  |
| ***************************************                                          |                                                       | lance with approved drawings and specifications.  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              | 14          | IV/A                                 |  |  |
|                                                                                  | orque anchorage and all buss                          |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | $+\hat{\Pi}$ |             |                                      |  |  |
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| Print & Sign B                                                                   | Stuart Old Star<br>er-Mac Representative<br>OCT 12/12 | Signature<br>Ow<br>Date                           | ner Representati                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | ve           |             | verelhoush kindama sing a dada gu ja |  |  |
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| Perform resistance test on each bus section, phase to phase and phase to ground. |                                                       |                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |             | $\overline{\mathbf{H}}$              |  |  |
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## FIELD SERVICES

## MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST PAGE: 1 OF 1

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FSM16014/060510

#### FIELD SERVICES

#### MOTOR CONTROL CENTRE ACCEPTANCE CHECKLIST

PAGE: 1 OF 1 **Project** BM-117 Location MCC-100-R4H Tag# TNS-EHT-300 Manufacturer BREAKER Type Serial# Size HZ 60 HZ Voltage 480 V HP **AMPS** 150 A Any deficiency on installation or acceptance must have a non-conformance report. Installation N/A N Record and verify nameplate data in accordance with approved drawings and specifications. П Verify and/or torque anchorage and all buss connections. 尾 Verify required area clearances and proper alignment. M Inspect for external or shipping damage. D Check all nameplate data of cubical to drawing and specifications. M Fill out QA/QC sheet on each starter. M Check phasing of busses visually, and /or with continuity check. Check all groundings in accordance with the specifications. d Check for cleanliness. B Comments: \ Print & Sign Signature Ber-Mac Representative Owner Representative Date Date Acceptance Testing N N/A Check terminations are complete & verified in accordance with approved drawings and specifications. A Check all conductors are labeled & identified. X П Check all spare conductors are isolated and identified. B Check all external connections. M Check the main breaker is of proper size, type and ratings. Ø Verify polarity and phase relation. П Z Check for over current protection as per specifications. П Z Complete point to point. Ø Pull, tug method completed after termination. 囚 Check barriers or shuttles if applicable. 

Comments:

Print & Sign

FSM16014/060510

Mac Representative

Signature

Owner Representative

П

Date

Perform resistance test on each bus section, phase to phase and phase to ground.

Check for cleanliness; wipe down barriers, cell walls and insulators from construction dust.

Date



# MOTOR STARTER ACCEPTANCE CHECKLIST

| Project         | BM-117                           |                                               | Location                 | MCC-100-F5B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            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# **FIELD SERVICES**

### MOTOR STARTER ACCEPTANCE CHECKLIST

| Project <u>BM-117</u> P & ID Tag # <u>BL-7040</u> Type <u>HMCP</u> Size <u>3</u> | Location<br>Manufacturer<br>Serial#<br>HZ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | MCC-100-F6C<br>Eaton<br>37BA 2498       | ) 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                         |                                                                                                                |
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| Any deficiency on installation or acceptance mus                                                                                                                                                                                                                                                                                                                                                                 | t have a non-confe      | ormance report.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
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| Record and verify nameplate data in accordance with approved dra                                                                                                                                                                                                                                                                                                                                                 | wings and specification | s.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
| Verify and/or torque bolted connections accordance with manufactor                                                                                                                                                                                                                                                                                                                                               | ırer specs.             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 4                                       |
| Inspect for external or shipping damage missing parts, cracks or br                                                                                                                                                                                                                                                                                                                                              | oken arc boxes.         | 图                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
| Check all circuit breakers, fuses, overloads and contractor to motor                                                                                                                                                                                                                                                                                                                                             | size.                   | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
| Check all groundings and connections are in accordance with the s                                                                                                                                                                                                                                                                                                                                                | pecifications.          | 725                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
| Check for cleanliness.                                                                                                                                                                                                                                                                                                                                                                                           |                         | E E                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | * 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                         |
| Comments: Vextor Hestel Good:                                                                                                                                                                                                                                                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
| Commens.                                                                                                                                                                                                                                                                                                                                                                                                         |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | *************************************** |
| Print & Sign Sheer + Old That                                                                                                                                                                                                                                                                                                                                                                                    |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | WARRANT CONTRACTOR OF THE PARTY |                                         |
| Ber-Mac Representative                                                                                                                                                                                                                                                                                                                                                                                           | Signature               | Owner Representative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
| Date 0c7 /2/12                                                                                                                                                                                                                                                                                                                                                                                                   | Date                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
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| Acceptance Testing                                                                                                                                                                                                                                                                                                                                                                                               |                         | Contraction of the Contraction o | N                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | N/A                                     |
| Acceptance Testing  Check terminations are complete & verified in accordance with appr                                                                                                                                                                                                                                                                                                                           | oved drawings and spec  | ifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | N D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | N/A                                     |
|                                                                                                                                                                                                                                                                                                                                                                                                                  | oved drawings and spec  | Y iffications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | N D                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                         |
| Check terminations are complete & verified in accordance with appr                                                                                                                                                                                                                                                                                                                                               | oved drawings and spec  | Y ifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Ø                                       |
| Check terminations are complete & verified in accordance with appr<br>Check all conductors are labeled & identified.                                                                                                                                                                                                                                                                                             | oved drawings and spec  | ifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Ø                                       |
| Check terminations are complete & verified in accordance with appr<br>Check all conductors are labeled & identified.  Check all spare conductors are isolated and identified.                                                                                                                                                                                                                                    | oved drawings and spec  | ifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
| Check terminations are complete & verified in accordance with approach Check all conductors are labeled & identified.  Check all spare conductors are isolated and identified.  Check all devices are of proper size ,type and rating.                                                                                                                                                                           | oved drawings and spec  | ifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
| Check terminations are complete & verified in accordance with approach Check all conductors are labeled & identified.  Check all spare conductors are isolated and identified.  Check all devices are of proper size ,type and rating.  Check all external connections.                                                                                                                                          | oved drawings and spec  | ifications.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
| Check terminations are complete & verified in accordance with appr Check all conductors are labeled & identified. Check all spare conductors are isolated and identified. Check all devices are of proper size ,type and rating. Check all external connections. Verify phases for motor rotation.                                                                                                               | oved drawings and spec  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
| Check terminations are complete & verified in accordance with appr Check all conductors are labeled & identified. Check all spare conductors are isolated and identified. Check all devices are of proper size ,type and rating. Check all external connections. Verify phases for motor rotation. Perform Meggar test on motor leads.                                                                           | oved drawings and spec  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
| Check all conductors are labeled & identified.  Check all spare conductors are isolated and identified.  Check all devices are of proper size ,type and rating.  Check all external connections.  Verify phases for motor rotation.  Perform Meggar test on motor leads.  Complete point to point.                                                                                                               | oved drawings and spec  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                         |
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# FIELD SERVICES

# MOTOR STARTER ACCEPTANCE CHECKLIST

| Project                                                                  | BM-117                                                                                   |                              | Location             | MCC-100-F6C          |                                                  |                                         |                                        |
|--------------------------------------------------------------------------|------------------------------------------------------------------------------------------|------------------------------|----------------------|----------------------|--------------------------------------------------|-----------------------------------------|----------------------------------------|
| P & ID Tag #                                                             | HM (D                                                                                    |                              | Manufacturer         | 27000100             | 9                                                |                                         |                                        |
| Туре                                                                     | TINCY                                                                                    |                              | Serial#              | 21842490             | <u> </u>                                         |                                         |                                        |
| Size                                                                     | 3                                                                                        |                              | HZ                   | 60 HZ                | -                                                |                                         |                                        |
| Voltage _                                                                | 480 V                                                                                    |                              | НР                   | 30                   |                                                  |                                         |                                        |
| AMPS _                                                                   | 100A                                                                                     |                              |                      |                      |                                                  |                                         |                                        |
| Any defici                                                               | iency on installation o                                                                  | r acceptance must h          | nave a non-confo     | ormance report.      |                                                  |                                         |                                        |
| Installatio                                                              |                                                                                          |                              |                      |                      | Υ                                                | N                                       | N/A                                    |
|                                                                          | erify nameplate data in accor                                                            |                              |                      | S.                   | 12                                               |                                         |                                        |
|                                                                          | torque bolted connections acc                                                            |                              | •                    |                      |                                                  |                                         | ₽                                      |
| Inspect for ex                                                           | ternal or shipping damage mi                                                             | ssing parts, cracks or broke | en arc boxes.        |                      |                                                  | 10                                      |                                        |
| Check all circ                                                           | uit breakers, fuses, overloads                                                           | and contractor to motor si   | Ze.                  |                      |                                                  | $\dagger \Box$                          |                                        |
| Check all grou                                                           | undings and connections are                                                              | in accordance with the spe   | cifications.         |                      |                                                  |                                         |                                        |
| Check for clea                                                           | anliness.                                                                                |                              |                      |                      | Ø                                                | 10                                      |                                        |
|                                                                          | Va. 1 - 4-1-1                                                                            |                              |                      |                      |                                                  | <u> </u>                                |                                        |
| Comments:                                                                | VEVIDOR TESTED                                                                           | gen.                         |                      |                      |                                                  |                                         |                                        |
|                                                                          | CL FAI                                                                                   | (A)                          |                      |                      |                                                  | *************************************** | 7************************************* |
| Print & Sign -                                                           | Ber-Mac Representative                                                                   | Small                        | Signature            | Owner Representative | <del>*************************************</del> |                                         |                                        |
| Date                                                                     | OCT 12/12                                                                                |                              | Date                 | - Topicsenaave       |                                                  |                                         |                                        |
| Acceptance                                                               | e Testing                                                                                |                              | Date                 |                      |                                                  | T                                       |                                        |
|                                                                          | ations are complete & verified                                                           | in accordance with approve   | ed drawings and spec | ifications.          | Y                                                | N                                       | N/A                                    |
| Check all cond                                                           | luctors are labeled & identifie                                                          | d.                           |                      |                      |                                                  |                                         |                                        |
| Check all spare                                                          | e conductors are isolated and                                                            | I identified.                |                      |                      |                                                  |                                         | 0                                      |
| Check all device                                                         | ces are of proper size ,type ar                                                          | nd rating.                   |                      |                      |                                                  |                                         | (D)                                    |
|                                                                          | rnal connections.                                                                        |                              |                      |                      |                                                  |                                         | 8                                      |
| Verify phases f                                                          | for motor rotation.                                                                      |                              |                      |                      |                                                  |                                         | <b>1</b> 20                            |
| , ,                                                                      |                                                                                          |                              |                      |                      |                                                  |                                         |                                        |
| Perform Megas                                                            | ar test on motor leads                                                                   |                              |                      |                      | П                                                |                                         | <u>u</u>                               |
|                                                                          | ar test on motor leads.                                                                  |                              |                      |                      |                                                  |                                         | Ø                                      |
| Complete point                                                           | t to point.                                                                              |                              |                      |                      | П                                                |                                         |                                        |
| Complete point                                                           | t to point.  d completed after termination                                               |                              |                      |                      |                                                  |                                         | Ø                                      |
| Complete point Pull, tug metho                                           | t to point.  d completed after termination  ment of the contactor.                       |                              |                      |                      |                                                  |                                         |                                        |
| Complete point                                                           | t to point.  d completed after termination  ment of the contactor.                       |                              |                      |                      |                                                  |                                         |                                        |
| Complete point Pull, tug methor Check the align Check for clean          | t to point.  d completed after termination  ment of the contactor.                       |                              | stalled, te          | sted in the          |                                                  |                                         |                                        |
| Complete point Pull, tug methor Check the align Check for clean          | t to point.  d completed after termination of the contactor.  hiliness.  BL-7040 Cee     |                              | stalled, te          | sted in the          |                                                  |                                         |                                        |
| Complete point Pull, tug metho Check the align Check for clean Comments: | t to point.  d completed after termination ment of the contactor.  nliness.  BL-7040 See |                              | Signature _          |                      |                                                  |                                         |                                        |
| Complete point Pull, tug metho Check the align Check for clean Comments: | t to point.  d completed after termination of the contactor.  hiliness.  BL-7040 Cee     |                              | Signature _          | when Representative  |                                                  |                                         |                                        |

# FIELD SERVICES

# MOTOR STARTER ACCEPTANCE CHECKLIST

| Project <u>BM-117</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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# FIELD SERVICES

# MOTOR STARTER ACCEPTANCE CHECKLIST

| Project         BM-117         Location                                                           | MCC-100-R4M<br>Eafon |               |                                     |
|---------------------------------------------------------------------------------------------------|----------------------|---------------|-------------------------------------|
| Type Serial#                                                                                      | 57BA24902            | _             |                                     |
| Size1 HZ                                                                                          | 60 HZ                | _             |                                     |
| Voltage HP                                                                                        | 6KW                  |               |                                     |
| AMPS                                                                                              |                      |               |                                     |
| Any deficiency on installation or acceptance must have a non-conforma                             | nce report.          |               |                                     |
| Installation                                                                                      | Y                    | N             | N/A                                 |
| Record and verify nameplate data in accordance with approved drawings and specifications.         | <b>1</b> 5           |               |                                     |
| Verify and/or torque bolted connections accordance with manufacturer specs.                       |                      |               | Ø                                   |
| Inspect for external or shipping damage missing parts, cracks or broken arc boxes.                | 423                  |               |                                     |
| Check all circuit breakers, fuses, overloads and contractor to motor size.                        | Ŋ                    |               |                                     |
| Check all groundings and connections are in accordance with the specifications.                   | (Z                   | $+$ $_{\Box}$ |                                     |
| Check for cleanliness.                                                                            |                      |               |                                     |
| Comments: Vewlac tested acac                                                                      |                      |               |                                     |
| Comments: Vewor tested gear.                                                                      |                      | A             | minimum analysis and analysis, paid |
| Print & Sign Signature Signature Owner                                                            | er Representative    |               |                                     |
| Date Date                                                                                         |                      |               |                                     |
| Acceptance Testing                                                                                | Υ                    | N             | N/A                                 |
| Check terminations are complete & verified in accordance with approved drawings and specification | ons.                 |               | 图                                   |
| Check all conductors are labeled & identified.                                                    |                      |               | 团                                   |
| Check all spare conductors are isolated and identified.                                           |                      |               | A                                   |
| Check all devices are of proper size ,type and rating.                                            | T.                   |               | 点                                   |
| Check all external connections.                                                                   |                      |               | A                                   |
| Verify phases for motor rotation.                                                                 |                      |               | Ø                                   |
| Perform Meggar test on motor leads.                                                               |                      |               | 区                                   |
| Complete point to point.                                                                          |                      |               | A                                   |
| Pull, tug method completed after termination.                                                     |                      |               |                                     |
| Check the alignment of the contactor.                                                             |                      |               |                                     |
| Check for cleanliness.                                                                            |                      |               |                                     |
|                                                                                                   |                      |               |                                     |
| Comments: MTR-TK-6270 feeders to be in stalle.                                                    | ), tested in         | Ne.           | field.                              |
| Print & Sign Short Old Signature                                                                  |                      |               |                                     |
| Oignature                                                                                         | Representative       |               |                                     |
| Date Date                                                                                         |                      |               |                                     |
| FSM16017/060510                                                                                   |                      |               |                                     |

### FIELD SERVICES

# VARIABLE FREQUENCY DRIVE ACCEPTANCE CHECKLIST

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### FIELD SERVICES

# VARIABLE FREQUENCY DRIVE ACCEPTANCE CHECKLIST

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| Acceptan<br>Check termi<br>Check all co<br>Check all sp                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | nations are complete & verified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | d.                                                                                                            | Date -                                                 |                     |                                                                                                                |                                                  |                               |
| Acceptan<br>Check termin<br>Check all co<br>Check all sp<br>Check all into                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | nations are complete & verified<br>inductors are labeled & identifier<br>are conductors are isolated and<br>ernal connections.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | d.<br>Lidentified.                                                                                            | Date -                                                 |                     |                                                                                                                |                                                  | 改改改                           |
| Acceptan<br>Check termin<br>Check all co<br>Check all sp<br>Check all int<br>Check the m                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | nations are complete & verified<br>inductors are labeled & identified<br>are conductors are isolated and                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | d.<br>Lidentified.                                                                                            | Date -                                                 |                     |                                                                                                                |                                                  |                               |
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| Acceptan Check termin Check all co Check all sp Check all int Check the m Verify polarit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | nations are complete & verified inductors are labeled & identified are conductors are isolated and ernal connections. It is a present that is a present the proper size, the proper size is and phase relation. It is a per specified as per specified in the proper size is a per specified as per specified in the proper size.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | d. I identified. pe and ratings.                                                                              | Date -                                                 |                     |                                                                                                                |                                                  |                               |
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| Acceptant Check terming Check all co Check all interpretation Check the many Verify polarity Check for ove Complete po Pull, tug metter Check barrie                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | nations are complete & verified inductors are labeled & identified are conductors are isolated and ernal connections.  It is in breaker is of proper size, ty and phase relation. It is recurrent protection as per specified to point.  In the point is inducted after termination inductions are completed after termination.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | d. I identified.  pe and ratings.  cifications.                                                               | Date –                                                 |                     |                                                                                                                |                                                  |                               |
| Acceptant Check termin Check all co Check all int Check the m Verify polarit Check for ov Complete po Pull, tug mett Check barrie Perform resis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | nations are complete & verified inductors are labeled & identified are conductors are isolated and ernal connections.  Italian breaker is of proper size, typy and phase relation.  Iter current protection as per specified to point.  The proper size of proper size of proper size, typy and phase relation.  The current protection as per specific to point.  The proper size of proper size of proper size of proper size of proper size.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | d. d identified. pe and ratings. cifications.                                                                 | Date -                                                 |                     |                                                                                                                |                                                  |                               |
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| Acceptant Check termin Check all co Check all int Check the m Verify polarit Check for ov Complete po Pull, tug mett Check barrie Perform resis                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | nations are complete & verified inductors are labeled & identified are conductors are isolated and ernal connections.  Italian breaker is of proper size, ty y and phase relation.  Iter current protection as per specified to point.  Induction the point of the proper size of the point of the  | d. d identified. pe and ratings. cifications. h.                                                              | Date -                                                 |                     |                                                                                                                |                                                  |                               |
| Acceptant Check termin Check all co Check all int Check the m Verify polarit Check for ov Complete po Pull, tug mett Check barrie Perform resis Check for cle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | nations are complete & verified inductors are labeled & identified are conductors are isolated and ernal connections.  Italian breaker is of proper size, ty y and phase relation.  Iter current protection as per specified to point.  Induction the point of the proper size of the point of the  | d. I identified.  pe and ratings.  cifications.  phase to phase and phase to ell walls and insulators from co | Date -                                                 |                     |                                                                                                                |                                                  |                               |
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| Acceptant Check termin Check all co Check all int Check the m Verify polarit Check for ov Complete po Pull, tug mett Check barrie Perform resis Check for cle                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | nations are complete & verified inductors are labeled & identified are conductors are isolated and ernal connections.  Italian breaker is of proper size, to a y and phase relation.  Iter current protection as per specified to point.  Induction to point and the proper size of a point to point.  In a point to point and the proper size of a point to a point a point and the point are so a shuttles if applicable.  Italian to be a point and the proper size of the point and the po | d. I identified.  pe and ratings.  cifications.  phase to phase and phase to ell walls and insulators from co | Date — drawings and specifi  ground. enstruction dust. | cations.            |                                                                                                                |                                                  |                               |
| Acceptant Check termin Check all co Check all sp Check all int Check the m Verify polarit Check for ov Complete po Pull, tug mett Check barrie Perform resis Check for cle Comments:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | nations are complete & verified inductors are labeled & identified are conductors are isolated and ernal connections.  Italian breaker is of proper size, ty y and phase relation.  Iter current protection as per specified to point.  Induction the point is applicable.  In stance test on each bus section.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | d. I identified.  pe and ratings.  cifications.  phase to phase and phase to ell walls and insulators from co | Date — drawings and specifi  ground. enstruction dust. |                     |                                                                                                                |                                                  |                               |

### **FIELD SERVICES**

# VARIABLE FREQUENCY DRIVE ACCEPTANCE CHECKLIST

| Project BM-117 Location  Tag # PM-6000 Manufactor  Type BREAKER Serial#  Size N/A HZ  Voltage 480 V HP  AMPS 100  Any deficiency on installation or acceptance must have a none | 37BA2490Z<br>60 HZ              |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------|
| Installation                                                                                                                                                                    | Y N N/A                         |
| Record and verify nameplate data in accordance with approved drawings and spec                                                                                                  | sifications.                    |
| Verify and/or torque anchorage and all buss connections.                                                                                                                        |                                 |
| Verify required area clearances and proper alignment.                                                                                                                           |                                 |
| Inspect for external or shipping damage.                                                                                                                                        |                                 |
| Check phasing of busses visually, and /or with continuity check.                                                                                                                |                                 |
| Check all groundings in accordance with the specifications.                                                                                                                     |                                 |
| Check for cleanliness.                                                                                                                                                          |                                 |
| Print & Sign Shart Old States  Ber-Mac Representative                                                                                                                           | Signature                       |
| Oct 12/12                                                                                                                                                                       | Owner Representative  Oate      |
| Acceptance Testing                                                                                                                                                              | Y N N/A                         |
| Check terminations are complete & verified in accordance with approved drawings a                                                                                               |                                 |
| Check all conductors are labeled & identified.                                                                                                                                  |                                 |
| Check all spare conductors are isolated and identified.                                                                                                                         |                                 |
| Check all internal connections.                                                                                                                                                 |                                 |
| Check the main breaker is of proper size, type and ratings.                                                                                                                     |                                 |
| Verify polarity and phase relation.                                                                                                                                             |                                 |
| Check for over current protection as per specifications.                                                                                                                        |                                 |
| Complete point to point.                                                                                                                                                        |                                 |
| Pull, tug method completed after termination.                                                                                                                                   |                                 |
| Check barriers or shuttles if applicable.                                                                                                                                       |                                 |
| Perform resistance test on each bus section, phase to phase and phase to ground.                                                                                                |                                 |
| Check for cleanliness; wipe down barriers, cell walls and insulators from construction                                                                                          | n dust.                         |
| Comments: Unit to be dested in the field.                                                                                                                                       |                                 |
| Print & Sign Steer Cl. Co. Sign                                                                                                                                                 |                                 |
| Ber-Mac Representative                                                                                                                                                          | gnature<br>Owner Representative |

### **FIELD SERVICES**

# VARIABLE FREQUENCY DRIVE ACCEPTANCE CHECKLIST

|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                |                             | 11-11-11                               |                  |                          |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------|-----------------------------|----------------------------------------|------------------|--------------------------|
| Project         | BM-117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Location                                       | MCC-100-R6M                 |                                        |                  |                          |
| Tag #           | ACM-5020                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | Manufacturer                                   | Eator                       |                                        |                  |                          |
| Туре            | BREAKER                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Serial#                                        | 37BA24902                   |                                        |                  |                          |
| Size            | N/A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                                | / <sub>\(\Delta\U_2\)</sub> |                                        |                  |                          |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | HZ                                             |                             |                                        |                  |                          |
| Voltage         | 480 V                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | НР                                             | 25                          |                                        |                  |                          |
| AMPS            | 50 A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                |                             |                                        |                  |                          |
| Any defi        | ciency on installation or                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | acceptance must have a non-confor              | mance report.               |                                        |                  |                          |
| Installati      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                | positiones                  | Υ                                      | N                | NI/A                     |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | nce with approved drawings and specifications. |                             |                                        | N                | N/A                      |
|                 | or torque anchorage and all buss                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                |                             |                                        | $\overline{\Pi}$ | 8                        |
| Verify requir   | red area clearances and proper                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | ignment.                                       |                             | 虱                                      | H                |                          |
| Inspect for e   | external or shipping damage.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                |                             | 3                                      |                  |                          |
| Check phas      | ing of busses visually, and /or w                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | n continuity check.                            |                             | -                                      | ౼                |                          |
| Check all gr    | oundings in accordance with the                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | specifications.                                |                             |                                        | 뉴                |                          |
| Check for cl    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                | *                           |                                        |                  |                          |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                |                             |                                        |                  |                          |
| Comments:       | Vendor Yesled                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | OCOV.                                          |                             | -                                      |                  |                          |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                |                             |                                        |                  |                          |
| D-3-4 0 03      | Ch. 4-OIL Ch                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | tov .                                          |                             | ······································ |                  |                          |
| Print & Sign    | Ber-Mac Representative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Signature _                                    | wner Representative         |                                        |                  |                          |
| Date            | Oct 12/12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                                                | who riepresentative         |                                        |                  |                          |
| Date            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Date -                                         |                             |                                        |                  |                          |
| Acceptan        | ce Testing                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                                                | Stanfordation.              | /                                      | N                | N/A                      |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | accordance with approved drawings and specifi  | cations.                    | ]                                      |                  | 43                       |
|                 | nductors are labeled & identified                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                |                             | J                                      |                  | Ø                        |
|                 | are conductors are isolated and                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | entified.                                      |                             | ]                                      |                  | Ø                        |
|                 | ernal connections.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                                |                             | ]                                      |                  | Ø                        |
|                 | ain breaker is of proper size, typ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | and ratings.                                   | L                           |                                        |                  | 凶                        |
|                 | y and phase relation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                | L.                          |                                        |                  | Ø                        |
|                 | er current protection as per spec                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | ications.                                      | L.                          | ]                                      |                  | Ø                        |
| Complete poi    | Walter Commence of the Commenc |                                                |                             | ]                                      |                  | Ø                        |
|                 | nod completed after termination.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                                |                             | ]                                      |                  | Ø                        |
|                 | rs or shuttles if applicable.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                                                |                             |                                        |                  | Ø                        |
|                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | hase to phase and phase to ground.             |                             |                                        | J                | 7                        |
| Crieck for cie. | aniiness; wipe down barriers, ce                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | walls and insulators from construction dust.   | L                           |                                        |                  |                          |
| Comments:       | Unit to be do                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | ted in the tipl                                |                             |                                        |                  |                          |
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|                 | STALL SE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | /                                              |                             |                                        |                  |                          |
| Print & Sign    | Ber-Mac Representative                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Signature                                      |                             |                                        | -                |                          |
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| Date            | Oct 17/12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Date                                           | mer Representative          |                                        |                  |                          |



#250 42<sup>nd</sup> Avenue S.E. Telephone: (403) 287-6026 Calgary, Alberta T2G 1Y4 Facsimile: (403) 287-6099

|                     | SHIP LOOSE PA                                                                                     | ACKING LIST Page/_ of/      | ,           |
|---------------------|---------------------------------------------------------------------------------------------------|-----------------------------|-------------|
|                     |                                                                                                   | Job Name: Cadotte Pilot CSS |             |
| Customer Name: Mu   | iphy Oil Corporation                                                                              | Customer Ref.:              | nonantana.  |
|                     | materials shipped from site:                                                                      |                             |             |
| Forwarded to:       |                                                                                                   | Title:                      | *********** |
| Completed by: Stuce | omer Representative - Name & Signature,  A Cla Signature,  Mac Representative - Name & Signature) | Ni Li                       |             |
| Date:               | No. of Pieces:                                                                                    |                             | **********  |
|                     |                                                                                                   |                             |             |

| Date:                                  | No. of Pieces:                                     |
|----------------------------------------|----------------------------------------------------|
| Quantity                               | Description (use proper part no. where applicable) |
|                                        | Red Strobe                                         |
| 1                                      | Amber Strobe                                       |
|                                        | Blue Strobe                                        |
| <u>į</u>                               | Box of Equipment Instructions and Manuals          |
| 14                                     | Fluorescent light Tubes                            |
|                                        | Ouellet Unit Heater 480V                           |
|                                        | Controllogix 32 T Sinking Point Module             |
|                                        | Controllogix 32 Point DO Module                    |
|                                        | CLX HI-CAP ENET/IP Module                          |
|                                        | ControlLogix 8 Point A/O Module                    |
|                                        | Boxes PLC Components                               |
|                                        | · Allen Bradley 'Cat No. 1756L63                   |
|                                        | · Allen Bradley Cat. No. 17560B16E                 |
|                                        | Converter                                          |
| 1904                                   | as suff red me drawing                             |
| 1 Set                                  | QAQC downerts                                      |
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# PROJECT TURNOVER NOTICE PAGE: 1 OF 1

| PROJECT: BM-117                                                  |                                           |
|------------------------------------------------------------------|-------------------------------------------|
| JOB: BU-1100 MCC/I/A BLDG                                        | LOCATION: WARNICK INDUSTRIES CALGARY PO#: |
| OOD. ON THOS MEETENA BLASCI                                      | PO#:                                      |
| 1. THE FOLLOWING FACILITIES AND/OR EQUIP                         | MENT ARE COMPLETE AND ARE BEING TURNED    |
| OVER TO THE CLIENT FOR THEIR CUSTODY                             | , CONTROL, AND MAINTENANCE:               |
| BU-1100                                                          |                                           |
|                                                                  |                                           |
|                                                                  |                                           |
|                                                                  |                                           |
|                                                                  |                                           |
| 2. WORK TO BE COMPLETED AS PER ATTACH                            | ED (DUNOU LICT)                           |
|                                                                  |                                           |
| RE-TOROUNG OF ALL SPLICES AFTE<br>STALLATION OF BEACONS; THISTAL | of SHIPPING; TERMINATION/IN-              |
| CAMACOIDS; INSTALL GROUND CAPLE                                  | CAMA CHILDRAN COLD TO AC OUR              |
| INSTALL GROUND LABLE FROM PLC TO                                 | from BUILDING GRID TO AC BUS,             |
| NON-TERMINATED CONDUCTORS UPON                                   | CLARIFICATION BY IMV VISTA.               |
| TERMINATE HORN AH-1100 AT DEVICE.                                | TEMPLE (CALLON B) DOLY VISIA,             |
|                                                                  |                                           |
|                                                                  |                                           |
| 3. THE CLIENT SHALL ASSUME RESPONSIBILIT                         | Y OF THE EQUIPMENT SYSTEMS AND WILL       |
| NOTIFY THE CONTRACTOR IMMEDIATELY IF                             | ANY FURTHER WORK IS TO BE PERFORMED       |
| UNDER THIS CONTRACT WITH THE EXCEPTION                           | ON OF THE ATTACHED ITEMS.                 |
| 4. DESCRIPTION OF WORK COMPLETED:                                |                                           |
|                                                                  | A Manna A Lann and the Davis              |
| LIST ITEMS.                                                      | M 16000A/090208, LESS PUNCH-              |
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| 5. EFFECTIVE DATE OF TURNOVER:                                   |                                           |
|                                                                  |                                           |
| BER-MAC REPRESENTATIVE:                                          |                                           |
| NAME: SIGNATURE:                                                 | DATE:                                     |
| A SI I                                                           | EL IX/12                                  |
| / / tvort                                                        | Ula 1 45. 10/14                           |
| CLIENT REPRESENTATIVE:                                           | <b>V</b>                                  |
| NAME. A SIGNATURE !                                              | DATE: Of se                               |
| Sustry North                                                     | DATE: COV 18/12                           |
|                                                                  |                                           |
| - 1011                                                           | C 1 S                                     |
| ESMITTANTINETIERE                                                | J. Nov roll                               |
| FSM17001/050808 ON IN 10 HODE                                    | J. On. V.                                 |
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# **PUNCH LIST**

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| Murphy Cadotte Pilot CSS          | Project #:BM-117                          | Location / Module: BU 1100   |   |
|-----------------------------------|-------------------------------------------|------------------------------|---|
| Date of Inspection: Inspected By: | Project Name:<br>Murphy Cadotte Pilot (SS |                              |   |
| CETEBER 10 2012                   | Date of Inspection:                       | Inspected By: Sway NARRY ANA | 1 |

Preliminary (Internal) Inspection prior to turnover to Customer

Final Inspection of Sub-contracted work

| Item #                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Description                                                        | Priority<br>(1,2 or 3) | Schedule to Complete   | Date<br>Completed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                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                                               | Re-torque all bus splices after shipping.                          | erionenge.             |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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| hame.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Mount alarm beacons on respective mosts and terminate.             | 2                      |                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 10 8       | AT! 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| The second secon | Install cable tags and lamacoids.                                  | 2                      | 2012<br>S-             | Det 23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | D          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Install ground to AC Bus from grid and ground to iso. bus from TLC | 2                      | - Complete as a second | Secretary Secret | 10 -       | Nt                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| CONTRACTOR  | Terminate wires still pending information from Vista.              | - Automating           | Oσ23<br>2012           | Oct 23                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 10.        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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                                               | Terminate horn AH-1100 at device.                                  | 2                      | 80                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  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FSM18001/061120



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FSM18001/061120



FIELD FABRICATION: MODULE COMPLETION CHECKLIST

| Completed By: Client Representative: |                                                                                                                  |                |              |                 |  |  |
|--------------------------------------|------------------------------------------------------------------------------------------------------------------|----------------|--------------|-----------------|--|--|
| Co                                   | ompleted By: Client Represe                                                                                      | illative.      | (Signa       | ture)           |  |  |
| Ans                                  | swer questions with a "√". If answer is "No", provide comment at                                                 | bottom of page | , or on reve | erse            |  |  |
|                                      |                                                                                                                  | Yes/           | <u>No</u>    | Date            |  |  |
| 1.                                   | Has internal point to point check been completed?                                                                | <b>U</b>       | U _          | <u>OCT 21/1</u> |  |  |
| 2.                                   | Did owner witness check out?                                                                                     |                |              | 000 21/1        |  |  |
| 3.                                   | Are all tech cables tagged correctly?                                                                            |                |              | OCT 21/17       |  |  |
| 4.                                   | Is every wire tagged correctly?                                                                                  |                |              | 000 21/12       |  |  |
| 5.                                   | Are all clamps in place and tight?                                                                               | <b>U</b>       | 0            | 021/13          |  |  |
| 6.                                   | Is all conduit straight and true?                                                                                |                |              | 0012412         |  |  |
| 7.                                   | Have lights been hung and energized?                                                                             | <u>M</u>       |              | OCT 21/1        |  |  |
| 8.                                   | Have fans, heaters, receptacles, etc. been energized?                                                            | les .          |              | 00-21/1         |  |  |
| 9.                                   | Are junction boxes complete and secure?                                                                          | 9              |              | Oct 21/15       |  |  |
|                                      | Are all end devices installed?                                                                                   |                | <b>0</b>     | OCT 21/1        |  |  |
|                                      | Have seals been packed and poured?                                                                               | U              |              | Oct 21/17       |  |  |
|                                      | Are junction boxes clear of vents and windows?                                                                   | <u>a</u>       |              | Oct 21/1        |  |  |
|                                      | Have all tools and materials been returned to supply?                                                            | u d            |              | Der 21/1-       |  |  |
|                                      | . Is worksite cleaner than the way you found it?                                                                 | 50/            |              | OCT 22/1        |  |  |
|                                      | . Have as-builts been turned in?                                                                                 |                |              |                 |  |  |
|                                      | . Have all questions regarding as-builts been answered?                                                          | <b>4</b>       | 0<br>52      | OCT 22/1        |  |  |
|                                      | . Has all grounding been completed?                                                                              | u<br>n/        | _            | OCT 22/1        |  |  |
| 18.                                  | . Is the module (as per defined scope) 100 % complete?                                                           | <b>4</b>       |              | -12/1           |  |  |
| Co                                   | mments                                                                                                           |                |              |                 |  |  |
| RI<br>Qu                             | #11: No explosion-proof seals in the # 8: Francisco the following circuits Alghts of receptacles HVACIOO, HVACIO | 25 yers        | ontside      | lights, insi    |  |  |

### FIELD FABRICATION: MODULE COMPLETION CHECKLIST

**PAGE: 2 OF 2** 

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| RFK-WAC                                                     | FIELD SERVICES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |
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| ELECTRICAL (*) INSTRUMENTATION<br>A MEMBER OF THE ABB GROUP | SIGNATURE & INITIAL                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | LOG                 |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | PAGE: 1 OF 1 |
| Project #:                                                  | BM-117                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |
| Project Name:                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |              |
| \ \                                                         | Nurphy Cade                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | othe Pilot CSS - Bu | Allog MCC                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |              |
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| First                                                       | and Last Name                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | Company Name        | Signature                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Initial      |
| Stuart                                                      | 019                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ABB Ber Mac         | ALO/                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 20           |
| Iciotan                                                     | Campbell                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ABB Ber Mac         | Interfrench                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |              |
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#### Warwick Industries

Document No: W28406 Revision: 0

#### INSPECTION AND TEST PLAN

Customer: ABB Ber-Mac C/O MURPHY OIL MCC BU-1100 Project Description: Project/Location: CADOTTE HEAVY OIL FIELD, PEACE RIVER ALBERTA Job Number: W28406 Customer Reference: PO 4500497048 Point of Manufacture: Calgary AB, Canada DESIGN & FABRICATION BY WARWICK INDUSTRIES LTD Quality Management System Reference Document(s) Quality Activity to be Completed or Characteristic to be inspected/Tested Verifying Documents WARWICK ARR BER-MAC Responsibility Acceptance Criteria Initial Date Initial Date GENERAL Warwick Best Practices 1.0 Inspection and Test Plan (ITP) Client Approval Signature Stamped ITP SMS Apr. 25 and/or Quality Plan Cross-reference BOM with IFC Drawings Warwick Best Practices Signed BOM/IFC Drawings Warwick Signed BOM SMS 6/22/12 and/or Quality Plan Cross-reference Shipped Materials to Packing Slips Warwick Best Practices and/or Quality Plan Signed Packing Slips/Bills of Lading Warwick Packing Slips/Bills of Lading SMS 6/22/12 R WELDING Warwick Best Practices and/or Quality Plan CWB W47.1 (spec, contro Welding Procedures Approved (WPS) Warwick R Myzin Approved & Stampe SB Warwick Best Practices and/or Quality Plan CWB W47.1 (spec, control Warwick Approved & Stampe В May 2/12 procedure, drawing, other) Warwick Best Practices and/or Quality Plan CSA W178.1 (spec, control procedure, drawing, other) NDE Procedures Approved Approved & Stampe В Sh May 2/14 Warwick Best Practices and/or Quality Plan CSA W178.2 (spec, control NDE Technicians Approved Warwick Approved & Stampe R Manulh procedure, drawing, other) Warwick Best Practices and/or Quality Plan CSA W-59 (spec, control procedure, drawing, other) Signed Inspection Report Weld Inspection Warwick R So myzn CWB 47.1 (spec, control procedure, drawing, other) 2.7 Visual Inspection of Welding Warwick Supplier Procedures R SB May 21 CWB 47.1(spec, control procedure, drawing, other) Weekly Third Party Level II Welding 2.8 Warwick Supplier Procedures н BUILDINGS AND ARCHITECTURAL 3.0 Approval of Drawings Approved/Stamped Drawings Approved IFC Drawings MAGIGA Warwick Warwick Best Practices Sms Approved Drawings (spec. Field Inspection 3.1 Doors (Manual) Warwick Warwick Best Practices м control procedure, drawing Checklist FORM July 3/12 Smo other)
Approved Drawings (spec, control procedure, drawing, WAR-003 Field Inspection 3.2 Windows Warwick М Warwick Best Practices Checklist FORM 1.13/12 8mo control procedure, drawing, other)
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Field Bldg Inspection FORM WAR-002

Approved & Stamped

Drawing Submittal

ITP Acceptance

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| ITP APPROVED: |       |         |
|---------------|-------|---------|
| CONTRACTOR:   | DATE: | De15/12 |
| ABB BER-MAC   | DATE: |         |

Warwick

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Warwick

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M= Monitor

Warwick Best Practices

Supplier Procedures

Supplier Procedures

Warwick Best Practices

Warwick Best Practices

R= Document Review W= Witness Point

CWB 47.1

CSA-S16.1

Warwick

Warwick

3.9

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Final Building Inspection

FABRICATION Company Certification

Engineered Drawings

As-Builts/Red-line Drawings

Furnover Documentation



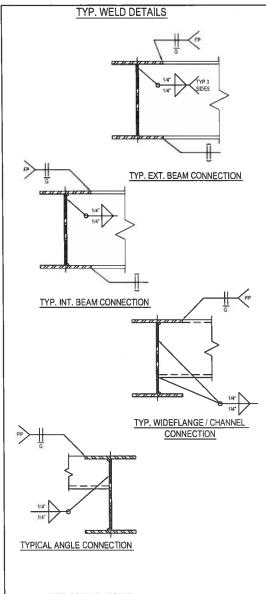
6999 - 84<sup>th</sup> Street SE Calgary, AB Canada T2C 4T6

Phone: 403-720-9425 Fax: 403-720-9426

# **FIELD INSPECTION CHECKLIST**

| CUSTOMER: Ass/ Bumas                                                                                                                                     | - 10 - 14 - 14 - 14 - 14 - 14 - 14 - 14                                                                                          |        |  |  |  |
|----------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------|--------|--|--|--|
| LOCATION: WARMER YARD                                                                                                                                    |                                                                                                                                  |        |  |  |  |
| JOB #: _ W28406                                                                                                                                          |                                                                                                                                  |        |  |  |  |
| P.O.#:                                                                                                                                                   | Unit #:                                                                                                                          |        |  |  |  |
| DESCRIPTION OK N/A                                                                                                                                       | DESCRIPTION                                                                                                                      | OK N/A |  |  |  |
| Skid leveled Cross braces Ridge Roof caulked Insulation Vapor barrier Liner Liner caulked Doors caulked Windows caulked Louvers caulked Doors & hardware | Sectional doors Roll-up doors Eavestrough Ice rakes T.R.P. Canopies Fans Door IWG Removable panels Windows Louvers Site clean-up |        |  |  |  |
| Date:                                                                                                                                                    |                                                                                                                                  |        |  |  |  |
| Field Crew Chief's Printed Name:                                                                                                                         | DEAN HARVEY                                                                                                                      |        |  |  |  |
| Field Crew Chief's Signature:                                                                                                                            |                                                                                                                                  |        |  |  |  |
| Customer's Representative Printed Nam                                                                                                                    | ne:                                                                                                                              |        |  |  |  |
| Customer's Representative Signature:                                                                                                                     |                                                                                                                                  |        |  |  |  |
| Customer's Representative Comments:                                                                                                                      |                                                                                                                                  |        |  |  |  |
|                                                                                                                                                          | ·                                                                                                                                |        |  |  |  |
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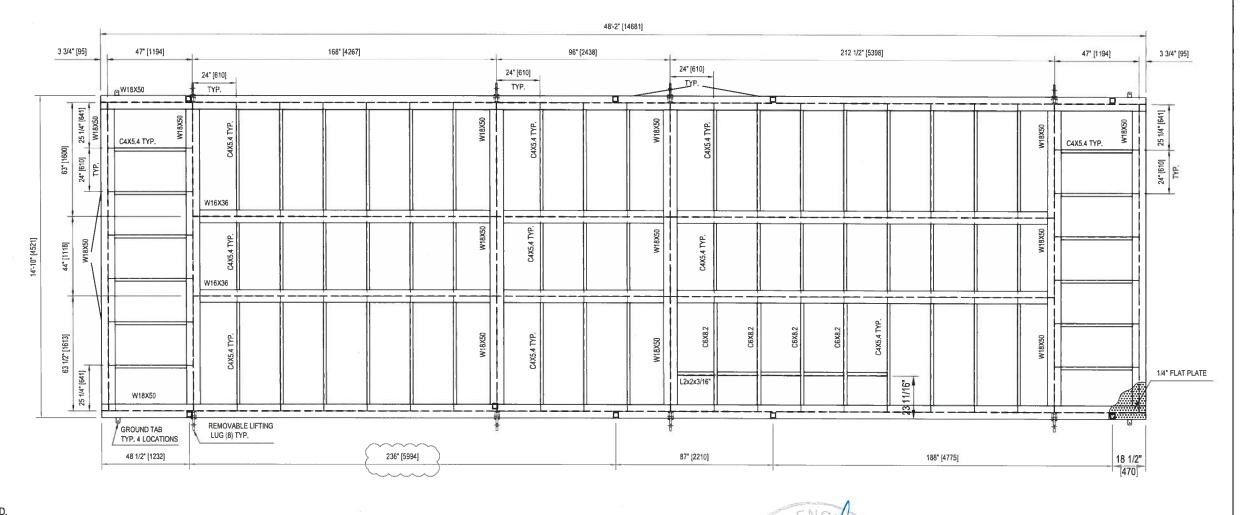
#### **NOTES:** - EXTERIOR WALLS TO BE: 22 GA. GALVALUME - CLIMASEAL FASTENERS APPROX. BLDG. DIMENSIONS: (FOR SHIPPING) SITE LOADS FOR AB P.ENG STAMP: LOCATION: 13-09-085-17 W5M - EXTERIOR ROOF TO BE: 22 GA. GALVALUME OVERALL WIDTH = 196" [16'-4"] (INCLUDED EAVESTROUGHS & LIFTING LUGS) - CAULKED INTERIOR JOINTS - EXTERIOR TRIM TO BE: 22 GA. GALVALUME - OVERALL HEIGHT = 205" [17'-1"] (FROM BTM OF SKID TO RIDGE CAP) NEAREST TOWN = PEACE RIVER, AB - ALL CABLE TRAY CUT-OUTS TO BE COORDINATED WITH ELECTRICAL - DOORS TO BE PAINTED: GREY 1/50 SNOW = 2.2 kPa - ROLL-UP DOORS TO BE PAINTED: -NONE 1/50 WIND = 1.12 kPa CONTRACTOR - INTERIOR LINER TO BE: SEE DWG -BUILDING IS DESIGNED TO COMPLY WITH THE N.B.C 2005 AS PER THE HVAC (BASED ON NON-CLASSIFIED AREA): WIND AND SNOW LOAD SPECIFIED ON THE DRAWING. OWNER SHALL - INSULATION IN WALLS: R12 BATT INSULATION CONTACT WARWICK INDUSTRIES IF ACTUAL BUILDING LOCATION DIFFERS - 17 KW OF HEAT GAINS (T.B.C.) - INSULATION IN ROOF: R20 BATT INSULATION FROM THOSE SHOWN, IN ORDER TO VALIDATE THE SUITABILITY OF - VAPOUR BARRIER TO BE: 6 mil. - BASED ON 3 ACPH CONTINOUS DESIGN FOR THE INTENDED LOCATION. - MCC/IA BLDG: SURFACE AREA = 2,365 SQ.FT - (2) BARD PACKAGE WALL MOUNT UNITS W48A1-C15 EPXXXJ C/W APPROX. TOTAL SHIPPING WEIGHT = 53,958 lbs (24,628 kg) (BLDG, SKID & EQUIPMENTS) 4 TON COOLING AND 15 KW OF HEAT 480/3/60 - SUPPLY / RETURN GRILLES 48'-2" [14681](578") - J CONTROL MODULE - TEC 40 TEMPERATURE CONTROLLER C/W TEC 40 TO CONTROL BARD UNIT AND UNIT HEATER, FIRE SHUTDOWN CONTACT, (B) (B) COMMON TROUBLE ALARM FROM UNIT - NOTE: FAN TO RUN CONTINUOUSLY, BALANCED TO 3 ACPH #26 #25 #24 #23 - 8 WEEK DELIVERY 20° 20" 14" - 1-15 KW OAS ELECTRIC UNIT HEATER 480/3/60 C/W WALL BRACKET AND BUILT IN THERMOSTAT (INSTALLATION BY OTHERS) - COMPRESSOR ROOM: - 1-ET12-1 GP EXHAUST FAN 120/1/60 1140 RPM MOTORTEFC 20 GA. WHITE PERFORATED ALUM. (10 %) ABOVE 3' IWG W/ 24 GA. WHITE FLUTED ALUM, BELOW 3' (I/A ROOM ONLY, MCC ROOM WHITE FLUTED ALUM,) C/W SHUTTER, BACK GUARD AND HOOD 3' x 7' (LH)20GA 3' x 7' (RH) - 1-18"X18" XF445W FIXED INTAKE LOUVER C/W BDX DAMPER. 0 GA.DOOR DOOR c/w PH-LC, CC c/w 2 B-BOLTS FILTER AND HOOD WS, <u>ALUM.</u> THRESHOLD CC. SWEEP. - 1-15 KW OAS ELECTRIC UNIT HEATER 480/3/60 C/W WALL BRACKET 18GA, FRAME SWEEP DO R12 INS. AND BUILT IN THERMOSTAT 18GA. FRAME TE I I SEE RETURN OPENING 152 11/16" #15C S \ \ 4:12 151 5/16 SUPPLY OPENING\_ #28 RO = 31" x 16 7/8" RO = 31" x 10 7/8" 158" FINISH = 29 7/8" x 15 7/8" FINISH = 29 7/8" x 9 7/8" 159 5/16° #14 249" [E325] #29 251 1/2" [6388] #13 164 11/16" DOOR CTR 166° #30 167 5/16\* 58 5/16 3' x 7' (RH)20GA, DOOR #31 🛂 c/w PH-LC, CC, WS 172 11/16" ALUM. THRESH SWEEP, DC, R12 INS. 69 11/16" 18GA FRAME 179 5/16\* 3' x 7' (LH) 20GA,DOOR #33 % 179 11/16"(PEAK c/w 2 - B-BOLTS #10 173 5/16° LCC SWEEP 20° 20" #34 R12 INS. 18GA, FRAME 170 5/16° SUPPLY OPENING 58.5/16\* OCT. 3,2012 RO = 31" x 10 7/8" #35 ROOF PANELS = 93 13/16" FINISH = 29 7/8" x 9 7/8" 160 11/16 #7 70 13/16" (B) (B) E (S) (S) RETURN OPENING #36 I/A ROOM MCC ROOM FINISH = 29 7/8" x 15 7/8" 217 11/16\* (5529) 4:12 #1C 150" 20\* 20° 20" 20" 20" 20° 20" 20" 20" 20" 20° 172 7/8" 170 7/8" 158 7/16" [3810](150") 6999 84 ST SE, - ALL WALL PANELS ARE TO BE TYPICAL B/S (BIG / SMALL ENDS) PANELS UNLESS NOTED. Calgary, Alberta, T2C 4T6 ALL DIMENSIONS ARE IN INCHES AND DECIMAL INCHES. Telephone (403) 720-9425, DO NOT SCALE DRAWINGS. Fax (403) 720-9426 **INDUSTRIES**LTD ALL DIMENSIONS TO WINDOWS AND DOORS ARE TO ROUGH OPENINGS. 15/06/2012 KW CONFIRM LOCATION OF ANY LOUVERS AND OR FANS PRIOR TO HVAC UPDATED, BLDG WT UPDATED, IFA 22/05/2012 JSG INSTALLATION REVISED AS NOTED 27/04/2012 KW CENTER BUILDING ON SKID REVISED AS PER MARK-UPS 23/04/2012 KW BUILDING INSTALLATION & ASSEMBLY SHALL BE AS PER WARWICK FOR APPROVAL -----INSTALLATION MANUAL, AND DETAILS. WHERE THERE ARE CONFLICTS Rev. No. Description INFORMATION ON DRAWINGS SHALL BE TAKEN AS CORRECT CUSTOMER -ABB BERMAC REFERENCE CADOTTE PILOT CSS DS = DOUBLE GLAZED RIDGE LAY-OUT CC = CHECK CHAIN 4" BOX-OUT CUSTOMER P.O.# -4500497048 IWG = INDUSTRIAL WIRE GLASS WS = WEATHERSTRIPPING 93 13/16" , 22 3/16" LOCATION -WARWICK'S YARD DC = HYDRAULIC CLOSURE RH = RIGHT HAND SWING 120" BLANKED DATE REQUIRED I-APRII SG = INTERIOR SLIDE GATE 96" BLANKED X 120° BLANKED c/w BOX-OUT 96° BLANKED 120° BLANKED LH = LEFT HAND SWING JOB NUMBER W28406 GA = GAUGE PH = PANIC HARDWARE ACTIVE ACTIVE LC=LOCK CYLINDER INS = INSULATED DRAWING# W28406-01 R-12 = CORE INSULATION (R-12) LS= LOCK SET Dwg Name SHOP & FIELD PRINT

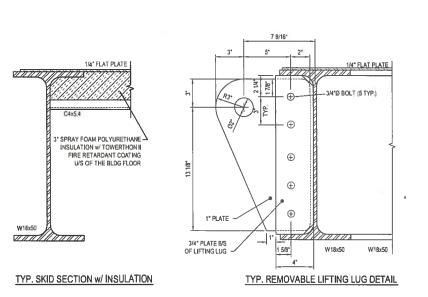


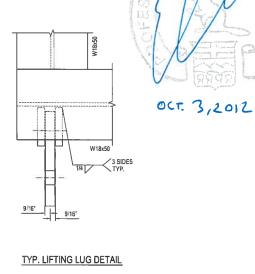
#### SKID / STEEL NOTES:

- WELDING SHALL BE IN GENERAL CONFORMANCE WITH CSA W59-2003.
- WELDS TO BE 1/4" CONTINUOUS FILLET WELD UNLESS NOTED. - CHECKER PLATE TO BE STITCH WELDED TO SKID USING 3/16\* FILLETS 2" AT 12" INTERVALS.
- CHECKER PLATE SEAMS TO BE WELDED CONTINUOUSLY ON ONE SIDE.
- ALL WORK SHALL GENERALLY CONFORM TO THE LATEST EDITIONS OF THE FOLLOWING CODES AND STANDARDS:

  - \* CISC HANDBOOK OF STEEL CONSTRUCTION
- ALL STEEL SHALL BE OF NEW STOCK AND SHALL BE IN ACCORDANCE WITH CSA G40.21-M.
  - \* STRUCTURAL STEEL = GRADE 350W
  - \* CHANNELS & ANGLES = GRADE 300W
  - \* LIFTING LUGS= GRADE 300W
  - \* CHECKER & FLAT PLATE = GRADE 300W
- FILLER METAL SHALL CONFORM TO CSA STD. W48.5-M -E4802C-6-CH.
- 3"-R20 SPRAY FOAM POLYURETHANE INSULATION w/ TOWERTHON II FIRE RETARDANT COATING U/S OF THE BLDG FLOOR
- -1/4" FLAT PLATE DECKING W/ ANTI-SLIP PAINT
- SSPC-SP-6 SURFACE PREPARATION
- PRIME WITH ONE COAT OF CLOVERDALE 710 SERIES PRIMER
- TOPCOAT WITH ONE COAT OF CLOVERDALE 74 SERIES INDUSTRIAL ENAMEL
- FINISH COLOR IS TO BE BLACK







INDUSTRIESITO

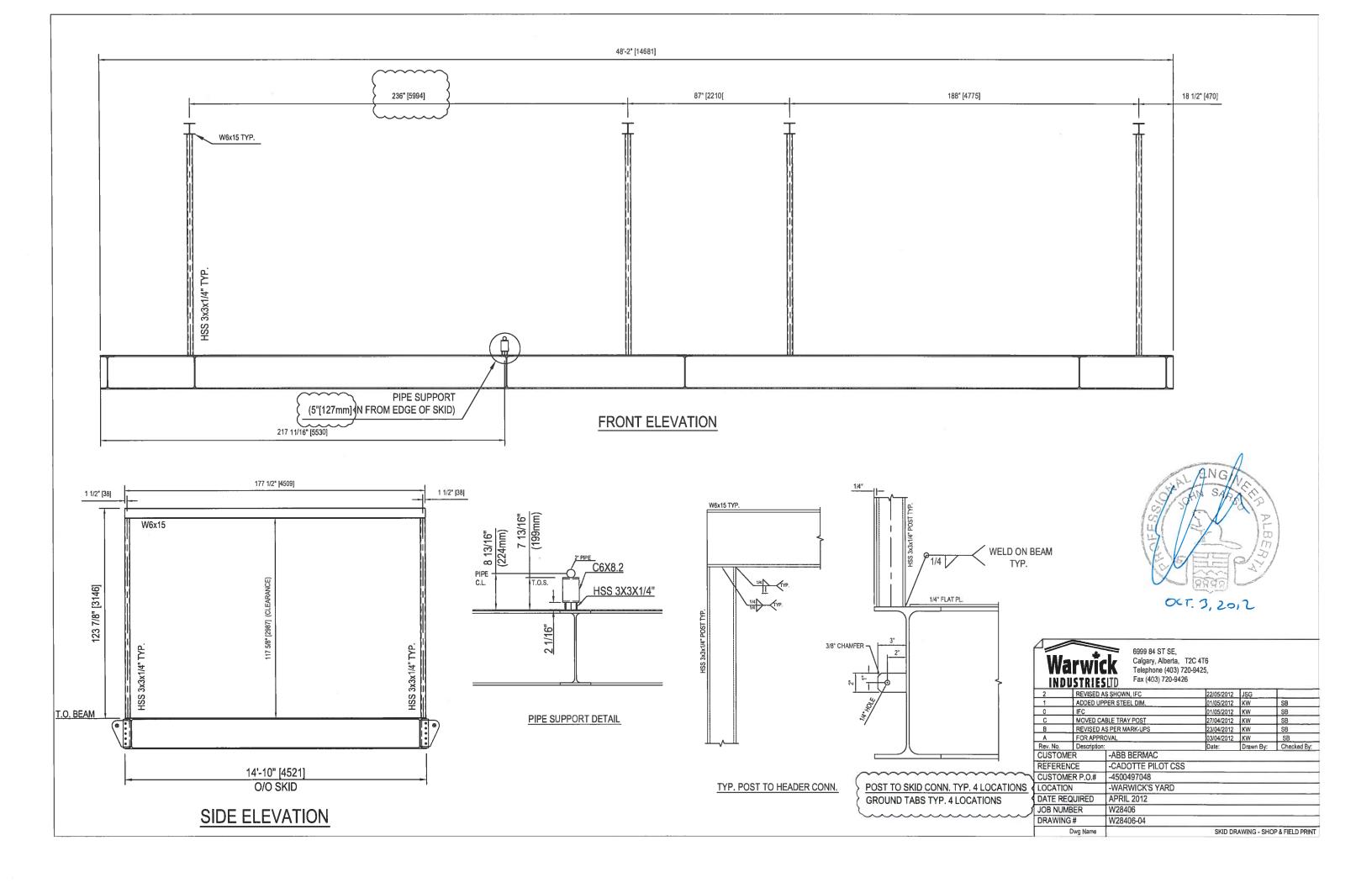
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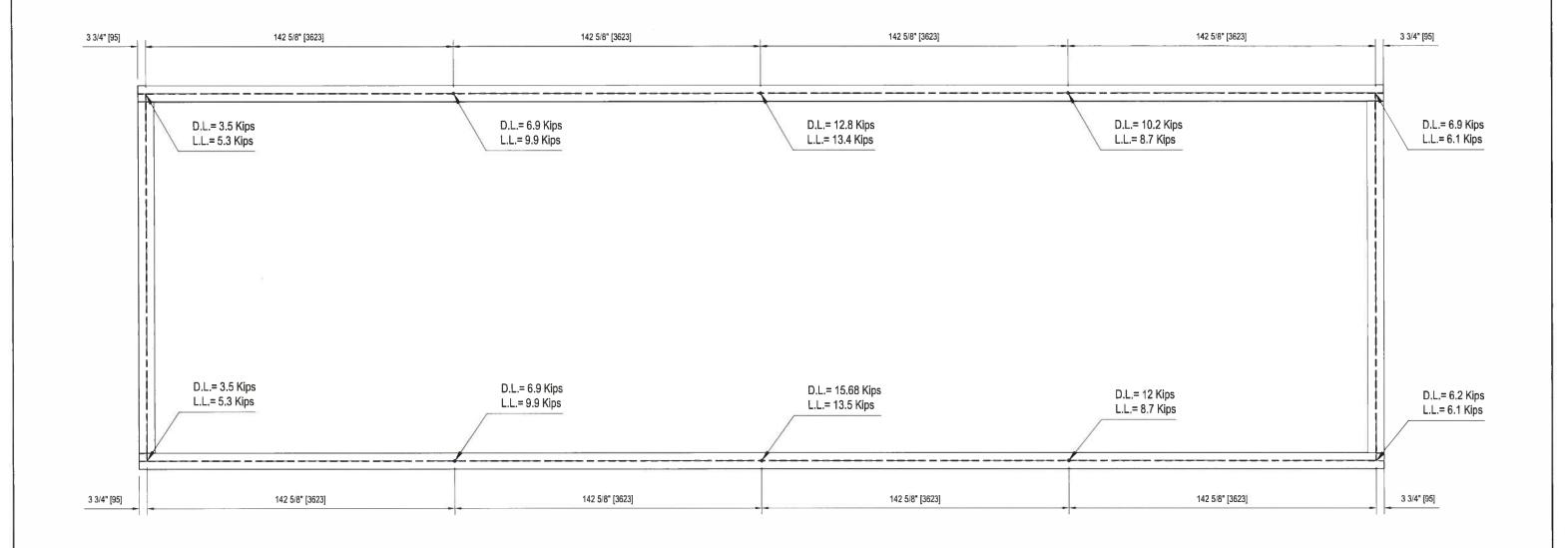
6999 84 ST SE, Calgary, Alberta, T2C 4T6 Telephone (403) 720-9425, Fax (403) 720-9426

| IND           | USTRIES     | LTD Pax (403) 720-9426 |             |             |               |
|---------------|-------------|------------------------|-------------|-------------|---------------|
| 2             | REVISED A   | REVISED AS SHOWN, IFC  |             | JSG         |               |
| 1             | REVISED D   | M                      | 14/05/2012  | kw          |               |
| 0             | IFC         |                        | 01/05/2012  | KW          | SB            |
| С             | MOVED CA    | BLE TRAY POST          | 27/04/2012  | KW          | SB            |
| В             | REVISED A   | S PER MARK-UPS         | 23/04/2012  | KW          | SB            |
| A             | -FOR APPR   | ROVAL                  | -03/04/2012 | -KW         | -SB           |
| Rev. No.      | Description |                        | Date:       | Drawn By:   | Checked By:   |
| CUSTOM        | ER          | -ABB BERMAC            |             |             |               |
| REFEREN       | ICE         | -CADOTTE PILOT CSS     |             |             | -             |
| CUSTOM        | ER P.O.#    | -4500497048            |             |             |               |
| LOCATIO       | N           | -WARWICK'S YARD        |             |             |               |
| DATE REQUIRED |             | -APRIL 2012            |             |             |               |
| JOB NUMBER    |             | W28406                 |             |             |               |
| DRAWING#      |             | W28406-03              |             |             |               |
|               | Dwg Name    |                        | SKID DRA    | WING - SHOP | & FIELD PRINT |

SKID DRAWING - SHOP & FIELD PRINT

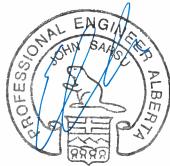
- STANDARD QC PACKAGE





# **PILE LOADING NOTES:**

- SUGGESTED PILE LOCATIONS
- PILE LOADS ARE UNFACTORED
- PILE DESIGN BY OTHERS
- LATERAL PILE LOADS BY OTHERS



OCT. 3,2012

|                  | rwic<br>stries |                    | 6999 84 ST SE,<br>Calgary, Alberta,<br>Telephone (403) 72<br>Fax (403) 720-9426 | 20-9425,         |             |                 |
|------------------|----------------|--------------------|---------------------------------------------------------------------------------|------------------|-------------|-----------------|
|                  | -              |                    |                                                                                 | <del>- [</del> - |             | -               |
|                  | -              |                    |                                                                                 |                  | -           |                 |
| -                | -              |                    |                                                                                 | -                | ]-          |                 |
| A                | FOR APPRO      | DVAL               |                                                                                 | 23/04/2012       | KW          | SB              |
| Rev. No.         | Description:   |                    |                                                                                 | Date:            | Drawn By:   | Checked By:     |
| CUSTOME          | R              | -ABB I             | -ABB BERMAC                                                                     |                  |             |                 |
| REFEREN          | Œ              | -CADOTTE PILOT CSS |                                                                                 |                  |             |                 |
| CUSTOME          | R P.O.#        | -45004             | 197048                                                                          |                  |             |                 |
| LOCATION -       |                | -WARWICK'S YARD    |                                                                                 |                  |             |                 |
| DATE REQUIRED AP |                | APRIL 2012         |                                                                                 |                  |             |                 |
| JOB NUMBER       |                | W28406             |                                                                                 |                  |             |                 |
| DRAWING# W2      |                | W28406-05          |                                                                                 |                  |             |                 |
| D                | wg Name        |                    |                                                                                 | SKID DR.         | AWING - SHO | P & FIELD PRINT |



| Customer Job                                                    | CADOTTE PILOT CCS                                                                                                      | Date:                         | June 20, 2012      |
|-----------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------|-------------------------------|--------------------|
| Customer P.O:                                                   | 4500497048                                                                                                             | Warwick Job#:                 | W28406             |
| Sold To:                                                        | ABB BERMAC                                                                                                             | Ship To:                      | 4207               |
|                                                                 |                                                                                                                        | Attention:                    |                    |
|                                                                 |                                                                                                                        | n                             |                    |
| SIZE                                                            | 48'X14'X12'                                                                                                            | Color:                        | GALVALUME          |
| BLDG TYPE                                                       | GABLE                                                                                                                  | Trim Color:                   | GALVALUME          |
| # Doors:                                                        | 1-LH DB 1-RH DBL                                                                                                       | #Windows:                     |                    |
| Canopies:                                                       |                                                                                                                        | Eaves&Downspou                | 12                 |
| Louvers:                                                        | 1-18"X18"                                                                                                              | RIDGE VENT                    |                    |
| Insulation:                                                     | 25-R12 5-ROXUL                                                                                                         | Ice Rakes:                    | 2                  |
| Cross Braces:                                                   | 1                                                                                                                      | Uprights:                     |                    |
| CIUSS DIACES:                                                   | <b>-</b>                                                                                                               | oprignts:                     |                    |
| Liner:<br>Fans c/w hood<br>*                                    | 60-REGULAR 44-10%PERF 1-12" GP FAN WITH HOOD ****** Trucker is responsible                                             | COLOR  for final load measure | WHITE ments ****** |
| Liner:<br>Fans c/w hood<br>*<br>2-4TON BARD                     | 60-REGULAR 44-10%PERF 1-12" GP FAN WITH HOOD  ****** Trucker is responsible UNITS                                      | COLOR                         |                    |
| Liner: Fans c/w hood  * 2-4TON BARD 2-15KW OAS H                | 60-REGULAR 44-10%PERF 11-12" GP FAN WITH HOOD  ****** Trucker is responsible UNITS HEATERS  SHIPPING                   | COLOR                         |                    |
| Liner: Fans c/w hood  * 2-4TON BARD 2-15KW OAS H                | 60-REGULAR 44-10%PERF 11-12" GP FAN WITH HOOD  ******* Trucker is responsible UNITS HEATERS  SHIPPING Dany WARWICK     | color final load measure      | ments ******       |
| Liner: Fans c/w hood  * 2-4TON BARD 2-15KW OAS F  Trucking Comp | 60-REGULAR 44-10%PERF 11-12" GP FAN WITH HOOD  ******* Trucker is responsible UNITS HEATERS  SHIPPING Pany WARWICK ART | color final load measure      |                    |
| Liner: Fans c/w hood  * 2-4TON BARD 2-15KW OAS H                | 60-REGULAR 44-10%PERF 11-12" GP FAN WITH HOOD  ******* Trucker is responsible UNITS HEATERS  SHIPPING Dany WARWICK     | color final load measure      | ments ******       |

# Kent Steel Ltd.

MANUFACTURING INSPECTION & TEST PLAN (I.T.P) Prepared by: Kirby Kachmarski rev. 0

Product category: Structural Codes /Standards: CSA W59/W47.1

REFERENCE:

Date: May 2, 2012

Kent Steel Job # KS 1767 Project: ABB / Bermac P.O. # P12093

Customer: Warwick Industries W28406

Project P.O. # 4500497048

| ITP Customer - Consultant                                                                                         | Kent Steel QA | 4     | 3 <sup>rd</sup> Party   |          | Surveilland              | e:e                     |
|-------------------------------------------------------------------------------------------------------------------|---------------|-------|-------------------------|----------|--------------------------|-------------------------|
| QA Shop Inspection Reports<br>Customer - Consultant                                                               | Kirby Kachma  | erski |                         |          |                          |                         |
| Inspection Requirement                                                                                            | A/R – As Requ | ired  | DR – Document<br>Review | H – Hold | IP – Inspection<br>Point | N/A – Not<br>Applicable |
| Description (Structural Skid): 14'10" x 48'2" c/w Inspection Criteria (Specifications ,CSA –W59/47.1) Upper Steel |               |       |                         |          |                          |                         |

| Inspection Item                                                | Activity                                                                             | Acceptance Criteria                                       | Meets<br>Acceptance<br>Criteria<br>Yes/No | Inspection<br>Requirement | Kent Steel<br>Inspector's<br>Signature | Date      | Customer<br>Signature | End User<br>Signature | Date |
|----------------------------------------------------------------|--------------------------------------------------------------------------------------|-----------------------------------------------------------|-------------------------------------------|---------------------------|----------------------------------------|-----------|-----------------------|-----------------------|------|
| Prefabrication<br>meeting/Review<br>Customer<br>Specifications | Review Scope                                                                         | At Kent Steel                                             | 14                                        | A/R                       | RN                                     | MAY 2/12  |                       |                       |      |
| Receipt of P.O.                                                |                                                                                      |                                                           | Y€S                                       | H,DR                      | 41                                     | MAY 2 12  |                       |                       |      |
| Drawings Received Issued for Construction                      |                                                                                      | Customer requirements                                     | YES                                       | A/R                       | en en                                  | May 2/12  |                       |                       |      |
| Welding Procedure<br>Review                                    |                                                                                      | Customer requirements ,<br>CSA W-59 /47.1                 | YES                                       | Н                         | fy                                     | MAY 2/12  |                       |                       |      |
| Welder<br>Qualification                                        |                                                                                      | Customer requirements<br>CSA W-59/47.1                    | YES                                       | Н                         | *N                                     | MAY alia  |                       |                       |      |
| Materials Received                                             |                                                                                      | P.O. and Approved Drawings                                | 15                                        | DR                        | NA                                     | MAJ 2/12  |                       |                       |      |
| Material Identity,<br>Heat Numbers, Mill<br>Test Reports       | Review mill test reports<br>for material identity and<br>audit materials for project | Review to Project<br>requirements and CSA<br>requirements | 17                                        | DR                        | e N                                    | MAY 3/12  |                       |                       |      |
| Fit-Up Dimensional<br>Check                                    | Review dimensions on structure (attachments, etc.)                                   | Approved drawings                                         | Y                                         | H, IP                     | 81                                     | May 17/12 |                       |                       |      |
| Orientation Check                                              | Review orientation of material, attachments and holes                                | Approved drawings                                         | Y                                         | H, IP                     | 41                                     | may 17/12 |                       |                       |      |

### Kent Steel Job # KS 1767

Page 2 of 2

| Inspection Item                                             | Activity                                                                                                                   | Acceptance Criteria                 | Meets<br>Acceptance<br>Criteria<br>Yes/No | Inspection<br>Requirement | Kent Steel<br>Inspector's<br>Signature | Date      | Customer<br>Signature | End User<br>Signature | Date |
|-------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------|-------------------------------------|-------------------------------------------|---------------------------|----------------------------------------|-----------|-----------------------|-----------------------|------|
| Support Check                                               | Review supports for dimensional accuracy                                                                                   | Approved drawings                   | Υ                                         | H, IP                     | PH                                     | myallo    |                       |                       |      |
| Visual Weld Check                                           | Visually check all welds including attachment welds                                                                        | Approved drawings, CSA W-59/47.1    | Ч                                         | HP                        | PH                                     | Meg 21/12 |                       |                       |      |
| Stress Relief (if required)                                 | Review procedure for PWHT, calibration records and PWHT charts                                                             | Approved drawings, CSA W-59/47.1    | N/A                                       | N/A                       | N/A                                    | N/A       | N/A                   | N/A                   | N/A  |
| Radiography<br>Procedures(if<br>required)                   | Review radiography procedures, personnel qualifications, radiographs and reader sheets                                     | Approved drawings, CSA W-59/47.1    | N/A                                       | N/A                       | N/A                                    | N/A       | N/A                   | N/A                   | N/A  |
| Other N.D.E. and<br>Procedures<br>(describe)                | Review requirements for additional N.D.E. including procedures, qualification and results (hardness)                       | Approved drawings, CSA<br>W-59/47.1 | YES                                       | ΙP                        | N                                      | MAY 16/12 |                       |                       |      |
| Record of Elevation                                         | Record measurements and review documentation                                                                               | Customer requirements               | YES                                       | H, IP                     | 4)                                     | MAY 19/12 |                       |                       |      |
| Grating                                                     | Shipped Loose / Fixed                                                                                                      | Approved Drawings, CSA<br>W-59/47.1 | N/A                                       | N/A                       | N/A                                    | N/A       | N/A                   | N/A                   | N/A  |
| Sandblasting, Prime,<br>Paint (includes sub<br>contractors) | Review the sandblast,<br>prime and painting<br>(including documentation)<br>SP6. Rustex Primer.<br>Industrial Enamel Black | Approved drawings                   | YES                                       | IP, DR                    | 41                                     | MAY21/12  |                       |                       |      |
| Insulation Inspection                                       | Adhesive and thickness check 3" PF-2444-0 plus Towerthon                                                                   | Customer requirements               | 145                                       | IP                        | φγ                                     | 51/11 MM  |                       |                       |      |
| Final Documentation<br>Review                               | Review the requested documentation                                                                                         | Customer requirements               | YES                                       | DR                        | fy                                     | MAY 22/12 |                       |                       |      |
| Packaging, Loading                                          | Review Packaging,<br>Loading                                                                                               | Customer requirements               | NES                                       | DR, HP                    | PN                                     | MAY 22/12 |                       |                       |      |
| Release                                                     | Release the structural for shipment                                                                                        | Customer requirements               | YES                                       | DR                        | ŶĬ                                     | MAY 22/12 |                       |                       |      |



The CWB acknowledges that

### Kent Steel Ltd.

5441 52 Avenue SE , Calgary, AB T2C 4S5

is certified to CSA Standard W47.1

"Certification of Companies for Fusion Welding of Steel"

in DIVISION 2

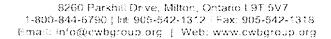
for the period March 10, 2012 to April 9, 2013

**Company Code: KENTS1** 

Scope: Structural steel fabricator - fabrication of structural steel, miscellaneous steel and steel plate works for the oil and gas and petro-chemical industries. Also fabrication of structural steel, miscellaneous steel and steel plate works for buildings.









# Kent Steel Ltd.

# Welding Procedure Specification SM-1

# SMAW of Carbon Steel

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#### A SCOPE

This Welding Procedure Specification covers welding and related operations in accordance with CSA Standard W59-03 and has been prepared to meet the requirements of Clause 10 of CSA Standard W47.1-03.

#### B WELDING PROCEDURE

The welding shall be done manually using the shielded metal are welding process (SMAW). The joints shall be made by single or multiple pass welding from one or both sides as indicated on the Welding Procedure Data Sheet referring to this Specification.

#### C BASE METAL

The base metal shall conform to Steel Groups 1, 2 & 3 of CSA Standard W59 – Table 11.1 and Table 12.1 with the exception of the atmospheric corrosion resistant steels. A copy of Tables 11.1 and 12.1 appears in the Appendix. If atmospheric corrosion resistant steels are to be used, they shall be shown on a separate data sheet.

#### D BASE METAL THICKNESS

Base metal from 3mm (1/8") to unlimited thickness may be welded under this Specification. In cases where base metals less than 3mm (1/8") thick are welded refer to Clause 1.5 of CSA Standard W59.

#### E PREPARATION OF BASE MATERIAL

Surfaces and edges to be welded shall be smooth, uniform and free from fins, cracks and other defects that would adversely affect the quality or strength of the weld. Surfaces to be welded shall also be free, within 50mm (2") of any weld locations, from loose or thick scale (except for tightly adhering small islands of scale), slag, loose rust, paint, grease, moisture and other foreign material that will prevent welding to acceptance criteria of this standard.

Occasional notches, not more than 5mm (3/16") deep, on otherwise satisfactory surfaces shall be removed by machining or grinding. Occasional notches exceeding 5mm (3/16") and less than 10mm (3/8") deep, in oxygen cut edges of plate up to 100mm (4") thick not to be welded, may, with the Contractor's Engineer's approval, be repaired by welding. For material 100mm (4") thick or over the depth of the notch shall not exceed 15mm (9/16"). Such weld repairs shall be made by suitably preparing the defective area, welding with low-hydrogen electrodes to an approved procedure, and grinding the completed weld smooth and flush with the adjacent surface to produce a workmanlike finish.

Planar edge discontinuities of plates are to be inspected in accordance with Clause 5.3.5 of CSA Standard W59.

Re-entrant corners, except for the corners of weld access cope holes adjacent to a flange shall be filleted to a radius of not less than 12mm (1/2").

The transition from the curved to the straight surface shall be smooth and without offsets.

Preparation of surfaces or edges of the parts to be joined by welding shall be prepared by machining, shearing, grinding, chipping, air carbon arc or oxygen gouging. Back gouging of welds or the removal of defective work or material shall be done by grinding, chipping, air carbon arc or oxygen gouging. Oxygen gouging shall not be used on quenched or tempered steels. Oxygen cutting shall preferably be done by machine oxygen cutting. Oxygen cut cdges shall be smooth, regular, and free of slag.

#### F FILLER METAL

The filler metal shall be certified by the Canadian Welding Bureau to the requirements of CSA W48-01 Filler Metals and Allied Materials for Metal Arc Welding.

#### G POSITION

The welding shall preferably be done in the flat position. The horizontal, vertical, or overhead positions may be used provided approved welding procedure data sheets referring to those positions and this procedure specification are followed. Unless otherwise called for on a specific data sheet, vertical welds shall be made with the progression of each pass in an

upward direction. If welds are to be made in a vertical-down sequence, the procedure shall be qualified by welder qualification in accordance with Clauses 9.9.3 of CSA Standard W47.1.

#### H PREHEAT AND INTERPASS TEMPERATURES

The minimum preheat and interpass temperature shall be in accordance with Table 5.3 of CSA Standard W59 (as shown in the Appendix). The preheat and interpass temperatures must be sufficient to prevent cracking. Experience has shown that the minimum levels specified in Table 5.3 are adequate to prevent cracking in most cases. However, higher preheats may be required in situations involving higher restraint, higher hydrogen, certain combinations of steel thickness, lower welding heat input, or steel composition at the top end of the steel specification. Some alternate recognized methods or guidelines for determining preheat are given in Appendix P of CSA Standard W59.

### I ELECTRICAL CHARACTERISTICS

The welding current shall be AC or DC RP. The welding equipment shall have drooping voltage characteristics. The following tables show recommended amperage and voltage ranges of commonly used electrodes.

#### Electrode Classification E4918-1

| Diameter |        | Amperage  | Voltage |  |  |
|----------|--------|-----------|---------|--|--|
| mm       | inches | Range     | Range   |  |  |
| 2.5      | 3/32   | 90 - 120  | 20 - 23 |  |  |
| 3.2      | 1/8    | 120 - 150 | 21 - 24 |  |  |
| 4.0      | 5/32   | 150 - 210 | 21 - 24 |  |  |
| 5.0      | 3/16   | 200 - 275 | 22 - 25 |  |  |
| 6.0      | 1/4    | 275 - 360 | 22 - 27 |  |  |

#### Electrode Classification E4928

| Diameter |        | Amperage Range    | Voltage |  |
|----------|--------|-------------------|---------|--|
| mm       | inches | Flat & Horizontal | Range   |  |
| 3.2      | 1/8    | 130 - 170         | 22 - 26 |  |
| 4.0      | 5/32   | 180 - 240         | 22 - 26 |  |
| 5.0      | 3/16   | 230 - 300         | 23 - 27 |  |

### Electrode Classification E4924

| Diameter |        | Amperage Range    | Voltage        |
|----------|--------|-------------------|----------------|
| mm       | inches | Flat & Horizontal | Range          |
| 3.2      | 1/8    | 125 - 165         | <b>28 32</b> ° |
| 4.0      | 5/32   | 175 - 235         | 32 - 35        |
| 5.0      | 3/16   | 240 - 350         | 32 - 35        |

### Electrode Classification E4310

| Diameter |        | Amperage . | Voltage |
|----------|--------|------------|---------|
| mm       | inches | Range      | Range   |
| 3.2      | 1/8    | 90 – 140   | 24 - 26 |
| 4.0      | 5/32   | 120 - 175  | 24 - 28 |
| 5.0      | 3/16   | 140 - 225  | 24 - 28 |

The maximum tolerances on the amperage listed on the procedure data sheets referring to this Specification shall be  $\pm 10\%$ .

### J WELDING TECHINQUE

The maximum thickness of layers shall be:

6mm (1/4") - for root passes of groove welds with the minimum size being such to prevent cracking.

5mm (3/16") - for subsequent layers of welds made in any position.

The maximum electrode size shall be:

4mm (5/32") - all passes in vertical fillet and groove welds.

5mm (3/16") - all passes in overhead fillet and groove welds.

- all passes in horizontal groove welds.

- root passes in grooves with backing where the root opening is less than 6mm (1/4") in the flat position.

- root passes in grooves without backing in the flat position.

6mm (1/4") - all passed for horizontal fillet welds.

- root passes for fillets in the flat position.

- root passes in grooves with backing where the root opening is greater than 6mm (1/4") in the flat position

8mm (5/16") - all passes subsequent to root passes for fillet and groove welds made in the flat position.

The maximum one pass fillet weld size shall be:

10mm (3/8") - in the flat position.

8mm (5/16") - in the horizontal or overhead position.

13mm (1/2) - in the vertical position.

The maximum width of one pass layers shall be such that weaving of the electrode is limited to 2 ½ times the electrode diameter.

The stringer bead technique should be used maintaining a short arc. Each pass should fuse properly into any backing plate, preceding pass, or adjacent plate metal. No unfilled or unfused pockets should be left between weld beads.

#### K WELDING CONDITIONS

No welding shall be done when temperatures of the base metal is lower than -18°C (0°F) except with the express consent of the Engineer. At temperatures below 0°C (32°F), the surfaces of all areas within 80mm (3") of the joint where a weld is to be deposited shall be heated to a temperature at least warm to the hand before welding is commenced – approximately 10°C (50°F).

The operator and the work shall be adequately protected against the direct effect of wind, snow, and rain.

#### L WELD PROFILES

The desirable, acceptable, and unacceptable fillet weld profiles are shown in Figure 5.4 in the Appendix.

The acceptable and unacceptable groove weld profiles are shown in Figure 5.4 in the Appendix.

#### M TREATMENT OF UNDERSIDE OF WELDING GROOVE

Prior to depositing weld metal on the underside of a welding groove, the root shall be back gouged to produce a groove contour substantially conforming to the prequalified single U-Joint and its depth shall be adequate to ensure complete penetration into the previously deposited weld metal.

#### N WELD METAL CLEANING

Slag shall be removed from all finished welds and before welding over previously deposited welds.

#### O TACK WELDS

Tack welds that are incorporated into the final weld shall be subject to the same quality requirements as the final welds and be made with electrodes meeting the requirements of the final welds and shall be cleaned thoroughly.

Tack welds not incorporated into the final weld shall be removed – except that they need not be removed for statically loaded structures unless required by the Engineer.

Tack welds located in the path of fillet welds 10mm (3/8") or smaller in size or in the roots of joints requiring specific root penetration shall be sufficiently small that they do not produce objectionable changes in the appearance of the weld surface or result in a decrease in penetration, otherwise they shall be removed or reduced in size by any suitable means prior to welding.

#### P ARC STRIKES

Are strikes outside of the area of permanent welds should be avoided on any material. When they occur in dynamically loaded structures, the surface of the arc strike should be lightly ground and checked for soundness using the magnetic particle inspection method.

#### Q ASSEMBLY PRACTICES

The parts to be joined by fillet welds shall be brought into as close a contact as practicable. The separation between parts shall normally not exceed 5mm·(3/16") except in cases involving shapes and plates 75mm (3") thick or greater when, after straightening and in assembly, the gap cannot be closed sufficiently to meet this tolerance. In such cases, a maximum gap of 8mm (5/16") is acceptable, provided that the sealing weld or suitable backing material\* is used to prevent melt-through.

If the separation is 2mm (1/16") or greater, the leg of the fillet weld shall be increased by the amount of the separation.

The separation between faying surfaces of lap joints and of butt joints landing on a backing shall not exceed 2mm (1/16"). Where irregularities in rolled shapes or plates after straightening do not permit contact within the above limits, the procedure necessary to bring the material within these limits shall be subject to the approval of the Engineer.

The parts, bearing joints excepted, to be joined by partial joint penetration having groove welds parallel to the length of the member shall be brought into as close contact as practicable. The gap between parts shall not exceed 5mm (3/16") except in cases involving rolled shapes and plates 75mm (3") or greater in thickness when, after straightening and in assembly, the gap cannot be closed sufficiently to meet this tolerance. In such cases, a maximum gap of 8mm (5/16") is acceptable provided a sealing weld or suitable backing material\* is used to prevent melt-through and the final weld meets the requirements for throat size. Tolerances for bearing joints shall be in accordance with the applicable contract specification.

The use of fillers is prohibited except as specified on the drawings or as specially approved by the Engineer and made in accordance with Clause 4.6 of CSA Standard W59.

<sup>\*</sup> Backing to prevent burn-through may be of flux, glass tape, iron powder or similar material or it may be provided by means of root passes deposited by a low-hydrogen electrodes or electrodes of other arc welding processes that are specified to an appropriate diffusible hydrogen designator.

Abutting parts to be joined by groove welds shall be carefully aligned. However, an offset not exceeding 10% of the thickness of the thinner part joined but in no case more than 3mm (1/8") shall be permitted as a departure from the theoretical alignment. In correcting misalignment in such cases, the parts shall not be drawn into a slope greater than 1 in 25. Measurement of the offset shall be based on centerline of parts unless otherwise shown on the drawing.

Backing for groove welds shall be continuous for the full length of the joint. Where backing is composed of individual lengths of bars, they shall be carefully aligned and welded into one continuous member.

Members to be welded shall be brought into correct alignment and held safely in position until welding has be completed. Suitable allowances shall be made for warpage and shrinkage.

#### R ALLOWABLE WORKMANSHIP TOLERANCES

With the exclusion of electroslag and electrogas welding and, with the exception of Clause 5.4.5.2 of CSA Standard W59 for root openings in excess of those permitted in the table below, dimensions of the cross-section of groove welded joints that vary from those shown on the detail drawings by more than the following workmanship tolerances shall be corrected in accordance with Appendix C, Clause C1.1(f) of CSA Standard W59 or referred to the Engineer for approval.

### Workmanship Tolerance for Groove Welds

|                         | Root Not Gouged | Root Gouged                      |
|-------------------------|-----------------|----------------------------------|
| Root Face of Joint      | ± 2mm           | Not Limited                      |
| Root Opening of Joints: |                 |                                  |
| Without steel backing   | ±2mm            | +2mm<br>-3mm                     |
| With steel backing      | + 6mm<br>- 2mm  | Not Applicable<br>Not Applicable |
| Groove Angle of Joint   | + 10°<br>- 5°   | + 10°<br>- 5°                    |

#### S CONTROL OF DISTORTION AND SHRINKAGE STRESSES

Insofar as practicable, all welds shall be deposited in a sequence that will balance the applied heat of welding while the welding progresses.

Before the start of welding on a member or structure in which shrinkage stresses or distortion are likely to effect the adequacy of the structure, a program for welding sequence and distortion control shall be developed by the Contractor.

The direction of the general progression in welding shall be from points where the parts are relatively fixed in position with respect to each other towards points where they have a greater relative freedom of movement.

Joints expected to exhibit significant shrinkage shall be welded first (where practical) while conditions of minimum restraint prevail. Joints expected to have lesser shrinkage shall be welded second.

#### T QUALITY OF WELDS

#### 1. Visual Examination

Cracks or blow holes that appear on the surface of any pass shall be removed before depositing the next covering pass. The procedure and technique shall be such that undercutting of base metal and adjacent passes is minimized.

All welds shall be visually inspected. A weld subject only to visual inspection shall be acceptable if visual inspection shows:

- (a) No surface cracks.
- (b) No visible lack of fusion between welds and base metal.
- (c) No craters.
- (d) Weld profiles in accordance with Clause 5.9 of CSA Standard W59.
- (e) In statically loaded structures, the sum of diameters of visible porosity does not exceed 10mm (3/8") in any linear 25mm (1") of weld and does not exceed 20mm (3/4") in any 300mm (12") length of weld. Any individual pore shall have a dimension not exceeding 2.5mm (3/32").

- (f) In statically loaded structures, irrespective of length, the undercut does not exceed the value shown in Figure 11.4 of CSA Standard W59 for the primary stress direction category applicable to the area containing the undercut. Further, the undercut may be twice the value permitted by Figure 11.4 (for the applicable load category) for an accumulated length of 50mm (2") in a 300mm (12") length of weld but in no case may the undercut be greater than 1.6mm (1/16"). For weld lengths of less than 300mm (12"), the permitted accumulated length of undercut shall be proportional to the actual length of the weld.
- (g) In cyclically loaded structures, the frequency of visible porosity in fillet welds does not exceed one in each 100mm (4") length of weld and the maximum diameter does not exceed 2.5mm (3/32"). That, for fillet welds connecting intermediate transverse stiffeners to web, the sum of the diameters of visible porosity does not exceed 10mm (3/8") in any 25mm (1") of weld nor 20mm (3/4") in any 300mm (12") length of weld. That groove welds have no visible porosity.
- (h) In cyclically loaded structures, the undercut is not more than 0.25mm (0.01") deep when its direction is transverse to the primary stress in the part that is undercut. The undercut is not more than 1mm (1/32") deep when its direction is parallel to the primary stress in the part that is undercut. For members not carrying primary stresses, undercuts in excess of the amounts stated shall be subject to approval by the Engineer.

#### 2. Radiographic and Magnetic Particle Examination

Welds that are subject to radiographic and magnetic particle testing - in addition to visual inspection - shall meet the requirements of:

- (a) Clause 11.5.4.3 of CSA Standard W59 for statically loaded structures.
- (b) Clause 12.5.4.3 of CSA Standard W59 for cyclically loaded structures.

### 3. Ultrasonic Inspection

Welds that are subject to ultrasonic examination in addition to visual inspection shall have no cracks and meet the following requirements:

(a) In statically loaded structures, any weld discontinuity shall be accepted or rejected on the basis of its defect rating and its length in accordance with Table 11.3 of CSA Standard W59.

- (b) In cyclically loaded structures, welds subject to tensile stress under any conditions of loading shall conform to the requirements of Table 12.5 of CSA Standard W59.
- (c) In cyclically loaded structures, welds subject to compressive stress only and specifically indicated as such in the detail drawings shall conform to the requirements of Table 11.3 of CSA Standard W59.

#### U STRESS RELIEF HEAT TREATMENT

Where required by the contract drawings or specifications, welded assemblies shall be stress relieved by heat treatment. Refer to Clause 5.12 of CSA Standard W59.

#### V STORAGE AND CONDITIONING OF ELECTRODES

#### 1. Low-Hydrogen Electrodes

All low-hydrogen electrodes shall be delivered in sealed containers. If such containers show evidence of damage, the low alloy steel electrodes shall be baked for at least 1 hour at a temperature between 370°C (700°F) and 430°C (800°F) before being used and carbon steel electrodes shall be baked for at least 2 hours at a temperature between 230°C (450°F) and 260°C (500°F) before being used.

Immediately after being removed from sealed containers or from baking ovens, the electrodes shall be stored in ovens held at a temperature of at least 120°C (250°F).

Low-hydrogen electrodes of the E49 classification that are not used within 4 hours after removal from the ovens - except as noted in Clause 5.2.2.4.4 of CSA Standard W59 - shall be reconditioned in accordance with clause 5.2.2.4.1.

Low-hydrogen electrodes shall be rebaked no more than once.

When approved by the Contractor's Engineer, auxiliary electrode containers or dispensers may be used to extend permissible exposure times in accordance with the following:

a) The Contractor's Engineer shall be satisfied that such electrode containers or dispensers have been demonstrated to provide adequate atmospheric scaling protection for the contained electrodes at a relative humidity of 90% at 30°C (86°F) for the total storage time proposed for acceptance; and

b) The electrodes so contained shall not produce diffusible hydrogen levels in weld metal in excess of the requirements of CSA Standard W48.

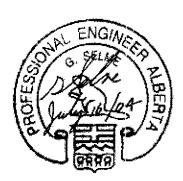
Low-hydrogen electrodes of the E49 classification that are not used within a maximum of 10 hours total exposure time after being removed from ovens and stored in approved electrode containers or dispensers shall be reconditioned in accordance with clause 5.2.2.4.1.

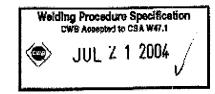
#### 2. Other Than Low-Hydrogen Electrodes

All other than low-hydrogen electrodes shall be stored in warm and dry conditions and kept free from oil, grease and other deleterious matter once they have been removed from their containers and packages.

#### 3. Wet Electrodes

Electrodes that have been wet shall be discarded.





| Weldir     | ng Prod        | edure                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Data S                                | heet                                   | No.           | SS2        | Re                                    | v 0 Date                    | July                                  | 16, 2009    | W47.                     |  |
|------------|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------|----------------------------------------|---------------|------------|---------------------------------------|-----------------------------|---------------------------------------|-------------|--------------------------|--|
| Compa      | ny Nam         | e Kent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Steel L                               | .td.                                   |               |            | Re                                    | f. WPS                      |                                       | SSM-        | ·3                       |  |
| Addres     | S              | 5441                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | - 52 A                                | renue S                                | E, Calga      | ary        | Re                                    | f. Standards                | V                                     | V47.1 &     | D1.6                     |  |
| Welding    | g Proces       | \$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | SMA                                   | W                                      | Pulse         | d I        | Vo We                                 | Welding Position Horizontal |                                       |             |                          |  |
| Process    | s Mode         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |                                        | Manua         |            | Join                                  | nt Type                     |                                       | Tee         |                          |  |
| Shieldir   | ng Gas T       | уре                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                       |                                        |               |            | Per                                   | netration                   | nny///                                | Fille       | t                        |  |
| Gas Flo    | w Rate         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |                                        |               |            | Tur                                   | igsten Type                 |                                       |             | <del> </del>             |  |
| Filler M   | etal Clas      | sificatio                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | חי                                    | . !                                    | E309L-1       | 6          | Tur                                   | igsten Size                 |                                       |             |                          |  |
| Electro    | de Exten       | sion                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                       |                                        |               |            | Pre                                   | heat Temp.                  |                                       |             | n/a                      |  |
| Base M     | aterial        | Sta                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | inless S                              | Steel typ                              | to Ste        | el Inte    | rpass Temp                            | . Min.                      |                                       | n/a         |                          |  |
|            |                | Gro                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | up 1, 2                               | & 3 Tab                                | le 11.1 '     | W59 (T     | 2) Inte                               | rpass Temp                  | . Max.                                | 1           | n/a                      |  |
| M. And All | 15.0           | ıl Joint Pr                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | · · · · · · · · · · · · · · · · · · · | Don-                                   | Eiler         | Current    |                                       | cal Pass and L              | ayer                                  | L Malte T   | 1AInletin                |  |
|            | T2             | _(                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | · · · · · · · · · · · · · · · · · · · |                                        |               |            |                                       | <u> </u>                    | eussen-europeanensensersensensensense |             |                          |  |
| Mat'l      | Typica<br>Weld | ıl Joint Pr                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | eparation<br>Layer                    | Pass                                   | Filler        | Current    |                                       | cal Pass and L<br>Wire Feed | ayer                                  | Volts       | Welding                  |  |
| Thk        | Size<br>S      | T2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Luyor                                 | Number                                 | Metal<br>Size | Polarity   | Amperes                               |                             |                                       |             | Speed                    |  |
| 6 mm       | 5 mm           | 5-13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1                                     | 1                                      | 3.2 mm        | DCEP       | 75-120                                |                             |                                       |             |                          |  |
| (1/4")     |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |                                        | (1/8")        |            |                                       |                             | ,,                                    |             | *                        |  |
|            |                | and the second s |                                       |                                        |               |            |                                       |                             |                                       |             |                          |  |
|            |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |                                        |               |            |                                       |                             |                                       |             |                          |  |
|            |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |                                        |               |            |                                       |                             |                                       |             |                          |  |
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| Revisio    | n App          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Explana                               | ation                                  |               | C          | MB Approv                             | /al                         | E                                     | Engineers   | Seal                     |  |
| Date       |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ANNIPOLICE                            |                                        |               |            |                                       |                             |                                       | N ENG       | WEEN .                   |  |
|            |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       | -41                                    |               | CMI        | 3 Acce                                | oted                        | 100                                   | G. SEL      |                          |  |
|            | ks             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |                                        |               |            | Jul 21, 20                            | 009                         | 1/8/7                                 | 2. <b>2</b> | 42 5                     |  |
| Remar      |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 3800 ·                                | ······································ |               | Valid only | if wolding const                      | anables .                   | 118/0                                 | Wat Sill    | & 13                     |  |
| Remar      |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |                                        |               | are A      | relied he line of                     | WB I                        | I A Y                                 | _           | 7 <b></b> / <b>L</b> / ) |  |
| Remar      |                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                       |                                        |               | ere d      | if wolding consi<br>artified by the C | WB J                        | 10-16                                 | 學           | アグ                       |  |

### Kent Steel Ltd.

# Welding Procedure Specification FC - 1

## FCAW or MCAW of Carbon Steel

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#### A SCOPE

This Welding Procedure Specification covers welding and related operations in accordance with CSA Standard W59-03 and has been prepared to meet the requirements of Clause 10 of CSA Standard W47.1-03:

#### B WELDING PROCESS

The welding shall be done semi-automatically using the flux cored arc welding process (FCAW) or metal cored arc welding process (MCAW). The joints shall be made by single or multiple pass welding – from one or both sides – as indicated on the Welding Procedure Data Sheets referring to this Specification.

#### C BASE METAL

The base metal shall conform to Steel Groups 1, 2 & 3 of CSA Standard W59 – Table 11.1 and Table 12.1 with the exception of the atmospheric corrosion resistant steels. When atmospheric corrosion resistant steel is used it shall be shown on a separate data sheet. A copy of Tables 11.1 and 12.1 appears in the Appendix.

#### D BASE METAL THICKNESS

Base metal from 3mm (1/8") to unlimited thickness may be welded under this Specification. In cases where base metals less than 3mm (1/8") thick are welded refer to Clause 1.5 of CSA Standard W59.

#### E PREPARATION OF BASE METAL

Surfaces and edges to be welded shall be smooth, uniform and free from fins, cracks and other defects that would adversely affect the quality or strength of the weld. Surfaces to be welded shall also be free, within 50mm (2") of any weld locations, from loose or thick scale (except for tightly adhering small islands of scale), slag, loose rust, paint, grease, moisture and other foreign material that will prevent welding to acceptance criteria of this standard.

Occasional notches, not more than 5mm (3/16") deep on otherwise satisfactory surfaces shall be removed by machining or grinding. Occasional notches exceeding 5mm (3/16") and less than 10mm (3/8") deep, in oxygen cut edges of plate up to 100mm (4") thick, not to be welded, may, with the Contractor's Engineer's approval, be repaired by welding. For material 100mm (4") thick or over the depth of the notch shall not exceed 15mm (9/16"). Such weld repairs shall be made by suitably preparing the defective area, welding with low-hydrogen electrodes to an approved procedure, and grinding the completed weld smooth and flush with the adjacent surface to produce a workmanlike finish.

Planar edge discontinuities of plates are to be inspected in accordance with Clause 5.3.5 of CSA Standard W59.

Re-entrant corners, except for the corners of weld access cope holes adjacent to a flange, shall be filleted to a radius of not less than 12mm (1/2).

The transition from the curved to the straight surface shall be smooth and without offsets.

Preparation of surfaces or edges of the parts to be joined by welding shall be prepared by machining, grinding, chipping, air carbon are or oxygen gouging. Back gouging of welds or the removal of defective work or material shall be done by grinding, chipping, air carbon are or oxygen gouging. Oxygen gouging shall not be used on quenched or tempered steels. Oxygen cutting shall preferably be done by machine oxygen cutting. Oxygen cut edges shall be smooth, regular, and free of slag.

#### F FILLER METAL

The filler metal shall be certified by Canadian Welding Bureau to the requirements of CSA W48 or AWS A5.29. Filler metal shall have a diffusible hydrogen designator of H16 or less.

#### G SHIELDING GAS

The shielding gas shall be as listed on the Welding Procedure Data Sheet. This gas mixture shall be a welding grade having a dew point of -40°C (-40°F) or lower.

#### H WELDING CONDITIONS

Welding shall not be done in a draught or wind unless the weld is protected by a shelter. This shelter shall be of material and shape appropriate to reduce wind velocity in the vicinity of the weld to a maximum of 8 km per hour (5 mph).

No welding shall be done when temperature of the base metal is lower than -18°C (0°F) except with the express consent of the Engineer. At temperatures below 0°C (32°F) the surfaces of all areas within 80mm (3") of the joint where a weld is to be deposited, shall be heated to a temperature at least warm to the hand before welding is commenced, approximately 10°C (50°F).

The operator and the work shall be adequately protected against the direct effect of wind, snow and rain.

#### I POSITION

The welding shall preferably be done in the flat position. The horizontal, vertical, or overhead positions may be used provided approved welding procedure data sheets referring to those positions and this procedure specification are followed. Unless called for otherwise on a specific data sheet, vertical welds shall be made with the progression of each pass in an upward direction. If welds are to be made in a vertical-down sequence, the procedure shall be qualified by welder qualification in accordance with Clause 9.9.3 of CSA Standard W47.1.

#### J PREHEAT AND INTERPASS TEMPERATURES

The minimum preheat and interpass temperature shall be in accordance with Table 5.3 of CSA Standard W59 (as shown in the Appendix). The preheat and interpass temperatures must be sufficient to prevent cracking. Experience has shown that the minimum levels specified in Table 5.3 are adequate to prevent cracking in most cases. However, higher preheat temperatures may be required in situations involving higher restraint, higher hydrogen, certain combinations of steel thickness, lower welding heat input, or steel composition at the top end of the steel specification. Some alternate recognized methods or guidelines for determining preheat are given in Appendix P of CSA Standard W59.

#### K ELECTRICAL CHARACTERISTICS

The welding equipment shall be constant voltage type with constant wire feed speed. Typical amperage, voltage, and wire feed speed ranges for welding is shown below.

#### Electrode Classification E491C-6M-H4

Diameter:

1.2 mm (0.045")

Amperage Range:

200 - 360

Voltage Range:

24 - 29

Wire Feed Speed Range:

230 - 510 ipm

Diameter:

1.6mm (1/16")

Amperage Range:

**290 - 470** 

Voltage Range:

25 - 31

Wire Feed Speed Range:

235 - 410 ipm

#### Electrode Classification E491T-9M-H8

Diameter:

1.2 mm (0.045")

Amperage Range:

220 - 325

Voltage Range:

23 - 29

Wire Feed Speed Range:

360 - 600 ipm

#### L WELDING TECHNIQUE

The maximum size of a fillet well made in one pass shall be 12mm (1/2") for the flat position and 10mm (3/8") for the horizontal position.

The thickness of weld layers – except root and surface layers – shall not exceed 6mm (1/4").

When the root opening of a groove weld is 12mm (1/2") or greater, a multiple pass split layer technique shall be used with the exception of the finishing weld layers. The split layer technique shall also be used in making all multiple pass welds when the width of the layers exceeds 16m (5/8").

Revised Dec 4/06

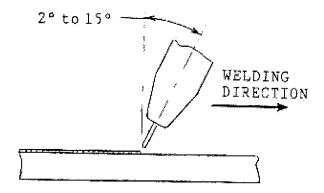
The maximum tolerances of the following parameters listed on the Welding Procedure Data Sheets referring to the Specification are listed below:

Amperage:  $\pm 10\%$ Wire Feed Speed:  $\pm 10\%$ Voltage:  $\pm 7\%$ Arc Travel Speed  $\pm 15\%$ 

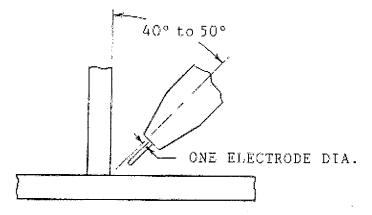
It is very important that the wire extension be kept as constant as possible during the welding operation. The electrode stickout is shown on each Welding Procedure Data Sheet referring to this Specification.

Each pass should fuse properly into any backing plate, preceding pass, or adjacent plate metal. Craters at the end of each weld pass shall be filled in to prevent undercut and cracking.

When making groove and fillet welds in the flat position, the torch should be angled 2° to 15° in the direction of travel as shown below.



When fillet welds are made in the horizontal position, the electrode should have a work angle of 40° to 50° in addition to the 2° to 15° in the direction of travel.



#### M TACK WELDS

Tack welds that are incorporated into the final weld shall be subject to the same quality requirements as the final welds and be made with electrodes meeting the requirements of the final welds and shall be cleaned thoroughly.

Tack welds not incorporated into the final weld shall be removed – except that they need not be removed for statically loaded structures unless required by the Engineer.

Tack welds located in the path of fillet welds 10mm (3/8") or smaller in size, or in the root of joints requiring specific root penetration, shall be sufficiently small that they do not produce objectionable changes in appearance of the weld surface or result in decrease in penetration; otherwise, they shall be removed or reduced in size by any suitable means prior to welding.

#### N WELD PROFILES

The desirable, acceptable, and unacceptable fillet weld profiles are shown in Figure 5.4 in the Appendix.

The acceptable and unacceptable groove weld profiles are shown in Figure 5.4 in the Appendix.

#### O ARC STRIKES

Arc strikes outside the area of permanent welds should be avoided on any material. When they occur in cyclically loaded structures, the surface of the arc strike should be lightly ground and checked for soundness using the magnetic particle inspection method.

#### P TREATMENT OF UNDERSIDE OF WELDED GROOVE

Prior to depositing weld metal on the underside of a welded groove, the root shall be back gouged to produce a groove contour substantially conforming to the prequalified single U-Joint and its depth shall be adequate to ensure complete penetration into the previously deposited weld metal.

#### Q WELD METAL CLEANING

Slag shall be removed from all finished welds and before welding over previously deposited metal.

#### R ASSEMBLY PRACTICES

The parts to be joined by fillet welds shall be brought into as close a contact as practicable. The separation between parts shall normally not exceed 5mm (3/16") except in cases involving shapes and plates 75mm (3") thick or greater when, after straightening and in assembly, the gap cannot be closed sufficiently to meet this tolerance. In such cases, a maximum gap of 8mm (5/16") is acceptable, provided that the scaling weld or suitable backing material\* is used to prevent melt-through.

If the separation is 2mm (1/16") or greater, the leg of the fillet weld shall be increased by the amount of the separation.

The separation between faying surfaces of lap joints and of butt joints landing on a backing shall not exceed 2mm (1/16"). Where irregularities in rolled shapes or plates after straightening do not permit contact within the above limits, the procedure necessary to bring the material within these limits shall be subject to the approval of the Engineer.

The parts, bearing joints excepted, to be joined by partial joint penetration having groove welds parallel to the length of the member shall be brought into as close contact as practicable. The gap between parts shall not exceed 5mm (3/16") except in cases involving rolled shapes and plates 75mm (3") or greater in thickness when, after straightening and in assembly, the gap cannot be closed sufficiently to meet this tolerance. In such cases, a maximum gap of 8mm (5/16") is acceptable provided a sealing weld or suitable backing material\* is used to prevent melt-through and the final weld meets the requirements for throat size. Tolerances for bearing joints shall be in accordance with the applicable contract specification.

The use of fillers is prohibited except as specified on the drawings or as specially approved by the Engineer and made in accordance with Clause 4.6 of CSA Standard W59.

<sup>\*</sup> Backing to prevent burn-through may be of flux, glass tape, iron powder or similar material or it may be provided by means of root passes deposited by a low-hydrogen electrodes or electrodes of other are welding processes that are specified to an appropriate diffusible hydrogen designator.

Abutting parts to be joined by groove welds shall be carefully aligned. However, an offset not exceeding 10% of the thickness of the thinner part joined but in no case more than 3mm (I/8") shall be permitted as a departure from the theoretical alignment. In correcting misalignment in such cases, the parts shall not be drawn into a slope greater than I in 25. Measurement of the offset shall be based on centerline of parts unless otherwise shown on the drawing.

Backing for groove welds shall be continuous for the full length of the joint. Where backing is composed of individual lengths of bars, they shall be carefully aligned and welded into one continuous member.

Members to be welded shall be brought into correct alignment and held safely in position until welding has be completed. Suitable allowances shall be made for warpage and shrinkage.

#### S ALLOWABLE WORKMANSHIP TOLERANCES

With the exclusion of electroslag and electrogas welding and, with the exception of Clause 5.4.5.2 of CSA Standard W59 for root openings in excess of those permitted in the table below, dimensions of the cross-section of groove welded joints that vary from those shown on the detail drawings by more than the following workmanship tolerances shall be corrected in accordance with Appendix C, Clause C1.1(f) of CSA Standard W59 or referred to the Engineer for approval.

#### Workmanship Tolerance for Groove Welds

|                         | Root Not Gouged | Root Gouged                   |
|-------------------------|-----------------|-------------------------------|
| Root Face of Joint      | ± 2mm           | Not Limited                   |
| Root Opening of Joints: |                 |                               |
| Without steel backing   | ±2mm            | +2mm<br>-3mm                  |
| With steel backing      | + 6mm<br>- 2mm  | Not Applicable Not Applicable |
| Groove Angle of Joint   | +10°<br>-5°     | ± 10°<br>- 5°                 |

#### T CONTROL OF DISTORTION AND SHRINKAGE STRESSES

Insofar as practicable, all welds shall be deposited in a sequence that will balance the applied heat of welding while the welding progresses.

Before the start of welding on a member or structure in which shrinkage stresses or distortion are likely to affect the adequacy of the structure, a program for welding sequence and distortion control shall be developed by the Contractor.

The direction of the general progression in welding shall be from points where the parts are relatively fixed in position with respect to each other towards points where they have a greater relative freedom of movement.

Joints expected to exhibit significant shrinkage shall be welded first (where practical) while conditions of minimum restraint prevail. Joints expected to have lesser shrinkage shall be welded second.

#### U QUALITY OF WELDS

#### 1. Visual Examination

Cracks or blow holes that appear on the surface of any pass shall be removed before depositing the next covering pass. The procedure and technique shall be such that undercutting of base metal and adjacent passes is minimized.

All welds shall be visually inspected. A weld subject only to visual inspection shall be acceptable if visual inspection shows:

- (a) No surface cracks.
- (b) No visible lack of fusion between welds and base metal.
- (c) No craters.
- (d) Weld profiles in accordance with Clause 5.9 of CSA Standard W59.
- (e) In statically loaded structures, the sum of diameters of visible porosity does not exceed 10mm (3/8") in any linear 25mm (1") of weld and does not exceed 20mm (3/4") in any 300mm (12") length of weld. Any individual pore shall have a dimension not exceeding 2.5mm (3/32").

- (f) In statically loaded structures, irrespective of length, the undercut does not exceed the value shown in Figure 11.4 of CSA Standard W59 for the primary stress direction category applicable to the area containing the undercut. Further, the undercut may be twice the value permitted by Figure 11.4 (for the applicable load category) for an accumulated length of 50mm (2") in a 300mm (12") length of weld but in no case may the undercut be greater than 1.6mm (1/16"). For weld lengths of less than 300mm (12"), the permitted accumulated length of undercut shall be proportional to the actual length of the weld.
- (g) In cyclically loaded structures, the frequency of visible porosity in fillet welds does not exceed one in each 100mm (4") length of weld and the maximum diameter does not exceed 2.5mm (3/32"). That, for fillet welds connecting intermediate transverse stiffeners to web, the sum of the diameters of visible porosity does not exceed 10mm (3/8") in any 25mm (1") of weld nor 20mm (3/4") in any 300mm (12") length of weld. That groove welds have no visible porosity.
- (h) In cyclically loaded structures, the undercut is not more than 0.25mm (0.01") deep when its direction is transverse to the primary stress in the part that is undercut. The undercut is not more than 1mm (1/32") deep when its direction is parallel to the primary stress in the part that is undercut. For members not carrying primary stresses, undercuts in excess of the amounts stated shall be subject to approval by the Engineer.

#### 2. Radiographic and Magnetic Particle Examination

Welds that are subject to radiographic and magnetic particle testing – in addition to visual inspection – shall meet the requirements of:

- (a) Clause 11.5.4.3 of CSA Standard W59 for statically loaded structures.
- (b) Clause 12.5.4.3 of CSA Standard W59 for cyclically loaded structures.

#### 3. Ultrasonic Inspection

Welds that are subject to ultrasonic examination in addition to visual inspection shall have no cracks and meet the following requirements:

(a) In statically loaded structures, any weld discontinuity shall be accepted or rejected on the basis of its defect rating and its length in accordance with Table 11.3 of CSA Standard W59.

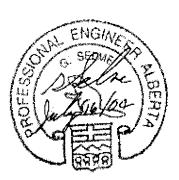
- (b) In cyclically loaded structures, welds subject to tensile stress under any conditions of loading shall conform to the requirements of Table 12.5 of CSA Standard W59.
- (c) In cyclically loaded structures, welds subject to compressive stress only and specifically indicated as such in the detail drawings shall conform to the requirements of Table 11.3 of CSA Standard W59.

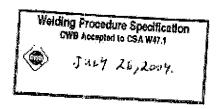
#### V STRESS RELIEF HEAT TREATMENT

Where required by the contract drawings or specifications, welded assemblies shall be stress relieved by heat treatment. Refer to Clause 5.12 of CSA Standard W59.

#### W STORAGE OF ELECTRODES

The electrodes shall be stored in a clean and dry area where contamination by moisture, grease, or dirt can be avoided.





|                                        | Weldin                                                                  | g Proced                                              | lure Dat         | ta Sheef                                        | t                                                                                                                   | No.          | F2 Date                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 14-Jul-04                                 | W47.1          |  |
|----------------------------------------|-------------------------------------------------------------------------|-------------------------------------------------------|------------------|-------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|--------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------|----------------|--|
| Company<br>Address:                    |                                                                         | <b>Kent Steel L</b><br>5441 - 52 Av                   |                  | algary                                          |                                                                                                                     |              | Welding Proce<br>Specification<br>Applicable Sta                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | No. FC-1<br>Indards: W5                   | 9 & W47.1      |  |
| Welding<br>Process                     | O (2) Gas                                                               | lded Metal Arc (<br>Metal Arc (GMA<br>Tungsten Arc (C | AW) O (          | 4) Flux-Cored 6<br>5) Submerged<br>6) Other MC/ | Arc (SAV                                                                                                            | '''          | etal Classification<br>ng Gas or Flux:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                           | r+             |  |
| Process<br>Mode<br>Material            |                                                                         | ual O<br>i-Automatic O<br>oups 1, 2 & 3               |                  | Tungste<br>Tungste<br>Welding                   | n Size:                                                                                                             |              | Preheat Temp:  Min Interpass Temp:  Horizontal  Max Interpass Temp:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                                           |                |  |
| Designation                            |                                                                         | .1 W59<br>Symbol with Data                            | ·······          |                                                 | rosido                                                                                                              | III. HOUZOU  | ldi M                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ax interpass 11                           | emp: W59       |  |
|                                        |                                                                         |                                                       | s                | F:                                              | 2                                                                                                                   |              | Lay                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 3 6 2 13 5<br>1 1 2 4<br>ers              | <u></u>        |  |
|                                        | SKETCH O                                                                | F TYPICAL JOIN                                        | T PREPARATIC     | ON                                              |                                                                                                                     |              | TYPICAL PA                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ASS AND LAYER SE                          | QUENCE         |  |
| (1) Back-gou                           | COMPLETE JO<br>uged to sound m<br>onto steel backin<br>from one side wi | ng [] (5) W                                           | Velded both side | s without back g                                | out back gouging  Steel backing  Groove Weld (specify effective throat)  (2) Fillet Weld  Automatic, Semi-Automatic |              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | BUTT  CORNER  matic, Semi-Autom           | ding Gas       |  |
| Mat'l We<br>Thk Size                   | eld Side<br>e/ETT No                                                    | •                                                     | Pass No.         | Filler Metal<br>Size                            | Curren<br>Polarit                                                                                                   | •            | Electrical<br>Stickout:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 16 mm Flow Rat                            |                |  |
| t s                                    | <br>S                                                                   |                                                       | <del></del>      |                                                 |                                                                                                                     | +/- 10%      | ipm +/- 10%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | +/- 7%                                    | ipm +/- 15%    |  |
|                                        | nm                                                                      | 1                                                     | 1                | 1.2 mm                                          | DCRP                                                                                                                | 250          | 310                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 27                                        | 28             |  |
| ······································ | nm                                                                      | 1                                                     | 1                | 1.2 mm                                          | DCRP                                                                                                                | 250          | 310                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 27                                        | 16             |  |
| 8 & up 8 r                             | nm                                                                      | 1                                                     | 1                | 1.2 mm                                          | DCRP                                                                                                                | 250          | 310                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 27<br>27                                  | 20             |  |
| 10 & up 10                             | mm                                                                      | 1                                                     | 1                | 1.2 mm                                          | DCRP<br>DCRP                                                                                                        | 250<br>250   | 310<br>310                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 27                                        | 23             |  |
| 13 & up 13                             | mm                                                                      | <u> </u>                                              | 2,3<br>1         | 1.2 mm<br>1.2 mm                                | DCRP                                                                                                                | 250          | 310                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 27                                        | 11             |  |
| 13 a up 13                             | 111111                                                                  | 2                                                     | 2,3              | 1.2 mm                                          | DCRP                                                                                                                | 250          | 310                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 27                                        | 13             |  |
| 19 & up 19                             | mm                                                                      | . 1                                                   | 1                | 1.2 mm                                          | DCRP                                                                                                                | 250          | 310                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 27                                        | 11             |  |
|                                        | ****                                                                    | 2,3                                                   | 2-6              | 1.2 mm                                          | DCRP                                                                                                                | 250          | 310                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 27                                        | 11             |  |
| Revision Date                          | e initials                                                              | Explanat                                              | ion              |                                                 |                                                                                                                     | Cl           | NB Approval                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | * E                                       | ngineer's Seal |  |
|                                        |                                                                         |                                                       |                  |                                                 |                                                                                                                     | WB Accepte   | dera Data She<br>a to CSA W47.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1 (N) | ENGINEER P     |  |
|                                        |                                                                         |                                                       |                  |                                                 | irho                                                                                                                | ntance velid | or by when Welding of the Welding of | PROFESSO P. 2.2                           |                |  |

|                                           | Welding I                                                                      | Proced                   | dure Dat            | a Sheet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | t                        | No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | F4                                 | Date                   | 14-Jul-04                                            | W47.1                   |
|-------------------------------------------|--------------------------------------------------------------------------------|--------------------------|---------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|------------------------|------------------------------------------------------|-------------------------|
| Company<br>Address:                       |                                                                                | nt Steel I<br>11 - 52 Av | .td.<br>venue SE, C | algary                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Welding<br>Specifica<br>Applicabl  | ition No.              | FC-1                                                 | & W47.1                 |
| Welding<br>Process                        | O (1) Shielded<br>O (2) Gas Met<br>O (3) Gas Tun                               | al Arc (GM               | AW) O(              | 4) Flux-Cored<br>5) Submerged<br>5) Other <u>M</u> C                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Arc (SAV                 | (")                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | letal Classii<br>ng Gas or F       | lux: 9                 | E491C-6M<br>0% to 92% Ar<br>0% to 8% CO <sub>2</sub> | +                       |
| Process<br>Mode<br>Material<br>Designatio | ○ (1) Manual                                                                   | tomatic O                | Name -              | Tungste<br>Tungste<br>Welding                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | n Size:                  |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                                    | Min                    | eat Temp:<br>nterpass Tem<br>Interpass Ten           |                         |
| <u>+</u>                                  | (Show Welding Sym                                                              | por with Data            | - Gap =             | <b>-</b> < <b>F</b> 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | . ·                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Side 1<br>Side 2                   | • (                    | Layers                                               |                         |
| (2) Welded                                | . SKETCH OF TY<br>COMPLETE JOINT<br>auged to sound metal<br>coto steel backing | PENETRAT  (4) Y          | *****               | <b>YELD</b><br>s without back g                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Groove W<br>(specify eff | TYPICAL PASS AND LAYER SEQUENCE  JOINT TYPE  Groove Weld (specify effective throat)  CORNER IEE ARC SF WELD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                    |                        |                                                      |                         |
| Matt W                                    | from one side withouted Side se/ETT No.                                        | I backing<br>Layer       | Pass No.            | Filler Metal<br>Size                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Curren<br>Polarit        | •                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Electrica<br>Stickout<br>Wire Feed | al 16 m                | s, Semi-Automat Shielding 6 Flow Rate: Volts         | 3as - 26 offe           |
| t<br>5 mm<br>6 mm                         | 1 2 1 2                                                                        | 1<br>2<br>1<br>2         | 1 2 1 2             | 1.2 mm<br>1.2 mm<br>1.2 mm<br>1.2 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | DCRP<br>DCRP<br>DCRP     | +/- 10%<br>250<br>250<br>250<br>250<br>250                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                    | 0<br>0<br>0            | +/- 7% 27 27 27 27 27 27                             | ipm +/- 15% 22 22 16 16 |
| Revision Da                               | te Initials                                                                    | Explana                  | lion                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                          | mage or was the second                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | WB Approva                         | le Shad                |                                                      | gineer's Seal           |
|                                           |                                                                                |                          |                     | ing a desirence of the second |                          | Tions And Control of the Control of |                                    | n Areidin<br>, it Well | 10 Val                                               |                         |

|                             | Welding F                                                                            | rocec                                    | lure Dat                                     | a Shee                                             | t                                                 | No.           |                                                                                                                                 | F5                              | Date             | 14-J     | lui-04                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | W           | <u> 17.1</u>                |
|-----------------------------|--------------------------------------------------------------------------------------|------------------------------------------|----------------------------------------------|----------------------------------------------------|---------------------------------------------------|---------------|---------------------------------------------------------------------------------------------------------------------------------|---------------------------------|------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------|-----------------------------|
| Company<br>Address:         |                                                                                      | it Steel L<br>1 - 52 Av                  | .td.<br>enue SE, C                           | algary                                             |                                                   |               |                                                                                                                                 | Welding<br>Specific<br>Applicat | ation N          | 0;       | FC-1<br>W59                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | & W47.1     |                             |
| Welding<br>Process          | O (1) Shielded<br>O (2) Gas Met<br>O (3) Gas Tun                                     | al Arc (GM/                              | \W) ○ (                                      | 4) Flux-Cored<br>5) Submerged<br>6) Other <u>M</u> | Arc (SAV                                          | ~ I .         |                                                                                                                                 | etal Class<br>ng Gas or         | Flux:            | 90% to   | 491C-6M<br>92% Ar<br>8% CO₂                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |             |                             |
| Process<br>Mode<br>Material | ○ (1) Manual                                                                         | omatic O                                 |                                              | Tungste<br>Tungste                                 | n Size:                                           |               | Min Interpass Temp: Tabl                                                                                                        |                                 |                  |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             | ble 5.3                     |
| 1                           | ris Table 11.1 \                                                                     |                                          |                                              | Welding                                            | Positio                                           | ort: F        | lat                                                                                                                             |                                 | Ma:              | x Interp | pass Ten                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ip: W       | 59                          |
| ± 5                         |                                                                                      | <i>√</i><br>⊐⊏<br>≠ -                    | 1.5 - 3                                      | < F5 €7  3 mm                                      | rsm                                               |               | {                                                                                                                               | Side 1                          | . (              |          | 1<br>2<br>Laye                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | ers         | }                           |
|                             | SKETCH OF TY                                                                         | PICAL JOIN                               | T PREPARATIO                                 | )N                                                 |                                                   |               |                                                                                                                                 | TY                              | PICAL PAS        | SS AND L | AYER SEQU                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |             |                             |
| (2) Welded                  | COMPLETE JOINT<br>ouged to sound metal<br>onto steel backing<br>from one side withou | (4) Y                                    | NON GROOVE Velded both side Velded onto othe | s without back (                                   |                                                   | G<br>(S       | ☐ (1) Partial Joint Penetration Groove Weld (specify effective throat) ☐ (2) Filtet Weld ☐ Automatic, Semi-Automatic or Machine |                                 |                  |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             | WELD                        |
| l                           | 'eld Side<br>re/ETT No.                                                              | Layer                                    | Pass No.                                     | Filler Metal<br>Size                               | Curren<br>Polari                                  |               | nperès                                                                                                                          | Electri<br>Sticko<br>Wire Fee   | ut 16            | mm       | Shielding (<br>Flow Rate:<br>Volts                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | L           | 35 cfh<br>vei Speed         |
|                             |                                                                                      | ··••                                     |                                              |                                                    | <i>γ(10-11-11-11-11-11-11-11-11-11-11-11-11-1</i> |               |                                                                                                                                 |                                 |                  |          | +/- 7%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |             | ·/- 15%                     |
| t                           | .#                                                                                   |                                          | 4                                            | 1.2 mm                                             | DCRP                                              |               | 10%<br>250                                                                                                                      |                                 | /- 10%<br>10     |          | 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             | 16                          |
| 6 mm                        | <u>1</u><br>2                                                                        | 1<br>2                                   | 2                                            | 1,2 mm                                             | DCRP                                              |               | 250                                                                                                                             |                                 | 10               |          | 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |             | 13                          |
| 10 mm                       | 1                                                                                    | 1                                        | 1                                            | 1.2 mm                                             | DCRP                                              | .1            | 250                                                                                                                             | 3                               | 10               |          | 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | ***         | 13                          |
|                             | 2                                                                                    | 2                                        | 2                                            | 1.2 mm                                             | DCRP                                              |               | 250                                                                                                                             | ·                               | 10               |          | 27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <del></del> | 10                          |
| 13 mm                       | 1 2                                                                                  | <u>1</u><br>2                            | 2                                            | 1.2 mm<br>1.2 mm                                   | DCRP<br>DCRP                                      |               | 250<br>250                                                                                                                      | £                               | 10<br>10         |          | 27<br>27                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Avr.        | 11<br>8                     |
|                             |                                                                                      |                                          |                                              |                                                    |                                                   |               |                                                                                                                                 |                                 | 4                |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |             | 30.00                       |
| Revision Da                 | ite Initials                                                                         | Explana                                  | lion                                         | debatage.get 1 0.7 4000                            |                                                   |               | Ċ                                                                                                                               | VB Approv                       | al               |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | gineer's    | THE RESERVE THE PROPERTY OF |
|                             |                                                                                      |                                          |                                              |                                                    |                                                   | Wild<br>U     | ing Pr<br>16 Acc                                                                                                                |                                 | Data S<br>Sylvat | heet     | PROFESSION TO THE PROPERTY OF THE PROFESSION TO | ENG         | WEST E                      |
|                             |                                                                                      | (A-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1-1 | -                                            |                                                    |                                                   | (E)<br>Austri |                                                                                                                                 | . 28 Z<br>marchys<br>marchae    |                  | long !   | A) SOFES                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |             | 104 PH                      |
|                             |                                                                                      |                                          |                                              |                                                    |                                                   |               |                                                                                                                                 | a 1446a<br>Mariana<br>Mariana   |                  | N.B.     | Lave                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 圖           | 計し                          |

|                                                                                                    | Welding I                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Ргосес                   | lure Dat                     | ta Sheet                                      | t                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | No.                      | F6 Date                                                                                       | 14-Jul-04                                    | W47.1                            |
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| Company<br>Address:                                                                                | , i                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | nt Steel L<br>I1 - 52 Av | .td.<br>enue SE, C           | algary                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          | Welding Proce<br>Specification M<br>Applicable Star                                           | lo. FC-1<br>ndards: W59                      | & W47.1                          |
| Welding<br>Process                                                                                 | (1) Shielded<br>(2) Gas Mel<br>(3) Gas Tun                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | al Arc (GMA              | iw) O                        | 4) Flux-Cored<br>5) Submerged<br>6) Other MC/ | Arc (SAW                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | "                        | etal Classificationg Gas or Flux:                                                             | n: E491C-6M<br>90% to 92% A<br>10% to 8% CC  | r+                               |
| Process<br>Mode                                                                                    | O (1) Manual<br>(2) Semi-Au                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                          | (3) Machine<br>(4) Automatic | Tungste<br>Tungste                            | <b>*</b> -                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                          | As per                                                                                        |                                              |                                  |
| Material<br>Designation                                                                            | Steel Group<br>ons Table 11.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                          | 3                            | Welding                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | n: Flat                  |                                                                                               | x Interpass Ter                              | -                                |
| <u>+</u> <u>-</u> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 45°                      | .5 - 3 m                     | F6<br>GTSM                                    | 3 mm                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1                        | ide 1                                                                                         | Layer                                        |                                  |
|                                                                                                    | SKETCH OF TY                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                          |                              |                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |                                                                                               | SS AND LAYER SECT<br>JOINT                   |                                  |
| (2) Welded                                                                                         | ouged to sound metal<br>conto steel backing<br>I from one side withou                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | (4) W                    | /elded both side             | es without back g                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Groove W                 | ective throat)<br>leid                                                                        | CORNER -                                     | LAP EOGE<br>TEE ARC SPOT<br>WELD |
| Mat'l V                                                                                            | /eld Side<br>ze/ETT No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Layer                    | Pass No.                     | Filler Metal<br>Size                          | Current<br>Polarit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                          | Electrical Slickout:                                                                          | atic, Semi-Automal Shielding Flow Rate Volts | Gas — 15 ABA                     |
| t                                                                                                  | The second secon |                          |                              |                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | +/- 10%                  | ipm +/- 10%                                                                                   | +/- 7%                                       | ipm +/- 15%                      |
| 10 mm                                                                                              | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                        | 1                            | 1,2 mm                                        | DCRP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 250                      | 310                                                                                           | 27                                           | 6                                |
|                                                                                                    | Ż                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4                        | В                            | 1.2 mm                                        | DCRP<br>DCRP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 250<br>250               | 310<br>310                                                                                    | 27<br>27                                     | 11<br>7                          |
| 13 mm                                                                                              | 1 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1,2<br>4                 | 1,2<br>B                     | 1,2 mm<br>1,2 mm                              | DCRP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 250                      | 310                                                                                           | 27                                           | 11                               |
| 19 mm                                                                                              | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1                        | 1                            | 1.2 mm                                        | DCRP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 250                      | 310                                                                                           | 27                                           | <del>7</del><br>6                |
|                                                                                                    | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 2,3                      | 2-4                          | 1.2 mm                                        | DCRP<br>DCRP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 250<br>250               | 310<br>310                                                                                    | 27<br>27                                     | 11                               |
|                                                                                                    | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | . 4                      | B                            | 1,2 mm                                        | 00111                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 2204                     |                                                                                               |                                              | 4/44                             |
| Revision Da                                                                                        | ate Initials                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | Explanal                 | noi                          |                                               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | C                        | l<br>WB Approval                                                                              | * En                                         | gineer's Seal                    |
| TEE COLUMN CONTRACTOR COLUMN                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |                              | 4.00                                          | The state of the s | CWB Aus                  | ventue Casa é<br>epen a CSA Vis                                                               | :                                            | and lane X                       |
|                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                          |                              |                                               | į (                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | eranieras<br>Desputation | uirik og reto ski<br>et uir skipe og skipe skip<br>et uir skipe og skipe<br>et skipe og skipe | A PROFESS                                    | 闘り                               |

| Weldin           | g Proc                     | edure Data                                             | a Sheet                | No.   |                                | F11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | `                   | Rev                                                                   | 0             | Date       | Pebruar          | y 09, 20  | 007 <b>W47.1</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| Compar           | ıy Name                    | Kent Ste                                               | el Ltd.                |       |                                | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                     | Ref.                                                                  | WPS           |            |                  | FC-       | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Address          | <b>;</b>                   | 5441 - 52                                              | 2 Avenue               | SE, C | alga                           | ry                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     | Ref.                                                                  | Stan          | lards      | W                | 59 & V    | V47.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Welding          | Proces                     | s N                                                    | 1CAW                   | Pi    | ulsed                          | <del>'</del>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | No                  | Welc                                                                  | ling F        | ositio     | חח               | Fla       | t                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Process          | Mode                       | ***                                                    |                        | Sem   | i-Aut                          | to                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     | Joint Type Butt                                                       |               |            |                  |           | t                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Shieldin         | g Gas T                    | ype                                                    | 90 - 92                | 2% Ar | 6 Ar + 10 - 8% CO <sub>2</sub> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                       | Penetration   |            |                  | Comp      | lete                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| Gas Flo          | w Rate                     |                                                        |                        | 35    | 35 cfh                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                       | Tungsten Type |            |                  |           | The state of the s |
| Filler Me        | etal Clas                  | sification                                             |                        | E491C | 91C-6M-H4                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                     |                                                                       | jsten         | Size       |                  |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Electroc         | e Exten                    | sion                                                   | 16                     | mm    | a,                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Preh                | eat T                                                                 | emp.          |            | А                | s per     |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Base M           | aterial                    | Š                                                      | ups 1,                 | 2 &   | 3                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | Inter               | pass                                                                  | Tem           | o. Min.    | Та               | ble 5.3   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                  |                            | Т                                                      | able 11.1              | 8 12. | 1 W                            | 59                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                     | Inter                                                                 | pass          | Temp       | o. Max.          | ,         | <i>N</i> 59                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                  | Typica                     | ap = t 1.5 —                                           |                        |       |                                | 2000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     | Typical Pass and Layer rrent   Wire Feed   Burn Off   Volts   Welding |               |            |                  |           | Walding                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Mat'i<br>Thk     | Weld<br>Size               | g                                                      | yer Pas<br>Numt        |       | ler<br>stal                    | Curren<br>Polarit                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4                   | rent<br>eres                                                          |               | Feed<br>ed | Burn Off<br>Rate | Volts     | Welding<br>Speed                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| t                |                            |                                                        |                        |       | ze                             | DADE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                     | 0%                                                                    |               | :10%<br>0  |                  | ±7%<br>27 | ipm ±15%<br>17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| 3 mm             |                            | ,                                                      | 1 1                    |       | mm<br>45")                     | DCRF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | - 2                 | 50                                                                    | J             | U          |                  | 24        | 1 f                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| 5 mm             |                            |                                                        | 1 1                    |       | mm                             | DCRF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2:                  | 50                                                                    | 3.            | 0          |                  | 27        | 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 6 mm             |                            | 1                                                      | ,2 1,2                 | 2 1.2 | mm                             | DCRF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2 2                 | 50                                                                    | 3′            | 0          |                  | 27        | 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                  |                            |                                                        | 0 40                   | 1 4 2 | mm                             | DCRF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2 2                 | 50                                                                    | 3,            | 0          |                  | 27        | 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| 8 mm             |                            |                                                        | ,2 1,2                 | 1,2   | TIGIES                         | DOM                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | <i>5</i>            | VV                                                                    |               |            |                  |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 10 mm            |                            | 1                                                      | ,2 1,2                 | 2 1.2 | mm                             | DCRF                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 2                   | 50                                                                    | 3.            | 10         |                  | 27        | 6                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Revision<br>Date | ۱ App.                     | Ex                                                     |                        |       | (                              | CWB A                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | pprova              | al                                                                    |               | E          | ngineer          | s Seal    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Remar            | /B Acce<br>FEE<br>lance vi | ocedure<br>epted to<br>3 1 5<br>alld only<br>a cartifi | 2007<br>when<br>led by | Weldi |                                | STATE OF THE PARTY | ENG<br>JEST<br>JEST |                                                                       |               |            |                  |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |

| . !                                        | Welding F                                                                  | roced                    | ure Dat                     | a Sheet                                               |                    | No.         | F                 | 32                                     | Date            | 14-Jul-04                                    |                 | W47.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------|----------------------------------------------------------------------------|--------------------------|-----------------------------|-------------------------------------------------------|--------------------|-------------|-------------------|----------------------------------------|-----------------|----------------------------------------------|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Company Address:                           |                                                                            | t Steel Lt<br>1 - 52 Ave | d.<br>eune SE, Ca           | algary                                                |                    | Ý           |                   | Welding<br>Specific<br>Applicat        | ation N         | io. FC-<br>ndards: W                         | 59 &            | W47.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Welding<br>Process                         | O (1) Shielded O (2) Gas Meta O (3) Gas Tun                                | al Arc (GMA)             | w) O (5                     | 4) Flux-Cored /<br>5) Submerged<br>6) Other <u>MC</u> | Arc (SAW           | "           |                   | etal Class<br>ig Gas or                |                 | n: E491©-6<br>90% to 92%<br>10% to 8% (      | Ar+             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Process<br>Mode<br>Material<br>Designation | (1) Manual (2) Semi-Aut Steel Group                                        | omatic () (s 1, 2 & 3    | (3) Machine<br>4) Automatic | Tungsten Type: Tungsten Size: Welding Position:       |                    |             | Min Inter         |                                        |                 | eheat Temp:<br>n Interpass T<br>ax Interpass | •               | ,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|                                            | Show Welding Symb                                                          | ool with Data            | Sheet No. in tali           | ,                                                     | 32                 | <b>&gt;</b> |                   | 12                                     | } {             | 3<br>2<br>1                                  | 167             | 5<br>24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                            | SKETCH OF TY                                                               | DIOM IONS                | DEDARATIO                   | N.                                                    | <u> </u>           |             | <u></u>           | TY                                     | PICAL PA        | SS AND LAYER S                               | EQUE            | NCE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| (1) Back-got                               | COMPLETE JOINT uged to sound metal onto steel backing from one side withou | PENETRATI (4) W (5) W    | ON GROOVE V                 |                                                       |                    |             | roove We          | ective throat)                         |                 | □ BUTT  CORNER                               | NT TY           | AP DEDGE  BARC SPOT  WELD                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| Mat'l W                                    | eld Side<br>e/ETT No.                                                      | Layer                    | Pass No.                    | Filler Metal<br>Size                                  | Current<br>Polarit |             | nperes            | Electri<br>Sticko                      | cal<br>ut:      | atic, Semi-Auto Shield Flow F                | ing Ga<br>Rate: |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|                                            |                                                                            |                          |                             |                                                       |                    | <u> </u>    | 100/              | Wire Fee                               |                 | +/- 7%                                       |                 | ipm +/- 15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|                                            | S                                                                          | 4                        |                             | 1.6 mm                                                | DCRP               |             | - 10%<br>290      |                                        | -/- 10%<br>:40  | 26                                           |                 | 34                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | mm                                                                         | 1                        | 1                           | 1.6 mm                                                | DCRP               |             | 290               |                                        | 40              | 26                                           |                 | 19                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | mm<br>mm                                                                   | 1                        | 1                           | 1.6 mm                                                | DCRP               |             | 290               | 2                                      | 40              | 26                                           | ······          | 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            | mm                                                                         | 1                        | 1a                          | 1.6 mm                                                | DCRP               |             | 290               |                                        | 40              | 26                                           |                 | 16                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                            |                                                                            | 2                        | 2a                          | 1.6 mm                                                | DCRP               |             | 290               |                                        | 40              | 26<br>26                                     |                 | 18                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 13 & up 13                                 | mm .                                                                       | 1                        | 2,3                         | 1.6 mm                                                | DCRP<br>DCRP       |             | 290<br>290        |                                        | 40              | 26                                           |                 | 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 19 & up 19                                 | mm                                                                         | <u>2</u><br>1            | <u> </u>                    | 1.6 mm                                                | DCRP               |             | 290               |                                        | 40              | 26                                           |                 | 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 19 & UP 19                                 | 111111                                                                     | 2,3                      | 2-6                         | 1.6 mm                                                | DCRP               |             | 290               | 2                                      | 40              | 26                                           |                 | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Revision Da                                | te initials                                                                | Explanat                 |                             | ,20 11/113                                            | <u></u>            |             |                   | WB Appro                               | /al             | 4                                            | Eng             | ineer's Seal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|                                            |                                                                            |                          |                             |                                                       |                    | CV          | ling Pr<br>VB Acc | ocedure<br>epied to C<br>L 2 5 2       | Dato S<br>SA V4 | OFFSSS                                       | Jal July        | ENGINECTS P. ST. LAND P. ST. L |
|                                            |                                                                            |                          |                             |                                                       | (                  | Const       | unable            | elid cróy w<br>e certifico<br>254 VV47 | d by C.         | W.S.                                         | 9               | 疆的                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

|                                            | Welding F                                                       | Proced                  | lure Dat          | ta Sheel                                            |                     | No.                                                                        | F34                                | Date                        | 14-Jul-04                                        | W47.1                               |  |  |  |
|--------------------------------------------|-----------------------------------------------------------------|-------------------------|-------------------|-----------------------------------------------------|---------------------|----------------------------------------------------------------------------|------------------------------------|-----------------------------|--------------------------------------------------|-------------------------------------|--|--|--|
| Company<br>Address:                        |                                                                 | nt Steel L<br>1 - 52 Av | td.<br>enue SE, C | algary                                              |                     | Welding Procedure Specification No. FC-1 Applicable Standards: W59 & W47.1 |                                    |                             |                                                  |                                     |  |  |  |
| Welding<br>Process                         | (1) Shielded<br>(2) Gas Met<br>(3) Gas Tun                      | al Arc (GM              | w) O(             | 4) Flux-Cored<br>5) Submerged<br>6) Other <u>MC</u> | Arc (SAW)           | መመስ መመስ መመስ መመስ መስለ መስለ መስለ መስለ መመስ መመስ                                    |                                    |                             |                                                  |                                     |  |  |  |
| Process<br>Mode<br>Material<br>Designation | ○ (1) Manual<br>○ (2) Semi-Au<br>Steel Group<br>ns Table 11.1 \ | tomatic O<br>s 1, 2 & 3 | WW.W              | Tungste<br>Tungste<br>Welding                       | n Size:             | ı: Flat                                                                    |                                    | Min                         | neat Temp:<br>Interpass Te<br>Interpass Te       | _                                   |  |  |  |
| ± 5                                        | Show Welding Syml                                               | ool with Data           | Sheel No. in tai  | < F34  ☐                                            |                     |                                                                            | Side 1                             | 2~                          | Layer                                            | s                                   |  |  |  |
|                                            | SKETCH OF TY                                                    | PICAL JOIN              | T PREPARATIO      | ON .                                                | Lactions            |                                                                            | TYPI                               | CAL PASS                    | AND LAYER SEC                                    | DUENCE                              |  |  |  |
| (1) Back-goo                               | COMPLETE JOINT<br>uged to sound metal<br>onto steel backing     | (4) W                   | /ekled both side  | WELD<br>s without back g<br>ir than steel bac       | 1                   | Groove W                                                                   | fective throat)<br>Veld            | offices and the second      | BUTT CORNER                                      | TTYPE  LAP EDGE  TEE MARC SPOT WELD |  |  |  |
| Mat'l We                                   | from one side withou<br>eld Side<br>e/ETT No.                   | Layer                   | Pass No.          | Filler Metal<br>Size                                | Current<br>Polarity | Amperes                                                                    | Electrica<br>Stickout<br>Wire Feed | 19 r                        | ic, Semi-Autom<br>Shielding<br>Flow Rat<br>Volts | G2s                                 |  |  |  |
| ŧ                                          |                                                                 | ***                     |                   | grape, Statutherians                                |                     | +/- 10%                                                                    | ipm +/-                            | 10%                         | +/- 7%                                           | ipm +/- 15%                         |  |  |  |
| 5 ជា <b>កា</b>                             | 1                                                               | 1                       | 1                 | 1.6 ភាពា                                            | DÇRP                | 290                                                                        | 244                                | Ó                           | 26                                               | 25                                  |  |  |  |
|                                            | 2                                                               | 2                       | 2                 | 1.6 mm                                              | DCRP                | 290                                                                        | 244                                |                             | 26                                               | 25                                  |  |  |  |
| 6 mm                                       | 1                                                               | 1                       | 11                | 1.6 mm                                              | DCRP                | 290                                                                        | 240                                | armente de la communicación | 26<br>26                                         | 19<br>19                            |  |  |  |
|                                            | 2                                                               | 2                       | 2                 | 1.6 mm                                              | DCRP                | 290                                                                        | 244                                |                             |                                                  |                                     |  |  |  |
| Revision Dai                               | ie Initials                                                     | Explanat                |                   |                                                     | MM FIG. (C.C.)      | C                                                                          | WB Approva                         | ]<br>                       | * E                                              | ngineer's Seal                      |  |  |  |
|                                            |                                                                 |                         |                   |                                                     |                     |                                                                            |                                    |                             | PHOFESSON AND AND AND AND AND AND AND AND AND AN | ENGING<br>SELECTION<br>Secolo4      |  |  |  |
|                                            |                                                                 |                         |                   |                                                     |                     |                                                                            | S                                  |                             |                                                  | CHA MAIL                            |  |  |  |

# Welding Procedure Data Sheet No. F35 Date 14-Jul-04 Welding Procedure FC-1

| Company                                                                                                                                                                                                                           | Name: Kent                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Steel Ltd.     | Acceptance of the |                                   | Welding Procedure Specification No. FC-1 |                                |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |  |
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| Address:                                                                                                                                                                                                                          | 5441                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | lgary          |                   | Applicable Standards: W59 & W47.1 |                                          |                                |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |  |
| Welding<br>Process                                                                                                                                                                                                                | O (1) Shielded Metal Arc (SMAW) O (4) Flux-Cored (Cored Cored Cor |                |                   |                                   |                                          | 3                              | Filler Metal Classification: E491C-6M-H4 Shielding Gas or Flux: 90% to 92% Ar + 10% to 8% CO <sub>2</sub> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |  |
| Process<br>Mode<br>Material                                                                                                                                                                                                       | ocess (1) Manual (3) Machine (2) Semi-Automatic (4) Automatic                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                |                   |                                   | n Type:<br>n Size:                       | Flat                           | Preheat Temp: As per Min Interpass Temp: Table 5.  Flat Max Interpass Temp: W59                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |  |
| Designation                                                                                                                                                                                                                       | rs Table 11.1 W                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                |                   | MéiomA                            | Position:                                | FIBL                           |                                                                                                           | Mgy (Mic) hada i eini                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | p. Mas            |  |
| (Show Welding Symbol with Data Sheet No. in tail)  F35 GTSM  Side 1  2  Side 2  Layers                                                                                                                                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                |                   |                                   |                                          |                                |                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |  |
|                                                                                                                                                                                                                                   | SKETCH OF TYP                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | PICAL JOINT PR | EPARATIO          | N                                 |                                          |                                | TYPICAL                                                                                                   | PASS AND LAYER SEQUE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                   |  |
| COMPLETE JOINT PENETRATION GROOVE WELD  (1) Back-gouged to sound metal (4) Welded both sides without back gouging (2) Welded onto steel backing (5) Welded onto other than steel backing (3) Welded from one side without backing |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                |                   |                                   |                                          |                                | JOINT TYPE   (1) Partial Joint Penetration   Groove Weld   Weld   BUTT   LAP   EDGE                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                   |  |
|                                                                                                                                                                                                                                   | eld Side<br>e/ETT No.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Layer F        | ass No.           | Filler Melal<br>Size              | Current<br>Polarity                      | Amperes                        | Electrical ;<br>Stickout: :                                                                               | \$ Shielding G<br>Flow Rate:                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | , 35 CM           |  |
|                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |                |                   | A                                 |                                          |                                | Wire Feed Spe                                                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Arc Travel Speed  |  |
| t                                                                                                                                                                                                                                 | 10, 199000                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                |                   |                                   | **^50                                    | +/- 10%                        | ipm +/- 10'                                                                                               | % <u>+/- 7%</u><br>26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ipm +/- 15%<br>19 |  |
| \$ mm                                                                                                                                                                                                                             | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1              | 1                 | 1.6 mm                            | DCRP<br>DCRP                             | 290<br>290                     | 240                                                                                                       | 26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 15                |  |
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| 13 mm                                                                                                                                                                                                                             | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1              | 1                 | 1.6 mm                            | DCRP                                     | 290                            | 240                                                                                                       | 26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 13                |  |
| 15 han                                                                                                                                                                                                                            | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2              | 2                 | 1,6 mm                            | DCRP                                     | 290                            | 240                                                                                                       | 26                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10                |  |
| Revision Da                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | Explanation    |                   |                                   |                                          | C                              | WB Approval                                                                                               | * Eng                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | ineer's Seal      |  |
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|                                                                                                                                                                                                             | Welding F                                   | roced       | lure Dai                     | ta Sheet             | <b>!</b> .                                                                 | No. F          | 36 Date                                                                                                   | 14-Jul-04                            | W47.1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|-------------|------------------------------|----------------------|----------------------------------------------------------------------------|----------------|-----------------------------------------------------------------------------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|--|
| Company<br>Address:                                                                                                                                                                                         | td.<br>enue SE, C                           | algary      |                              |                      | Welding Procedure Specification No. FC-1 Applicable Standards: W59 & W47.1 |                |                                                                                                           |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |
| Welding<br>Process                                                                                                                                                                                          | (1) Shielded<br>(2) Gas Meti<br>(3) Gas Tun | al Arc (GM/ | iw) O (                      | 5) Submerged         | Arc (SAM                                                                   | "              | Filler Metal Classification: E491C-6M-H4 Shielding Gas or Flux: 90% to 92% Ar + 10% to 8% CO <sub>2</sub> |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |
| Process<br>Mode                                                                                                                                                                                             | O (1) Manual<br>(2) Semi-Aul                |             | (3) Machine<br>(4) Automatic | Tungste<br>Tungste   |                                                                            |                |                                                                                                           | eheat Temp:<br>in Interpass Tei      | As per                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |  |  |
| Material<br>Designatio                                                                                                                                                                                      | Steel Group<br>ns Table 11.1 \              |             | }                            | Welding              |                                                                            | n: Flat        | Max Interpass Temp: W59                                                                                   |                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |
|                                                                                                                                                                                                             | (Show Welding Symt                          | 45°         | - /                          | 736 GTS              | M<br>3 mm                                                                  | 1              | de 1                                                                                                      | 3 4 2<br>2 2<br>1 4<br>Layer         | 2<br>-<br>-<br>-                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |  |  |
| <b> </b>                                                                                                                                                                                                    | SKETCH OF TY                                | 1 7         |                              | warmer-              |                                                                            |                | TYPICAL PA                                                                                                | SS AND LAYER SEC                     | UENĈE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |  |  |
| COMPLETE JOINT PENETRATION GROOVE WELD  [7] (1) Back-gouged to sound metal [7] (4) Welded both sides without back [7] (2) Welded onto other than steel backing [7] (5) Welded from one side without backing |                                             |             |                              |                      | (snecify affective throat)                                                 |                |                                                                                                           | LAP EDGE TEE MARC SPOT WELD          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |  |  |
| , <b>-,</b>                                                                                                                                                                                                 | eld Side<br>e/ETT No.                       | Layer       | Pass No.                     | Filler Metal<br>Size | Current<br>Polarit                                                         | -              | Electrical<br>Stickout:<br>Wire Feed Speed                                                                | 9 mm Shielding<br>Flow Rate<br>Volks | (A) C(D)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |  |  |
|                                                                                                                                                                                                             |                                             |             |                              | Sec. A.              | · · · · · · · · · · · · · · · · · · ·                                      | - 1 4007       | ipm +/- 10%                                                                                               | +/- 7%                               | ipm +/- 15%                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |  |  |
| 10 mm                                                                                                                                                                                                       | 1                                           | 1           | 1                            | 1.6 നണ               | DCRP                                                                       | +/- 10%<br>290 | ερια +ν- 107s<br>240                                                                                      | 26                                   | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |
| PQ HAZIE                                                                                                                                                                                                    | 2                                           | 4           | В                            | 1.6 mm               | DCRP                                                                       | 290            | 240                                                                                                       | 26                                   | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |
| 13 mm                                                                                                                                                                                                       | 1                                           | 1,2         | 1,2                          | 1.8 mm               | DCRP                                                                       | 290            | 240                                                                                                       | 26<br>26                             | <u>8</u><br>13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |  |  |
|                                                                                                                                                                                                             | 2                                           | 44          | <u>B</u>                     | 1.6 mm               | DCRP<br>DCRP                                                               | 290<br>290     | 240<br>240                                                                                                | <u>ಕೆಲ್ಲಿ</u><br>26                  | 8                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |
| 19 mm                                                                                                                                                                                                       | 1                                           | 1<br>2,3    | 2-4                          | 1.6 mm<br>1.6 mm     | DCRP                                                                       | 290            | 240                                                                                                       | 26                                   | 7                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |
|                                                                                                                                                                                                             | 2                                           | 4           | В                            | 1.6 mm               | DCRP                                                                       | 290            | 240                                                                                                       | 26                                   | 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |  |  |
| Revision Dat                                                                                                                                                                                                | Revision Date Initials Explanation          |             |                              |                      |                                                                            | Ci             | VB Approval                                                                                               | * B                                  | * Engineer's Seal                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |  |  |
|                                                                                                                                                                                                             |                                             |             |                              |                      | 30.00                                                                      |                |                                                                                                           |                                      | The loss of the lo |  |  |



ly while employed by a CWB certified con Transferable Welder

Name: SHEA W. BROWN
Employer: Kent Steel Ltd., Calgary, AB
Thickness Range: 3mm & above

Mode: SEMI-AUTO
Single Electrode Mechanized
Single Electrode Automatic

Class: FLAT/HORIZONTAL/VERTICAL UP

Exp. Date: Jul 18, 2013

Material: Carbon Steel
Process: FCAW/MCAW
Standard: CSA W47.1
Classification: FW



# Welder Qualification The cardis walld only while employed by a CWB certified company a Transferable Welder

Name: NICHOLAS B. CHARLESON
Employer: Labros Enterprises Ltd., Calgary, AB
Thickness Range: 3mm & above Material: Carbon Steel
Process: FCAWMCAW
Standard: CSA W47-1
Classification: S

Mode SEMI-AUTO
Single Electrode Mechanized
Single Electrode Automatic
Class FLAT



#### Transferable Welder

Nov 03, 2012 Exp. Date:

Name NGAN D DINH Exp. Date:
Employer T & K Iron Works Inc., Calgary
Thickness Range; 3mm & above Material:

Carbon Steel FCAW/MCAW

Process FCAW/MCAV Standard CSA W47.1 Classification S

Mode of Transfer N/A

Mode Semi Automatic

Single Electrode Mechanized

Single Electrode Automatic

Class: Fiat

See Reverse for Conditions



# Welder Qualification This card is valid only while employed by a CWB certified company Transferable Welder

Name: MICHAEL A. HARRIS Employer: Kent Steel Ltd., Calgary, AB Thickness Range: 3mm & above

Mode: SEMI-AUTO
Single Electrode Mechanized Single Electrode Automatic

Class: FLAT

Exp. Date: Sep 29, 2012

Material: Carbon Steel
Process: FCAW/MCAW Standard: CSA W47.1

Classification: S

See Reverse for Conditions



# Welder Qualification This card is valid only while employed by a CWB certified company Transferable Welder

Name: PAUL A. HELM

Employer: Kent Steel Ltd., Calgary, AB Thickness Range: 3mm & above

Mode: SEMI-AUTO

Single Electrode Mechanized Single Electrode Automatic

Class: FLAT/HORIZONTAL/VERTICAL UP

Exp; Date: Jul 18, 2013

Material: Carbon Steel
Process: FCAW/MCAW

Standard: CSA W47.1 Classification: FW

See Reverse for Conditions



### **Welder Qualification** ly while employed by a CWB cer Transferable Welder

Name: HUYNH L. CUONG Employer: Kent Steel Ltd., Calgary, AB

Thickness Range: 3mm & above

Mode: SEMI-AUTO

Single Electrode Mechanized Single Electrode Automatic

Class: FLAT

Exp. Date: Nov 26, 2013

Material: Carbon Steel

Process: FCAW/MCAW Standard: CSA W47.1

Classification: S



# Welder Qualification This card is valid only while employed by a CWB certified company Transferable Welder

Name: KHUONG A. NGUYEN Employer: Kent Steel Ltd., Calgary, AB Thickness Range: 3mm & above

Mode: SEMI-AUTO

Single Electrode Mechanized Single Electrode Automatic

Class: FLAT

Feb 28, 2014 Exp. Date:

Material: Carbon Steel
Process: FCAW/MCAW Standard: CSA W47.1

Classification: S



# Welder Qualification This card is valid only while employed by a CWB certified company Transferable Welder

Name: THO H, NGUYEN

Employer: Kent Steel Ltd., Calgary, AB 3mm & above

Thickness Range:

Mode: SEMI-AUTO
Single Electrode Mechanized
Single Electrode Automatic
Class: FLAT

Exp. Date: Dec 20, 2012

Material: Carbon Steel Process: FCAW/MCAW

Standard: CSA W47.1

Classification: S



## **Welder Qualification**

Lumin SANGT PHAM

Encorper Kenn Steel Ltd. Caligary, AB
Process Range Jam & above

Mage SEMI-AUTO
Single Electrode Mechanized
Single Electrode Automatic
Class C REATHORIZONTAL DEPTRICAL LIB



# Welder Qualification This card is valid only while employed by a CWB certified company Transferable Welder.

Name: ARNEL H. SANTIAGO Employer: Kent Steel Ltd., Calgary, AB

3mm & above Thickness Range:

Mode: SEMI-AUTO Single Electrode Mechanized Single Electrode Automatic

Class: FLAT

Exp. Date: Aug 10, 2013

Material: Carbon Steel
Process: FCAW/MCAW

Standard: CSA W47.1 Classification: S



#### Transferable Welder

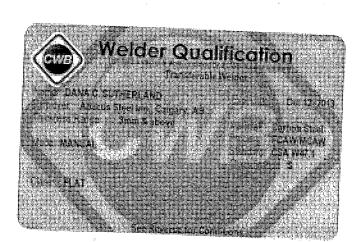
Transferable W
Name GREG M SAUVIAT
Employer Kent Steel Ltd., Calgary
Thickness Range 3mm & above
Mode of Transfer: N/A
Mode Manual

Exp. Date: Nov 15, 2012

Carbon Steel

Process SMAW
Standard CSA W47.1
Classification S
Electrode N/A

Class: Flat/Horizontal/Vertical Up/Overhead





# Welder Qualification card is valid only while employed by a CWB certified company

Exp. Date: Material:

Process FCA Standard CSA Classification FW

Sep 15, 2012

Carbon Steel

FCAW/MCAW CSA W47.1

#### Transferable Welder

Name CUONG CHI TRUONG
Employer Kent Steel Ltd., Calgary
Inickness Range 3mm & above

Mode of Transfer: N/A
Mode: Semi Automatic
Single Electrode Mechanized
Single Electrode Automatic

Class: Flat/Horizontal/Vertical Up/Overhead



Transferable Welder

Name: ROBERT J. WIKERUK

Employer: Kent Steel Ltd., Calgary, AB

Thickness Range: 3mm & above

Mode: SEMI-AUTO

Single Electrode Mechanized Single Electrode Automatic

Class: FLAT

Exp. Date: Feb 28, 2014

Material: Carbon Steel

Process: FCAW/MCAW
Standard: CSA W47.1
Classification: S



#### **MAGNETIC PARTICLE INSPECTION REPORT**

CG19-10 - MT279

Page 1 of 1

| Procedures: MT -2V (IRISNDT proc.5.0)  Code: ASME Sec. V. & VIII. Div.1 App.6   | Job / P.O. #: KS1767<br>Client: KENT STEEL                            | IRISNDT #: 252641                                                         | <b>Date:</b> 16-May-12                                  |
|---------------------------------------------------------------------------------|-----------------------------------------------------------------------|---------------------------------------------------------------------------|---------------------------------------------------------|
| & CSA W59 (Statically Loaded)                                                   | Location: Calgary , Al Item Inspected: Structual                      | perta                                                                     |                                                         |
| Surface Condition: Painted ⊠ Sandblasted □                                      | Machined ☐ As Cast ☐                                                  | As Forged ☐ Weldment ⊠                                                    | Other 🗌                                                 |
| Material: C.S.                                                                  |                                                                       | Thickness: 0.500" H                                                       | eat Treatment: N/A                                      |
| Magnetizing Equipment:       Yoke ☑       Coil ☐         IRISNDT #: 40104       | Prod ☐ Bench: He<br>Mfg: Contou                                       |                                                                           | Coil ☐<br>on Date: 2-Apr-12                             |
| Blacklight:   IRISNDT #:   Verification per ASME V                              | Mfg:                                                                  | Calibratio                                                                | on Date:12                                              |
| Whitelight: Battery Powered Min. 3V<br>110V Power Min. 60W Bu                   | <b>&gt;</b>                                                           | Held within 30 cm (12in) of the inspr<br>provides minimum 1000 Lx (100fc) | ection surface                                          |
| Method of Magnetization: AC ⊠ DC □ C                                            | Continuous ⊠ Residual □                                               |                                                                           |                                                         |
| Magnetic Particles: Dry ☐ Wet ⊠ Batch #: 1102                                   | Red ☐ G<br>Mfg: Magna                                                 | rey □ Black ⊠ Fluorescent □<br>lux Type: 70                               |                                                         |
| Background: ⊠ Batch #: 1211                                                     | Mfg: Ardrox                                                           | Type: 89                                                                  | 01W                                                     |
| Inspection Results: ACCEPTABLE TO CODE                                          |                                                                       |                                                                           |                                                         |
| Items inspected:                                                                |                                                                       |                                                                           |                                                         |
|                                                                                 | WARWICK INDUSTI<br>Job# W28406<br>P.O#: P12093<br>Project; ABB / BERI |                                                                           |                                                         |
| Inspection Limitation(s):                                                       | 16 – SIDEPLATES                                                       | <b>;</b>                                                                  |                                                         |
|                                                                                 |                                                                       | Interpretation by:                                                        |                                                         |
| Office, 555                                                                     | nsumables:<br>n. chg.                                                 | Paul Frank (Print)  (Signature) Client Representative: (Print)            | SNT-TC-1A II (Level) C.G.S.B. II (Level) C.G.S.B.# 7064 |
| 5311 – 86 Street Edmonton, Alberta, T6E 5T8 Phone: (780) 437-2022 Fax: (780) 43 | 38-1436                                                               | agreement with report contents (Sign)                                     | ALBERDA                                                 |

Calgary Lloydminster Barrhead Nisku

(403) 279-6121 (780) 875-6455 (780) 674-3018 (780) 955-7616

(780) 594-1114 (780) 743-1536 (780) 956-4094 (403) 347-1742 (403) 427-6284

Corpus Christi, TX Deer Park, TX Matrix,Houston, TX Texas City, TX Tulsa, OK

(361) 888-4700 (281) 476-4444 (713) 722-7177 (490) 945-2262 (918) 446-8773



5441 52nd Avenue S.E. Calgary, AB T2C 4S5 Phone: (403) 279 7000 Fax: (403) 279 7060

| Record                             | of Elevation                                                     |            |
|------------------------------------|------------------------------------------------------------------|------------|
| To:                                | Date: Nay 19/12                                                  |            |
|                                    | Kent Job#: 1767                                                  |            |
|                                    | Project:                                                         |            |
|                                    |                                                                  |            |
|                                    |                                                                  |            |
|                                    | Client Ref. #:                                                   |            |
| Attn:                              | Drawing Ref:                                                     |            |
|                                    | odel: NCL 26X SERIAL # 4073152. Calibration Date: August 12, 201 | 0          |
| Company Rep: Budd Silwsonkirb      |                                                                  | <u> </u>   |
| Specific Support Locations         |                                                                  |            |
| · <del>-</del>                     |                                                                  |            |
| @ Quarter Section<br>Zegual Spaces |                                                                  | \          |
| į                                  |                                                                  | , X        |
|                                    |                                                                  | <b>'</b> X |
|                                    | x                                                                | <b>X</b>   |
|                                    | 7 + x - x - 7                                                    | <b>x</b>   |
|                                    | $  \times$ $ \times$ $ \times$ $-$                               | <b>`</b> x |
|                                    |                                                                  |            |
|                                    | x                                                                | <b>X</b>   |
| 11                                 |                                                                  | <b>\</b> X |
| 2                                  | $ \longrightarrow                                   $            | `x         |
| 4 14                               |                                                                  | `          |
| 5 15<br>6 16                       | X X                                                              | <b>`X</b>  |
| 7 17                               | 7 x /x                                                           | /X         |
| 8 18<br>9 19                       |                                                                  |            |
| 10 20                              |                                                                  |            |
|                                    | ENED: full 1                                                     |            |
| ( PF                               | INT: Kirby Kachmarski                                            |            |





HOPKINS STREET SOUTH WHITBY ON L1N 5T1 CAN (905) 668-8811

#### **Chemical and Physical Test Report MADE IN CANADA**



W-122850 DEC 2 9 2011

SHIP TO

**RUSSEL METALS INC - CALGARY** C/O CALGARY DISTRIBUTION CTR 5200 84TH STREET SE

INVOICE TO

RUSSEL METALS INC CALGARY

SHIP DATE 12/16/11

**5724 - 40TH STREET SE** CALGARY, AB T2C 2A1

**CUST. ACCOUNT NO** 

60142676

CALGARY, AB T2P 2G7 PRODUCED IN: WHITBY

| SHAPE + SIZE |     | GRAD | E    | SPEC   | FICATIO | ON .    |         |        |         |        |         |          |         |       |        |        |       | SAL | ES OR   | DER | CU  | ST P.O. | NUMBE | R |
|--------------|-----|------|------|--------|---------|---------|---------|--------|---------|--------|---------|----------|---------|-------|--------|--------|-------|-----|---------|-----|-----|---------|-------|---|
| A2 X 2 X 1/4 |     | 44W  |      | A36/44 | 4W/50W  | /A529GF | R50;AST | M:A36- | 05;A529 | GR50 M | -05;CS/ | \:G40.21 | -04 44W | //50W |        |        |       | 109 | 8033-01 |     | 640 | 34957-0 | 01    |   |
| HEAT I.D.    | С   | Mn   | Р    | S      | Si      | Cu      | Ni      | Cr     | Мо      | ٧      | Nb      | В        | N       | Sn    | Ti.    | Zn     | C Eqv |     |         |     | i   |         |       |   |
| W100568      | .17 | .84  | .021 | .042   | .17     | .32     | .10     | .13    | .030    | .002   | .003    | .0001    | .0160   | .012  | .00100 | .01700 | .34   |     |         |     |     |         |       |   |

Mechanical Test:

Yield 54491 PSI, 375.7 MPA

Tensile: 77751 PSI, 536.07 MPA %EI: 26.2/8in, 26.2/200MM

Customer Requirements CASTING: STRAND CAST

Mechanical Test:

Yield 55213 PSI, 380.68 MPA Tensile: 77756 PSI, 536.11 MPA %EI: 27.5/8in, 27.5/200MM

Customer Requirements CASTING: STRAND CAST

**CUST ITEM NUMBER: 18310** 

PRODUCED IN: WHITBY

| SHAPE + SIZE |     | GRAD | E    | SPECI  | FICATIO | N      |         |        |         |        |         |         |          |       |        |        |       | SA      | LES OR | DER | CI | JST P.O | . NUMB | ER . |
|--------------|-----|------|------|--------|---------|--------|---------|--------|---------|--------|---------|---------|----------|-------|--------|--------|-------|---------|--------|-----|----|---------|--------|------|
| C4 X 6.25#   |     | 44W  |      | A36/44 | W/50W   | A529GF | 750;AST | M:A36- | 05;A529 | GR50 M | -05;CS/ | 4:G40.2 | I-04 44V | V/50W |        |        |       | <br>110 | 2537-0 | i   | 64 | 035044  | 01     |      |
| HEAT I.D.    | С   | Mn   | Р    | S      | Si      | Cu     | Ni      | Cr     | Мо      | V      | Nb      | В       | N        | Sn    | Ti     | Zn     | C Eqv |         |        |     |    |         |        |      |
| W100627      | .17 | .88  | .010 | .029   | .17     | .29    | .09     | .09    | .020    | .000   | .002    | .0001   | .0150    | .020  | .00200 | .01400 | .34   |         |        |     |    |         | •      |      |

Mechanical Test:

Yield 52941 PSI, 365.02 MPA Tensile: 75591 PSI, 521.18 MPA %EI: 25.0/8in, 25.0/200MM

Customer Requirements CASTING: STRAND CAST

Mechanical Test:

Yield 52087 PSI, 359.13 MPA Tensile: 74797 PSI, 515.71 MPA %EI: 25.0/8in, 25.0/200MM

Customer Requirements CASTING: STRAND CAST

**CUST ITEM NUMBER: 12700** 

**Customer Notes** 

NO WELD REPAIRMENT PERFORMED. STEEL NOT EXPOSED TO MERCURY.

This material, including the billets, was melted and manufactured in Canada

· Bhaskar Yalamanchili

**Quality Director** 

Gerdau

THE ABOVE FIGURES ARE CERTIFIED CHEMICAL AND PHYSICAL TEST RECORDS AS CONTAINED IN THE PERMANENT RECORDS OF COMPANY.

Metallurgical Services Manager

WHITBY STEEL MILL

Seller warrants that all material furnished shall comply with specifications subject to standard published manufacturing variations. NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, ARE MADE BY THE SELLER, AND SPECIFICALLY EXCLUDED ARE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

In no event shall seller be liable for indirect, consequential or punitive damages arising out of or related to the materials furnished by seller.

Any claim for damages for materials that do not conform to specifications must be made from buyer to seller immediately after delivery of same in order to allow the seller the opportunity to inspect the material in question.



#### Chemical and Physical Test Report

#### MADE IN CANADA

W-098056

(905) 668-8811

WHITBY STEEL MILL HOPKINS STREET SOUTH WHITBY ON L1N 5T1 CAN

SHIP TO **RUSSEL METALS INC - CALGARY** C/O CALGARY DISTRIBUTION **5724 - 40TH STREET SE** CALGARY, AB T2C 2A1

INVOICE TO

**RUSSEL METALS INC CALGARY 5724 - 40TH STREET SE** 

SHIP DATE 08/25/09

CALGARY, AB T2C 2A1

CUST, ACCOUNT NO

60142676

PRODUCED IN: WHITBY

| SHAPE + SIZE |     | GRAD | Ē    | SPEC   | FICATIO | N      |      |     |      |      |      |       | ***** |      |      |        |      |        | SA    | ES OR   | DER      | CU  | IST P.O. | NUMBE | R |
|--------------|-----|------|------|--------|---------|--------|------|-----|------|------|------|-------|-------|------|------|--------|------|--------|-------|---------|----------|-----|----------|-------|---|
| C8 X 8,2#    |     | 44W  |      | C.S.A. | G40.21  | 04 44W |      |     |      |      |      |       |       |      |      |        |      |        |       | 8261-01 |          | 840 | 030026-0 | )1    |   |
| HEAT I.D.    | С   | Mn   | Р    | S      | Si      | Cu     | . NI | Cr  | Mo   | ٧    | Nb   | В     | N     | Sn   | Al   | TI     | Zr   |        | C Eqv |         |          |     |          |       |   |
| W902116      | .17 | .82  | .013 | .030   | .19     | .29    | .08  | .05 | .023 | .000 | .000 | .0006 | .0187 | .010 | .037 | .00000 | .000 | .00000 | .353  | l       | <u> </u> |     |          |       |   |

Mechanical Test: Mechanical Test: Yield 55473 PSI, 382.47 MPA Tensile: 73686 PSI, 508.05 MPA %EI: 24.4/8in, 24.4/200MM

Yield 53025 PSI, 365.59 MPA Tensile: 72333 PSI, 498.72 MPA %EI: 24.5/8in, 24.6/200MM

Def HT: 0, 0MM %I/h 0

Def HT: '0, DMM % Wh OL

CUST ITEM NUMBER: 12720

PRODUCED IN: WHITBY

**CUST ITEM NUMBER: 12732** 

| TROUGED HAT  | · · · · · · · · |      |      |       |          |        |         |        |         |        |        |          |         |       | -    |        |      |        |       |        | 855      |          | COT D A  | A 11 10 40 |          |
|--------------|-----------------|------|------|-------|----------|--------|---------|--------|---------|--------|--------|----------|---------|-------|------|--------|------|--------|-------|--------|----------|----------|----------|------------|----------|
| SHAPE + SIZE |                 | GRAD | Æ    | SPEC  | IFICATIO | )N     |         |        |         |        |        |          |         |       |      |        |      |        | SA    | ES OR  | DEK      |          | UST P.O. | , NUMBI    | 4K       |
| . C6 X 13.0# |                 | 44W  |      | A36/4 | 4W/50W   | A529GF | 250;AST | M:A36- | 05;A529 | GR60 M | -05;CS | A:G40.21 | -04 44% | //50W |      |        |      |        |       | 0606-0 | 1        | 64       | 4030061- | 01         |          |
| HEAT I.D.    | C               | Mn   | P    | S     | SI       | Cu     | NI      | Cr     | Mo      | V      | Nb     | В        | N       | Sn    | Al   | Π      | Zr   | Ca     | C Eqv |        | İ        | <u> </u> |          | <u> </u>   |          |
| W902136      | .16             | .74  | .012 | .036  | .20      | .32    | .09     | .07    | .024    | .000   | .011   | .0005    | .0206   | .010  | .000 | .00000 | ,000 | .00000 | .328  |        | <u> </u> |          | 1        | <u> </u>   | <u> </u> |

Mechanical Test:

Yield 55552 PBI, 383.02 MPA Tensile: 74635 PSI, 514.59 MPA %EI: 24.5/8in, 24.5/200MM Def HT: 0, 0MM %I/h 0L

This material, including the billets, was produced and manufactured in Canada

Bhaskar Yalamenchill

**Quality Director** 

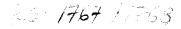
Gerdau Ameristeel

THE ABOVE FIGURES ARE CERTIFIED EXTRACTS FROM THE ORIGINAL CHEMICAL AND PHYSICAL TEST RECORDS AS CONTAINED IN THE PERMANENT RECORDS OF COMPANY.

Mgr. Metallurg, Svcs. WHITBY STEEL MILL

Seller warrants that all material furnished shall comply with specifications subject to standard published manufacturing variations. NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, ARE MADE BY THE SELLER, AND SPECIFICALLY EXCLUDED ARE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE.

in no event shall seller be Eable for Indirect, consequential or punitive damages arising out of or related to the materials furnished by seller. Any claim for damages for materials that do not conform to specifications must be made from buyer to seller immediately after delivery of same in order to allow the seller the opportunity to inspect the material in question.





HOPKINS STREET SOUTH WHITBY ON L1N 5T1 CAN (905) 668-8811

#### Chemical and Physical Test Report MADE IN CANADA

APR 0 9 2012

W-126055



SHIP TO

**RUSSEL METALS INC - CALGARY** C/O CALGARY DISTRIBUTION CTR 5200 84TH STREET SE CALGARY, AB T2P 2G7

INVOICE TO

RUSSEL METALS INC CALGARY 5724 - 40TH STREET SE

CALGARY, AB T2C 2A1

SHIP DATE

03/26/12

**CUST. ACCOUNT NO** 

60142676

PRODUCED IN: WHITRY

| I KODOCED III. II |     |      |      |        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |         |         |        |         |        |          |         |          |       |        |        |       | <br>   | •       |     |    |          |       |    |
|-------------------|-----|------|------|--------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|---------|--------|---------|--------|----------|---------|----------|-------|--------|--------|-------|--------|---------|-----|----|----------|-------|----|
| SHAPE + SIZE      |     | GRAD | E    | SPEC   | IFICATION OF THE PROPERTY OF T | NC      |         |        |         |        |          | e.      |          |       |        |        |       | <br>SA | LES OR  | DER | CL | JST P.O. | NUMBE | £R |
| C4 X 5.4#         |     | 44W  |      | A36/44 | 4W/50W                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | (A529GI | R50;AS1 | M:A36- | 05;A529 | GR50 M | 1-05;CS/ | 4:G40.2 | I-04 44V | V/50W |        |        |       | 200    | 03826-0 | 1   | 64 | 035241-0 | 01    |    |
| HEAT I.D.         | С   | Mn   | Р    | S      | Si                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Cu      | Ni      | Cr     | Мо      | V      | Nb       | В       | N        | Sn    | Ti     | Zn     | C Eqv |        | 1       |     |    |          |       |    |
| W101046           | .16 | .88  | .009 | .037   | .17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | .32     | .14     | .07    | .047    | .001   | .002     | .0001   | .0120    | .025  | .00120 | .01600 | .39   |        |         |     |    |          |       |    |

Mechanical Test:

Yield 52303 PSI, 360.62 MPA

Tensile: 74469 PSI, 513.45 MPA %EI: 28.1/8in, 28.1/200MM

Customer Requirements CASTING: STRAND CAST

Mechanical Test:

Yield 50860 PSI, 350.67 MPA

Tensile: 72900 PSI, 502.63 MPA %El: 26.9/8in, 26.9/200MM

Customer Requirements CASTING: STRAND CAST

CUST ITEM NUMBER: 12696

#### PRODUCED IN: WHITRY

| SHAPE + SIZE |      | GRAD | E    | SPECI  | FICATIO | )N     |         |        |         |        |         | •        |         |       | <del>-</del> |        |       |   | SA  | LES OR  | DER | CU  | ST P.O. | NUMBE    | R |
|--------------|------|------|------|--------|---------|--------|---------|--------|---------|--------|---------|----------|---------|-------|--------------|--------|-------|---|-----|---------|-----|-----|---------|----------|---|
| C4 X 5,4#    |      | 44W  |      | A36/44 | W/50W   | A529GF | R50;AST | M:A36- | 05;A529 | GR50 M | -05;CS/ | \:G40.21 | -04 44V | V/50W |              |        |       | _ | 200 | 3826-01 | ı . | 640 | 35241-  | 01       |   |
| HEAT I.D.    | С    | Mn   | P    | S      | Si      | Cu     | Ni      | Cr     | Mo      | ٧      | Nb      | В        | N       | Sn    | Ti,          | Zn     | C Eqv |   |     |         |     |     |         |          |   |
| W101047      | .16· | .88  | .010 | .044   | 19      | .31    | .13     | .08    | .040    | .001   | .002    | .0001    | .0240   | .019  | .00100       | .01400 | .33   |   |     |         | ľ   |     |         | <u> </u> |   |

Mechanical Test:

Yield 52529 PSI, 362.17 MPA

Tensile: 71537 PSI, 493.23 MPA %EI: 25.6/8in, 25.6/200MM

Mechanical Test:

Customer Requirements CASTING: STRAND CAST

Yield 52595 PSI, 362.63 MPA Tensile: 72709 PSI, 501.31 MPA %EI: 25.0/8in, 25.0/200MM

Customer Requirements CASTING: STRAND CAST

CUST FTEM NUMBER: 12696

#### **Customer Notes**

NO WELD REPAIRMENT PERFORMED. STEEL NOT EXPOSED TO MERCURY.

This material, including the billets, was melted and manufactured in Canada

Bhaskar Yalamanchili

Quality Director

Gerdau

THE ABOVE FIGURES ARE CERTIFIED CHEMICAL AND PHYSICAL TEST RECORDS AS CONTAINED IN THE PERMANENT RECORDS OF COMPANY.

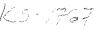
Metallurgical Services Manager

WHITBY STEEL MILL

Seiler warrants that all material furnished shall comply with specifications subject to standard published manufacturing variations. NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, ARE MADE BY THE SELLER, AND SPECIFICALLY EXCLUDED ARE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. In no event shall seller be liable for indirect, consequential or punitive damages arising out of or related to the materials furnished by seller.

Any claim for damages for materials that do not conform to specifications must be made from buyer to seller immediately after delivery of same in order to allow the seller the opportunity to inspect the material in question.







#### Chemical and Physical Test Report Made and Melted In USA

APR 1 6 2012

G-196911



SHIP TO

(770) 387-3300

RUSSEL METALS INC - CALGARY C/O CALGARY DISTRIBUTION CTR 5200 84TH STREET SE CALGARY, AB T2P 2G7

INVOICE TO

RUSSEL METALS INC CALGARY 5724 - 40TH STREET SE

CALGARY, AB T2C 2A1

SHIP DATE 03/28/12

**CUST. ACCOUNT NO** 

60142676

PRODUCED IN: CARTERSVILLE

| I INCOCUED III. O | ~1 < I C I |       |       |      |         |         |      |          |         |        |        |       |       |      |      |        |        |        |       |         |     |   |          |         |    |
|-------------------|------------|-------|-------|------|---------|---------|------|----------|---------|--------|--------|-------|-------|------|------|--------|--------|--------|-------|---------|-----|---|----------|---------|----|
| SHAPE + SIZE      |            | GRAD  | E     | SPEC | IFICATI | ON      |      |          |         |        |        |       |       |      |      |        |        | •      | SAL   | ES OR   | DER | C | UST P.O. | . NUMBE | ER |
| W6 X 15#          |            | A5725 | 0/992 | ASTM | A572 G  | R50-07, | ASTM | A992 -06 | A, ASTI | M A709 | GR50-1 | 0     |       |      |      |        |        |        | 200   | 1818-03 | 3   | 6 | 4035199- | 03      |    |
| HEAT I.D.         | C          | Mn    | P     | S    | Si      | Cu      | Ni   | Cr       | Мо      | ٧      | Nb     | В     | N     | Sn   | AJ   | Τī     | Ca     | Zn     | C Eqv |         |     |   |          |         |    |
| G121681           | .16        | 1.01  | .010  | .026 | .20     | .25     | .10  | .05      | .023    | .016   | .001   | .0010 | .0080 | .010 | .000 | .00100 | .00000 | .00600 | .4    |         |     | ł | 1        | 1       | (  |

Mechanical Test:

Yield 59700 PSI, 411.62 MPA Tensile: 82000 PSI, 565.37 MPA %EI: 24.9/8in, 24.9/200MM

Customer Requirements CASTING: STRAND CAST

Comment: NO WELD REPAIRMENT PERFORMED. STEEL NOT EXPOSED TO MERCURY.

Mechanical Test: Yield 58700 PSI, 404.72 MPA Tensile: 79700 PSI, 549.51 MPA %El: 24.0/8in, 24.0/200MM

Customer Requirements CASTING: STRAND CAST

Comment: NO WELD REPAIRMENT PERFORMED. STEEL NOT EXPOSED TO MERCURY.

#### PRODUCED IN: CARTERSVILLE

| I KOBOOLD III. C. |     |       |       |      |          |         |        |                       |        |        |        |       |       |      |      |        |        |        | 100   | CO 00   | <u> </u> | 10   | CTDO     | A 11 18 4171 | -0  |
|-------------------|-----|-------|-------|------|----------|---------|--------|-----------------------|--------|--------|--------|-------|-------|------|------|--------|--------|--------|-------|---------|----------|------|----------|--------------|-----|
| SHAPE + SIZE      |     | GRAD  | E     | SPEC | FICATION | JN.     |        |                       |        |        |        |       |       |      |      |        |        |        | SAL   | LES OR  | UER      | , cc | JST P.O. | , NUMBI      | 2P( |
| W6 X 15#          |     | A5725 | 0/992 | ASTM | A572 G   | R50-07, | ASTM A | \ <del>9</del> 92 -06 | A, AST | M A709 | GR50-1 | 0     |       |      |      |        |        |        |       | 1818-03 | 3        | 64   | 035199-  | 03           |     |
| HEAT I.D.         | С   | Mn    | Р     | S    | Si       | Cu      | Ni     | Cr                    | Mo     | V      | Nb     | В     | N     | Sn   | Al   | Ti     | Ca     | Zn     | C Eqv |         |          |      | 1        | L            |     |
| G121682           | .15 | 1.01  | .010  | .026 | .20      | .24     | .09    | .06                   | .021   | .015   | .001   | .0010 | .0070 | .009 | .000 | .00100 | .00000 | .00700 | .39   |         |          |      |          | <u> </u>     |     |

Yield 57100 PSI, 393.69 MPA Tensile: 76700 PSI, 528.83 MPA %EI: 23.4/8in, 23.4/200MM Mechanical Test:

Customer Requirements CASTING: STRAND CAST

Comment: NO WELD REPAIRMENT PERFORMED. STEEL NOT EXPOSED TO MERCURY.

Mechanical Test:

Yield 55500 PSI, 382.66 MPA Tensile: 76700 PSI, 528.83 MPA %EI: 24.5/8in, 24.5/200MM

Customer Requirements CASTING: STRAND CAST

Comment: NO WELD REPAIRMENT PERFORMED. STEEL NOT EXPOSED TO MERCURY.

#### **Customer Notes**

NO WELD REPAIRMENT PERFORMED. STEEL NOT EXPOSED TO MERCURY.

All manufacturing processes including melt and cast, occurred in USA. MTR complies with EN10204 3.1B

> Bhaskar Yalamanchili Quality Director

Gerdau

THE ABOVE FIGURES ARE CERTIFIED CHEMICAL AND PHYSICAL TEST RECORDS AS CONTAINED IN THE PERMANENT RECORDS OF COMPANY.

Metallurgical Services Manager

CARTERSVILLE STEEL MILL

Seller warrants that all material fumished shall comply with specifications subject to standard published manufacturing variations. NO OTHER WARRANTIES, EXPRESSED OR IMPLIED, ARE MADE BY THE SELLER, AND SPECIFICALLY EXCLUDED ARE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. In no event shall seller be liable for indirect, consequential or punitive damages arising out of or related to the materials furnished by seller.

Any claim for damages for materials that do not conform to specifications must be made from buyer to seller immediately after delivery of same in order to allow the seller the opportunity to inspect the material in question.

Atlas Tube (U.S.) Inc. 13101 Eckles Road Plymouth, Michigan, USA 48170

Tel: 313-454-5600 Fax: 313-454-1474

# **as**Tube

### MATERIAL TEST REPORT

Ref.B/L: Date: Customer:



Sold to

Russel Metals-Calgary 5724-40 St. SE CALGARY AB T2C 2A1 CANADA

Shipped to

RUSSEL C/O CDC (RAIL) 5724-40 ST. SE CALGARY AB J4G 1E6 APR 1 1 2012 CANADA

Made in: USA Material No: 30030250 Material: 3.0x3.0x250x20'0"0(7x5).-CSA-D Melted in: Canada Purchase Order: M64035516 Sales order: 707427 ΤI В N Ni Cr ν s Si ΑI Cu Cb Mo Heat No C Mn 0.049 0.002 0.000 0.000 0.000 0.002 0.006 0.018 0.053 762407 0.800 0.007 0.009 0.015 0.040 CE: 0,33 Eln.2in Certification Tensile Bundle No PCs Yield 29.6 % CSA G40.21-04 50W CLASS C M300611153 24 055463 Psi 067395 Psi Material Note: Sales Or. Note: Made in: USA Material No: 30030250 Material: 3.0x3.0x250x20'0"0(7x5).-CSA-D Melted in: Canada Purchase Order: M64035516 Sales order: 707427 ٧ Τi N Cr Cb Мо NI Р s Si C **Heat No** Mn 0.018 0.046 0.002 0.000 0.000 0.000 0.046 0.006 0.007 0.006 0.014 0.044 763314 0,180 0.790 0.006 CE: 0.33 Certification Eln.2in **Bundle No** PCs Yield Tensile 29.6 % CSA G40.21-04 50W CLASS C 079890 Psi M300611153 070860 Psi **Material Note:** 

Materiai: 3.0x3.0x250x20'0"0(7x5).-CSA-D

С

PÇs

35

Material No: 30030250

Made in: USA

Sales Or. Note:

ΑI

0.040

Melted in: Canada

Sales order: 707427

Purchase Order: M64035516

Cu

0.053

٧ Ti В N

0.000 0.000

762407 0.180

0,007 0.015 0.800 0.009

S

0.002 0.006

СЬ

Mo

Ni

0.018

CSA G40.21-04 50W CLASS C

Cr

0.049

0.000 CE: 0.33

Bundle No M300611154

**Heat No** 

Yield 055463 Psi

Mn

Tensile 067395 Psi Eln.2in 29.6 %

SI

Certification

0.002

**Material Note:** 

Sales Or. Note:

Mike Whalen

Authorized by Quality Assurance: The results reported on this report represent the actual attributes of the material furnished and indicate full compliance with all applicable specification and contract requirements. CE calculated using the AWS D1.1 method.





KS-17-67

Bill To: RUSSEL METALS INC CALGARY 5724 - 40TH STREET SE

AΒ

CA

SIZE

S

.037

Ship To: 22 Russel Metals - Calgary C/O CALGARDISCEN 5724 40th Street S.E.

Order Date:10/06/2011 PO No:64034645 Mill Order No:3938822 Load No:1414738 Manifest No:2108676

CERTIFIED MATERIAL TEST REPORT GERDAU AMERISTEEL

GE GERDAU AMERISTEEL

. 3

Midlothian Mill 300 Ward Road Midlothian, TX 76065 (972)775-8241

SPECIFICATIONS

HEAT NO: 22615430

C

.08

CALGARY

T2C 2A1

W 16 X 36# / W410 X 53

Cu

.35

Νi

.12

CALGARY

T2C 2A1

Si

.22

GRADE 992/572-50

Mo

.035

AB

CA

Cr

.14

LENGTH 45 FT / 13.716 M

.020

PRODUCT WF BEAMS

64A027334

Mn

.89

ASTM A6-09, A992-06a, A572-07

CHEMICAL ANALYSIS

.008

Sn V Αl Nb CE

.003

JAN 1 2 2012

PHYSICAL PROPERTIES

.002

| Yield Str    | rength | Tensile | Strength | Specime | en Area | Elor | ngation  | : .    | Bend Test   | ROA |
|--------------|--------|---------|----------|---------|---------|------|----------|--------|-------------|-----|
| KSI          | MPa    | KSI     | MPa      | Sq In   | Sq cm   | 양    | Gage Ler | ngth   | Dia. Result | %   |
| 5 <b>7.7</b> | 397.8  | 73.7    | 508.1    | 0.643   | 4.15    | 25.6 | 8 In     | 200 mm |             |     |
| 56.3         | 388.2  | 71.9    | 495.7    | 0.659   | 4.25    | 24.9 | 8 In     | 200 mm |             |     |

TENSILE TEST RATIOS

YLD/TENS TENS/YLD YLD/TENS TENS/YLD

Ρ

.014

.78 1.28 .78 1.28

All manufacturing processes of this product, including electric arc MELTING and continuous CASTING, occurred in the U.S.A. CMTR complies with EN 10204 3.1

"I hereby certify that the contents of this report are correct and accurate. All tests and operations performed by this material manufacturer or its sub-contractors, when applicable, are in compliance with the requirements of the material specifications and applicable purchaser designated requirements."

Jane 2 / Same Date: Dec. 17, 2011 Signed: Date: Signed: Notary Public (if applicable) Tom L. Harrington: Quality Assurance Manager Page: 1 of GRADE

| 017      |
|----------|
| n        |
| Page     |
| #2453212 |
| ä        |

Bill To: RUSSEL METALS INC CALGARY 5724 - 40TH STREET SE

CALGARY AB T2C 2A1 CA Ship To: 22 Russel Metals - Calgary 5724-40th Street, SE CALGARY

W 18 X 50# / W460 X 74

CA Manifest No:2121128

Order Date:01/06/2012 PO No:64035196 Mill Order No:3984801 Load No:1427140

V

CERTIFIED MATERIAL TEST REPORT GERDAU

( GERDAU

Petersburg Mill 25801 Hofheimer Way Petersburg, VA 23803 (804) 524-2855

PRODUCT WF BEAMS

SPECIFICATIONS

ASTM A6-09, A992-06a, A572-07

HEAT NO: 30574290

C Μn S .08 .029 .95 .009

.22 .30

T2C 2A1

SIZE

Si

Νi

.09 .14

Cr

.031

992/572-50

.014 .003

CHEMICAL ANALYSIS

Al .003 .017

LENGTH

CE .29

PHYSICAL PROPERTIES

| Yield Str | rength | Tensile | Strength | Specime | en Area | Elor | ngation  |        |
|-----------|--------|---------|----------|---------|---------|------|----------|--------|
| KSI       | MPa    | KSI     | MPa      | Sq In   | Sq cm   | 용    | Gage Ler | ngth   |
| 54.0      | 372.3  | 70.3    | 484.7    | 0.864   | 5.57    | 26.0 | 8 In     | 200 mm |
| 53.2      | 366.8  | 69.6    | 479.9    | 0.880   | 5.68    | 26.8 | . 8 In   | 200 mm |

50 FT / 15.24 M

Nb

Bend Test Dia. Result ROA

TENSILE TEST RATIOS

YLD/TENS YLD/TENS

. 76 . . 77 MAR 1 2 2012

All manufacturing processes of this product, including electric arc MELTING and continuous CASTING, occurred in the U.S.A. CMTR complies with EN 10204 3.1

"I hereby certify that the contents of this report are correct and accurate. All tests and operations performed by this material manufacturer or its sub-contractors, when applicable, are in compliance with the requirements of the material specifications and applicable purchaser designated requirements."

Signed: Wade Lumpkins: Quality Assurance Manager

Date: Feb. 22, 2012

Notary Public (if applicable)

Date:

Page: 2 of

## Order No. : LPP201109001

## MILL TEST CERTIFICATE



: J119500055

PO No.

STEEL PLATE

Commodity

Supplier

: DONGKUK INTERNATIONAL.INC.

SALZGITTER MANNESMANN INTERNAT

Certificate No. Date of Issue

: PP2-2-111129-015-002

: Nov. 29, 2011

|                                                                                    |                                                                           |               |                                                                                                                                            |                                               | p<br>D                        | Tensil                            | e Tesi                  | þ                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                   |         |               | Chen            | ical (             | canpos          | illon             |                                                                                   |                        |                                            |                                                                                                                                                                                                                                            |
|------------------------------------------------------------------------------------|---------------------------------------------------------------------------|---------------|--------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------|-------------------------------|-----------------------------------|-------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------|---------|---------------|-----------------|--------------------|-----------------|-------------------|-----------------------------------------------------------------------------------|------------------------|--------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ofmension:<br>Unit<br>Inch: ", om: Space                                           | Product No                                                                | Quant<br>i ty | Weight<br>ko                                                                                                                               | Heat No                                       | i G                           | YP M                              |                         | EL S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | C 2               | Si<br>2 | Nin<br>2      | Р<br>3          | S 1                | 3 H             | 1i D.<br>2 2      | 33                                                                                | NR<br>3                | y<br>3                                     |                                                                                                                                                                                                                                            |
| - ar app. 2015                                                                     | 7591355-01,07,03                                                          |               | 889                                                                                                                                        | SF06122                                       | T 1                           | 404                               | 542                     | 25 L                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 15                | 35      | 144           | 14              | 3                  | 20              | 1                 | 1                                                                                 | 1                      | 1                                          | 1 2388                                                                                                                                                                                                                                     |
| 6.35-2438-7315<br>.25"196"1288"<br>neclean No :PP05952405-a                        | 7591362-03<br>7591374-01,02,03<br>Sub Total (10)                          | 7             | 6.223                                                                                                                                      |                                               |                               |                                   |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |         |               |                 |                    |                 |                   |                                                                                   |                        |                                            | 1 2396                                                                                                                                                                                                                                     |
| 6.35-2438-7315<br>25"X86"X288"<br>Decimen No "PP05953510-a                         | 7591347-02.03<br>7591351-01:02.03<br>7591358-01:02.03<br>7591369-01:02.03 |               | 9,775                                                                                                                                      |                                               | I   I                         | 418                               | 548                     | 24 (                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 16                | 35      | 141           | 15              | 4                  | 20              |                   |                                                                                   |                        |                                            |                                                                                                                                                                                                                                            |
| 5:35*2438*7315<br>25*X96*X288*                                                     | Sub Total (10)<br>7590141-03<br>7590144-01,02.03                          | 1             | 885                                                                                                                                        |                                               | 1                             | 395                               | 530                     | 24                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | L 15              | 36      | 142           | 13              | 5                  | 20              | 1                 |                                                                                   | 1                      | ı                                          | 2 <b>2346</b>                                                                                                                                                                                                                              |
| oecimen No : PP05948508-a                                                          | 7590146-02.03<br>7590148-02.03<br>7590149-03<br>7590150-03                |               | 0 8,89                                                                                                                                     |                                               |                               |                                   |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |         |               |                 | F                  |                 |                   |                                                                                   |                        |                                            |                                                                                                                                                                                                                                            |
| 6.35*2438*7315                                                                     | Sub Tolal (10)<br>7592369-01                                              |               | 86                                                                                                                                         |                                               | T                             | 1 420                             | 540                     | 22                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | L i               | 35      | 142           | 12              | 4                  | 20              | 1                 |                                                                                   | 1                      | 1                                          | 1   23RB                                                                                                                                                                                                                                   |
| .25"X96"X288"<br>Specimen No : PP05955007-a                                        | Sub Total (10)                                                            |               | 1 68                                                                                                                                       | 8                                             |                               |                                   |                         | A de la composition della comp |                   |         |               |                 |                    |                 |                   |                                                                                   |                        |                                            |                                                                                                                                                                                                                                            |
|                                                                                    |                                                                           | 74.3          |                                                                                                                                            |                                               |                               |                                   |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |         | 1             |                 | - teas             | , killer        | i steel           |                                                                                   | sp.                    | cime                                       | n No. ( a-Tension                                                                                                                                                                                                                          |
| Tensile Test Direction-Tra<br>Supply Condition - As Rol<br>Chemical Composition Un | nsverse<br>led<br>li(%) : 2-x100.3-x1000.4-                               |               | We hereby C<br>Fine grain or<br>called for by<br>10204 3.1.                                                                                | ertify that the<br>actice) and<br>the above c | e male<br>satisfa<br>irder. T | rial has<br>clorily l<br>his mill | peen<br>ested<br>test c | made<br>in acco<br>entitics                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ordanc<br>ile has | e with  | abov<br>Issue | e spe<br>d in c | cilicati<br>omplia | on rec<br>nce w | quirem<br>/i(h EN | ante                                                                              | Por<br>Div<br>Su<br>GL | silion<br>Islon<br>b(Sub<br>(Gaug<br>54 R- | : T-Top, M-Middle, B-Bottom<br>L-Ladle Analysis, P-Product Analysis<br>Size, Rezi Vatue, mm): Blank-Full Size, 1-7.5-10, 2-5.0-10<br>e Length, mm): 1-200, 2-100, 3-80, 4-70, 5-50, 6-5.65, A-<br>4d, 3-8d<br>Total(Soluble) Al +Tr: Trace |
|                                                                                    |                                                                           |               |                                                                                                                                            |                                               |                               |                                   |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |         |               |                 |                    |                 |                   | ult : G-No Break, B-Break<br>bugh Thickness Position) : 1-Surface, 2-1/4T, 3-1/2T |                        |                                            |                                                                                                                                                                                                                                            |
|                                                                                    |                                                                           |               | When using the ordered product for other uses, rather than the above specification use, product damage and salety accidents may be caused. |                                               |                               |                                   |                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                   |         |               |                 |                    |                 |                   |                                                                                   |                        |                                            |                                                                                                                                                                                                                                            |

Pohang Works, 880 Songdong-ri, Daesong-myeon, Nam-gu, Pohang-si, Geyongsangbuk-do, 750-841, Korea

Chief of Customer Support Team

2/4 Page



### MILL TEST CERTIFICATE



Order No.

: J119500055

PO No.

: LPP201109001

Commodity

: STEEL PLATE

: CSA G40.21 300W/350W

Supplier Customer : DONGKUK INTERNATIONAL,INC.

: SALZGITTER MANNESMANN INTERNAT

Certificate No. Date of issue

: PP2-2-111129-015-004

: Nov. 29, 2011

|                                                                                     |                                                  |         |                                                             |                                                                                                               | р<br>0    | Tensi    | le Tos   | st | D   |         |       | Ox   | mi cal | Com     | posili | ion  | zary). |                                                    |                                                     |                                                                                                                                                                                                                                                                   |
|-------------------------------------------------------------------------------------|--------------------------------------------------|---------|-------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|-----------|----------|----------|----|-----|---------|-------|------|--------|---------|--------|------|--------|----------------------------------------------------|-----------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Dimension<br>Unit                                                                   | Product No.                                      | Quant   | lfeight<br>kg                                               | Heat No                                                                                                       | Ī         | ΥP       | IS       | EL | s   |         | n.    |      |        |         | AIE.   |      | Мо     | Nb                                                 | v                                                   | Remarks                                                                                                                                                                                                                                                           |
| inch: *, pm: Space                                                                  |                                                  |         |                                                             |                                                                                                               | i GL<br>n | ¥/a      | <b>*</b> | 3  | 0 2 | Si<br>2 | 2     | 3    | 3      | Cr<br>3 | 2      | Ci 2 | 3      | 3                                                  | 3                                                   |                                                                                                                                                                                                                                                                   |
| 6.35-2438-9754<br>.25"X96"X384"<br>pecimen No :PP05940014-a                         | 7590137-01,02.03                                 |         | 1,186                                                       | SF06308                                                                                                       | न त       | 390      | 534      | 24 | L S | 6 3     | 6 14  | 15   |        | 20      | 1      |      |        |                                                    |                                                     | 1 2008<br>1 2008                                                                                                                                                                                                                                                  |
| 6.35-2438-9754<br>25"X98"X384"                                                      | Sub Total (20)<br>7590(41-01:02<br>7590(46-0)    |         | 3,558<br>1,186                                              | SF06313                                                                                                       | ,         | 395      | 530      | 24 | L   | 15 3    | 6 14  | 2 13 | 5      | 20      |        |      |        |                                                    |                                                     | 5 53848.                                                                                                                                                                                                                                                          |
| pecimen No :PP05948508-a                                                            | 7590149-01.02<br>7590150-01.02<br>Sub Total (20) | ,       | 8,302                                                       |                                                                                                               |           |          |          |    |     |         |       |      |        |         |        |      |        |                                                    |                                                     |                                                                                                                                                                                                                                                                   |
| 5.35*3048*12192<br>.25"X120"X480"<br>pecimen No :PP05952405-a                       | 7589968-01:02                                    |         | 1,852                                                       | SF06122                                                                                                       | T         | 404      | 542      | 25 | L   | 15      | 15 14 | 4    | 1 3    | 20      | 0      |      |        |                                                    |                                                     | 1 2364                                                                                                                                                                                                                                                            |
| ≺Grand Total>                                                                       | Sub Total (30)                                   |         | 2 3,704<br>I 72,470                                         |                                                                                                               |           | Cities ( |          |    |     |         |       |      |        |         |        |      |        |                                                    |                                                     |                                                                                                                                                                                                                                                                   |
|                                                                                     |                                                  |         |                                                             |                                                                                                               |           |          |          |    |     |         |       |      |        |         |        |      |        |                                                    |                                                     |                                                                                                                                                                                                                                                                   |
|                                                                                     |                                                  |         |                                                             |                                                                                                               |           |          |          |    |     |         |       |      |        |         |        |      |        |                                                    |                                                     |                                                                                                                                                                                                                                                                   |
| Tensile Test Direction-Tra<br>Supply Condition - As Rol<br>Chemical Composition Uni | nsverse<br>led<br> (%) 2-x100, 3-x1000, 4-x1     | 10000 F | Ne hereby cerine grain pra-<br>called for by 1<br>10204 3.1 |                                                                                                               |           |          |          |    |     |         |       |      |        |         |        |      | ls *   | Positi<br>Divisi<br>Sub(S<br>GL(G<br>7-5d<br>T(S). | on: L<br>on: L<br>Sub S<br>Buge<br>L 8-4<br>Al: T   | No. : a-Tension T-Top, M-Middle, B-Bottom L-Ladle Analysis, P-Product Analysis Size, Real Value, mm): Blank-Full Size, 1-7.5-10, 2-5.0-10 Langth, mm): 1-200, 2-100, 3-80, 4-70, 5-50, 6-5.65 VA dd, 9-8d otal(Sokuble): Al -7r: Trace III: : G-No Break, 8-Break |
|                                                                                     |                                                  | 1       | When using ti                                               | 전 경기 (2011년 - 1912년 - |           |          |          |    |     |         |       |      |        |         |        |      | TTP(   | Throu                                              | igh Thickness Position) : 1-Surface, 2-1/41, 3-1/21 |                                                                                                                                                                                                                                                                   |

Chief of Customer Support Team Surveyor to Surveyor to Surveyor to

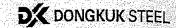
Poheng Works, 880 Songdong-ri, Daesong-myeon, Nam-gu, Pohang-si, Geyongsangbuk-do, 790-841. Kores





| ř | -   |               |      |           |     |     | -      |     | -        |         |
|---|-----|---------------|------|-----------|-----|-----|--------|-----|----------|---------|
| t | 4   |               |      |           |     |     | - inte | 200 |          | ·       |
| ı | 100 | _             | _    |           | / 7 |     |        |     |          |         |
|   | 200 | 200           | 0.79 | ]         | 100 | 1 1 |        |     |          | 1.00    |
|   | 200 | 1 - 7 - 4     |      | 7. No. 14 |     |     | 10000  |     | 200      | # 219 L |
|   | 1   |               | 17   |           |     | 100 | - 1    | _   | (2 de la | 20      |
|   |     | 100           |      | 100       | 100 |     | 24     | A   | 11.00    |         |
|   |     | $\overline{}$ | -    |           | ~   | -   | 100    |     |          |         |
|   |     |               |      |           |     |     |        |     |          |         |

## MILL TEST CERTIFICATE



Order No.

J119500055

PO No.

: LPP201109001

Commodity

: STEEL PLATE

Supplier

: DONGKUK INTERNATIONAL, INC.

SALZGITTER MANNESMANN INTERNAT

Certificate No. Date of issue

: PP2-2-111117-016-001

: Nov. 17, 2011

| Specification                                                  | : CSA G40.21 300W                                                | , <del>, , , , , , , , , , , , , , , , , , </del> |                                                                                                                                             | Cust                      | 0        |          |        | 1.     | 1        |         |       |       |                                                            | ta.     |         | Ç <u></u>                                                                                                                                                          |     |         | 17 ()<br>17 () |                                                                                                  |  |
|----------------------------------------------------------------|------------------------------------------------------------------|---------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------|---------------------------|----------|----------|--------|--------|----------|---------|-------|-------|------------------------------------------------------------|---------|---------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|---------|----------------|--------------------------------------------------------------------------------------------------|--|
|                                                                |                                                                  |                                                   |                                                                                                                                             |                           | 0        | Tensi    | le Tes | it     |          |         |       | One   | rical                                                      | Comp    | osili   | on.                                                                                                                                                                |     |         |                |                                                                                                  |  |
| Dimension<br>Unit<br>inch: ", mm: Space                        | Product No                                                       | Quant ity                                         | Weight<br>kg                                                                                                                                | Heat No                   | i        | YP       | TS     | EL.    |          |         |       |       |                                                            |         |         |                                                                                                                                                                    |     |         | in in          | Remarks                                                                                          |  |
| inch; ", mon: Space                                            |                                                                  |                                                   |                                                                                                                                             |                           | i G<br>n | L N/i    | a'     | *      | 2        | 3i<br>2 | 2     | 3     | S<br>3                                                     | Cr<br>3 | 2       | 2                                                                                                                                                                  | 3   | Nb<br>3 | 3              |                                                                                                  |  |
| 6:35*3048*12192<br>:25"X120"X480"<br>pecimen No : PP05677917-a | 7575954-01                                                       |                                                   | 1,852                                                                                                                                       | SF01688                   | 1        | 370      | 529    | 26     |          | 5 36    | 146   | 15    | 4                                                          | 20      | 1       |                                                                                                                                                                    | 1   | 1       | •              | 23716                                                                                            |  |
|                                                                | Sub Total (30)                                                   |                                                   | 1,852                                                                                                                                       | lungini di<br>Dinggani di |          |          |        |        |          |         |       |       | l jaz                                                      |         |         | ANG S                                                                                                                                                              |     |         |                |                                                                                                  |  |
| 6,35+3046+12192<br>.25*X120*X480*<br>Specimen No:PP05952405-a  | 7587391-01:02<br>7587393-01:02<br>7587394-01:02<br>7587395-01:02 |                                                   | 1,852                                                                                                                                       | SF06122                   | I        | 1 404    | 542    | න්     | L I      | 5 35    | 144   | *     | 3                                                          | 20      | 1       | 1                                                                                                                                                                  | t   | 1       | i in           | 23/FB                                                                                            |  |
|                                                                | Sub Total (30)                                                   | В                                                 | 14.816                                                                                                                                      |                           |          |          |        |        |          |         |       |       | (1) (A)<br>(B) (4)                                         |         |         |                                                                                                                                                                    |     |         |                |                                                                                                  |  |
|                                                                | 7587396-01.02<br>7587397-01.02                                   |                                                   | 1.852                                                                                                                                       | SF06313                   | 1        | 1 39     | 530    | 24     | <b>t</b> | 15 38   | 142   | - 13  | 5                                                          | 20      |         |                                                                                                                                                                    |     | 1       | 2              | 23998                                                                                            |  |
| peciaen no missocio a                                          | Sub Total (30)                                                   | 4                                                 | 7,408                                                                                                                                       |                           |          |          |        |        |          |         |       |       |                                                            |         |         |                                                                                                                                                                    |     |         |                |                                                                                                  |  |
| 7.94*2438*7315<br>5/16"X96"X288"<br>perimen No :PP05989503-a   | 7587182-01,02,03,04                                              |                                                   | 1,111                                                                                                                                       | K1122146                  | I        | 1 371    | 537    | 24     | L        | 16 3    | 141   | 10    | 2                                                          | 15      | 2       | 1                                                                                                                                                                  | 2   | 2       | 2              | 23668                                                                                            |  |
| becimen vo struccoccoa.                                        | Sub Total (40)                                                   | 4                                                 | 4,444                                                                                                                                       |                           |          |          |        |        |          |         |       |       |                                                            |         |         |                                                                                                                                                                    |     | 100     |                |                                                                                                  |  |
| <grand total=""></grand>                                       |                                                                  | 17                                                | 28,520                                                                                                                                      |                           |          |          |        |        |          |         |       |       |                                                            |         |         |                                                                                                                                                                    |     |         |                |                                                                                                  |  |
|                                                                |                                                                  |                                                   | 3 T. K.                                                                                                                                     |                           | 11       |          |        |        |          |         |       |       |                                                            |         | 42      |                                                                                                                                                                    |     |         |                |                                                                                                  |  |
| Tensile Test Oirection-Tran<br>Supply Condition - As Roll      |                                                                  | ∴ was d <b>F</b> i                                | e hereby cer<br>ne grain prai                                                                                                               | ctice) and sa             | distac   | tariy l  | ested  | n acce | rdane    | ce with | abovi | 2 SOE | cificati                                                   | on re   | auiren  | nents                                                                                                                                                              | • S |         |                | id : a-Tension<br>-Top: M-Middle: B-Bottom                                                       |  |
| Chemical Composition Unit                                      | (%) 2-x100, 3-x1000, 4-x                                         |                                                   | alled for by II<br>0204 3.1                                                                                                                 | ne abave on               | er. T    | his mill | lest c | ervica | le hai   | s been  | issue | in c  | omplia                                                     | ince v  | vilh El | N                                                                                                                                                                  | * S | ub(S.   | ub Siz         | -Ladle Analysis, P-Product Analysis<br>ze, Real Value, mm) : Blank-Full Size, 1-7.5•10, 2-5.0•11 |  |
|                                                                |                                                                  |                                                   | 204 3.1.                                                                                                                                    |                           |          |          |        |        |          |         |       |       |                                                            |         |         | * GL(Gauge Length, mm): 1-200, 2-100, 3-80, 4-70, 5-50, 6-5.65<br>7-5d, 8-4d, 9-8d<br>*T(S) Al: Total(Soluble) Al -*Tr: Frace<br>*NRL Result: 'G-No Break, B-Break |     |         |                |                                                                                                  |  |
|                                                                |                                                                  | N<br>d                                            | When using the ordered product for other uses, rather than the above specification use, produ<br>damage and safety accidents may be caused. |                           |          |          |        |        |          |         |       |       | * TTP(Through Thickness Position): 1-Surface 2-1/4T 3-1/2T |         |         |                                                                                                                                                                    |     |         |                |                                                                                                  |  |

Surveyor to

Surveyor to

Surveyor to

Chief of Customer Support Jeam

Page :

## 검사증명서

MILL TEST CERTIFICATE (INSPECTION CERTIFICATE)

MAR 0 8 2012

당진제철소 : 충남 당진시 송약읍 고대리 167-32 Godae-Ri, Songak-Eup, Dangin, Chungnam, Korea

주문번호 Order No.

: E111200017

명 Commodity

: Hot Rolled Steel Plate

제품규격 Specification

: CSA 44W/ASTM A36

고객사

주문자

: RUSSEL METALS Customer

: HYUNDAI CORPORATION

중명서 번호 Certificate No.

: 20111230-PS-026-003

발행일자 Date of le

| 제품치수                     | 수량       |       | 제김번호    | 제품번호        | Posi       |       |       |     | 인장시함<br>ensite Te |     |     |   |     |       | ٠.  |       | 화학(<br>cal Con | 성분<br>mpositio | n(%) |   |    |    | 2:x10<br>1:x10, | 단위<br>0 3<br>000 5 | 1:x10 | 00<br>0,000 |          |      |
|--------------------------|----------|-------|---------|-------------|------------|-------|-------|-----|-------------------|-----|-----|---|-----|-------|-----|-------|----------------|----------------|------|---|----|----|-----------------|--------------------|-------|-------------|----------|------|
| Dimension                | Quantity | (Kg)  | HeatNo. | Product No. | sition     | ΥP    | TS    | B.  | YP-EL             |     | YR  | N | D.  | С     | S   | Ma    | Р              | S              | ۵    | N | ã  | Мо | Nb              | ħ                  | ٧     | Sol<br>-Al  | 1        |      |
| ** Condition of supply:/ | 4c-D-4c  |       |         |             |            | OV.   | mi)   | (%) | (%)               | (%) | (%) | L | 3   | 4     | 3   | 3     | 4              | 4              | 2    | 2 | 3  | 2  | 3               | 3                  | 3     | 3           | Ĭ        |      |
| 1.000° x 96° x 288"      | 1 1      | 3,555 | M37435  | FA19032801  | ΤŦ         | 070.0 | 5400  | ~   |                   |     |     |   |     |       |     | , ,   |                |                |      |   |    |    |                 |                    |       |             |          |      |
|                          | ٠ ]      | سپ    | WD/433  | FA19032001  | ľ          | 370.2 | 2162  | 25  |                   |     |     |   |     |       |     | 1,173 |                | 23             | 2    | 1 | 17 | 0  | 29              | 1                  | 1     | 30          |          | <br> |
| 1.000"x96"x268"          | - 1 I    | 3,555 | M37435  | FA19032802  | ۱, ۱       | a     |       | ~   |                   |     |     | ł | C   |       |     | 1,162 |                | 20             | 2    | 1 | 16 | 0  | 26              | 2                  | 1     | 30          |          |      |
|                          | · ]      | 3,343 | WD/433  | raisuseus   | 1'         | 3/0,2 | 516.2 | 26  | 1 !               |     | 1   |   | L   |       |     | 1,173 |                | 23             | 2    | 1 | 17 | 0  | 29              | 1                  | 1     | 30          |          |      |
| 1.000" x 96" x 288"      | ۱ ،      | 3,555 | M37435  | FA19032803  | <b> </b> _ |       | E160  | ~   | 1 .               |     |     |   | C   |       |     | 1,162 |                | 20             | 2    | 1 | 16 | 0  | 26              | 2                  | 1     | 30          |          |      |
|                          | ' .      | محرد  | MD/-100 | rA19032003  | 1          | 3/02  | 516.2 | 25  | 1                 |     |     |   |     |       |     | 1,173 |                | 23             | 2    | 1 | 17 | 0  | 29              | 1                  | 1     | 30          | ł        |      |
| 1.000"x96"x288"          | , ]      | 3,555 | M37435  | FA19032804  | ۱.         | 270.0 | 516.2 | 28  |                   |     | ļ · |   |     |       |     | 1,162 |                | 20 `           | 2    | 1 | 16 | 0  | 26              | 2                  | 1     | 30          | }        |      |
|                          | Ė        | ٠     |         | TATALOZOUA  | I ' I      | 3/02  | 3102  | 26  | l I               |     |     | ļ |     |       |     | 1,173 |                | 23             | 2    | 1 | 17 | 0  | 29              | 1                  | 1     | 30          |          | ٠.   |
| 1.000"x96"x288"          | ١ ، ١    | 3,585 | M37435  | FA19032805  |            | 370.2 | 5100  | 28  | [                 |     |     |   |     |       |     | 1,162 |                | 20             | 2    | 1 | 16 | 0  | 26              | 2 '                | 1     | 30          | <b>1</b> |      |
|                          | '        | سب    | #5/435  | FAI3U20U    | 1'         | 3/02  | 310.2 | 26  |                   |     | 1   |   |     |       |     | 1,173 |                | 23             | 2    | 1 | 17 | 0  | 29              | 1                  | 1     | 30          | 1        | •    |
| 1.000"x96"x288"          | ı ا      | 3,556 | M37435  | FA19107105  | ١.,        | 270.2 | 540   | 20  | 1                 |     |     |   | l c |       |     | 1,162 |                | 20             | 2    | 1 | 16 | 0  | 26              | 2                  | 1     | 30          |          |      |
| ALL ALL                  | ٠ ا      | ٠,٠٠٠ | M21420  | LW1940/100  | 1'         | 370.2 | 310.2 | 28  | -                 |     | Į   | l | 1 L | 1,555 | 272 | 1,173 | 156            | 23             | 2    | 1 | 17 | 0  | 29              | 1 1                | l 1   | 30          |          |      |

\*\* Condition of supply: As Polled \*\*

Position - T:Top, M:Middle, B:Bottom Tensile test - Direction:Transverse, Gauge length:200mm (Rectangular), YP method: 0.2% off-set Division - C:Check analysis, L:Ladle analysis

ORDER NUMBER :M64034931

N O T É

ORIGINAL

상기의 제품은 검사의 결과 지정된 규격에 합격한 것을 증명합니다. WE HEREBY CERTIFY THAT THE MATERIAL HAS BEEN MADE AND TESTED IN ACCORDANCE WITH THE ABOVE SPECIFICATION AND THE REQUIREMENTS

SURVEYOR TO : CHEF OF CUALITY ASSURANCE TEAM







## MILL TEST CERTIFICATE

MAR 3 0 2012





Order No.

: J11B400064

PO No.

: LPP201110012

Commodity Specification

: STEEL PLATE

: ASTM A36/CSA G40.21 300W

Supplier

: DONGKUK INTERNATIONAL, INC.

Certificate No.

: PP2-2-111221-027-002

|                                                                                     | - ASIM ASS/CSA G4                                  | 0.21 3 | 0044                                                        | Cusi                        | lome                            | r<br>——            |        | : SA   | LZGN              | ITEA           | 1AM             | INES          | 1AM              | NN II   | NTE             | RNA        | r !    | Date             | of i         | SSUE          | : Oec. 21, 2011                                                                 |
|-------------------------------------------------------------------------------------|----------------------------------------------------|--------|-------------------------------------------------------------|-----------------------------|---------------------------------|--------------------|--------|--------|-------------------|----------------|-----------------|---------------|------------------|---------|-----------------|------------|--------|------------------|--------------|---------------|---------------------------------------------------------------------------------|
| Oinersion<br>Unit                                                                   | Product No                                         | Quant  | Weight                                                      |                             | P<br>Q<br>S                     | Teasi              | ile Te | st     |                   |                |                 | C             | hen i c          | al C    | onpos           | itior      | ,      |                  |              |               |                                                                                 |
| Inch: ", m: Space                                                                   |                                                    | Ity    | kg                                                          | Heat No                     | 0<br>1<br>1<br>1<br>1<br>1<br>1 | YP<br>N/i          | 12     |        | C 2               | SI<br>2        | <b>ዜ</b> ክ<br>2 | р<br>3        | S<br>3           | Cr<br>3 | Ni<br>2         | a۷         | 160    | ₩ <sub>0</sub>   | ۷<br>3       | Çeq           | Hemarks .                                                                       |
| 19.05*2438*7315<br>.75"X96"X288"<br>Specimen No : PP06031210-2                      | 7604249-02,03,04                                   |        | 2,667                                                       | K2815691                    | 7 '                             | 346                | 500    | 25     | L 16              | 25             | 120             | 12            | 5                | 20      | - 1             | 1          | 7      | 1                | - 2          | 366           | 22AB                                                                            |
|                                                                                     | Sub Total (40)                                     | 3      | 8,001                                                       |                             | П                               |                    |        |        | 1                 | 1              |                 |               |                  |         |                 |            |        | İ                | ļ            |               |                                                                                 |
| 19.05-2438-7315<br>.75"X96"X288"<br>Specimen No :FP06031211-a                       | 7604252-02,03,04<br>7604255-02,03,04               | -      | 2,687                                                       | K2815691                    | 7 7                             | 348                | 500    | 29     | L 16              | 25             | 120             | 12            | 5                | 20      | 1               | 1          | 1      | ١,               | 2            | 366           | 2298                                                                            |
|                                                                                     | Sub Total (40)                                     | 6      | 16.002                                                      |                             | П                               | 1                  |        |        |                   |                |                 | 1             |                  |         |                 |            |        |                  |              | ľ             | ·                                                                               |
| 19.05+2438+7315<br>.75"X96"X288"<br>Specimen No. :PP06001405-e                      | 7604259-01,03.04                                   |        | 2,667                                                       | KE9945                      | 7 1                             | 397                | 535    | 27     | L 17              | 29             | 123             | 16            | 5                | 20      | ,               | ,          | 10     | 1                | 2            | 383           | 1 2298                                                                          |
| 4                                                                                   | Sub Total (40)                                     | 3      | 8,001                                                       |                             |                                 |                    |        |        | 1                 | l              | 1 1             |               |                  |         |                 |            |        |                  |              | ŀ             | İ                                                                               |
| 19.05+2438+7315<br>.75"X96"X288"<br>Specimen No :PP06002111-a                       | 7804241-01,02                                      |        | 2,667                                                       | 1029951                     | וד                              | 356                | 514    | 28     | L 17              | 27             | 122             | 14            | 4                | 30      | ,               | 2          | 10     | 1                | 2            | 384           | 2398                                                                            |
|                                                                                     | Sub Total (40)                                     | 2      | 5.334                                                       |                             | H                               |                    |        |        | ı                 |                |                 |               |                  |         |                 |            |        |                  |              |               |                                                                                 |
| 25, 40+2438+7315<br>1*X96*X288*<br>Specimen No :PP06017006-a                        | 7602684-01,02                                      |        | 3,556                                                       | K2815590                    | וד                              | 360                | 494    | 27     | L 15              | 22             | 121             | 19            | 6                | 20      | ,               | 2          | 2      | ,                | a            | 356           | 3 2298                                                                          |
|                                                                                     | Sub Total (50)                                     | 2      | 7,112                                                       |                             |                                 |                    |        |        |                   |                |                 |               |                  |         |                 |            |        |                  |              |               |                                                                                 |
| Tensile Test Direction-Trans                                                        | EVerse                                             | W      | hereby cert                                                 | ify that the c              | nateria                         | l has l            | been r | nude b | y Basi            |                | 1 00            |               | /Eul             | مانتاء  |                 | <u> </u>   | Ļ      | <u> </u>         | L.           |               | <u> </u>                                                                        |
| Caq = C+Mn/5+(Ni+Cul/15<br>Supply Condition - As Rolle<br>Chemical Composition Unit | r(CT+M0+V)/5<br>.d<br>(%) : 2-x100, 3-x1000, 4-x10 | O00 10 | hereby cert<br>ne grain pract<br>and for by the<br>204 3.1. | tice) and sa<br>e above ord | tisfacto<br>er. Thi             | ortly te<br>s mili | sled i | n acco | rdance<br>e has l | with<br>been i | Spoke<br>Spoke  | Spec<br>in co | ificati<br>mpila | UCS /   | quire<br>with E | nents<br>N | - J* D | ositic<br>ivisio | ก:T·<br>ก:L· | -Top.<br>Ladi | r-Tension<br>M-Nilddle, B-Bottom<br>& Analysis<br>& Analysis P-Product Analysis |

- Director - C-Lade Analysis, F-Troduct Artistysis - Sub(Sub Size, Real Value, mm) : Blank-Flui Size, 1-7.5-10, 2-5.0-10 - GL(Gauge Length, mm) : 1-200, 2-100, 3-60, 4-70, 5-50, 6-5.65-/A, 7-5d, 9-4d, 9-8d - T(S), AI : Total(Sokbie) AI - Tir : Trace - NRI, Result : G-No Break, B-Break - TTP(Through Thickness Position) : 1-Surface, 2-1/4T, 3-1/2T

Surveyor to

Surveyor to

When using the ordered product for other uses, rather than the above specification use, product damage and safety accidents may be caused.

Surveyor to

S.H. Art Chief of Customer Support Team

Pohang Works, 880 Songdong-ri, Daesong-myeon, Nam-gu, Pohang-si, Geyongsangbuk-do, 790-841, Korea

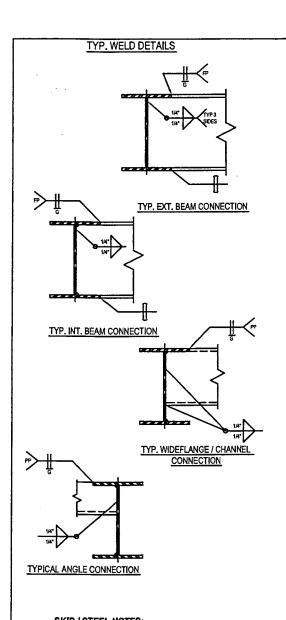


## CERTIFICATE OF COMPLIANCE FOR THE INSTALLATION OF INSULATION JOB No. KS -CUSTOMER: REFERENCE: 5441-52 ave S.E. Calgary Alberta - T2C 4S5 REFER TO KENT STEEL LT.P. FOR HOLD POINTS AND INSPECTOR SIGN-OFF Phone: (403) 279-7000 Fax: (403) 279-7060 INSULATION TYPE COMMENTS POLAR FOAM CLASS PF-7217-0 POLAR FOAM CLASS PF-2444-0 THICKNESS REQUIRED: YES NO TOP COAT IF "YES" SPECIFY TYPE: AMOUNT OF LAYERS OF INSULATION TIME ALLOWED BETWEEN APPLICATIONS (ONLY APPLIES FOR 4\* AND UP) SURFACE PREPARATION (SURFACE TEMP MUST BE ABOVE -5C) AMBIENT APPLICATION TEMP +70F MIXING SPRAY TEMP +110F EQUIPMENT USED: H-20 / 35 PLURAL COMPONENT PROPORTIONED - MAKE GRACO / GUSMER COMPRESSOR TYPE / SIZE: 5 H.P. CHAMPION SIZE OF MIXING CHAMBER: SIZE 70 GENERAL MAKE OUTPUT: JOHN DEERE 50KW APPLICATOR NAME (SIGNATURE) APPLICATOR NAME (PRINT) KENT STEEL Q.C. NAME (SIGNATURE) KENT STEEL Q.C. NAME (PRINT)

### KENT STEEL PAINT SPECIFICATION

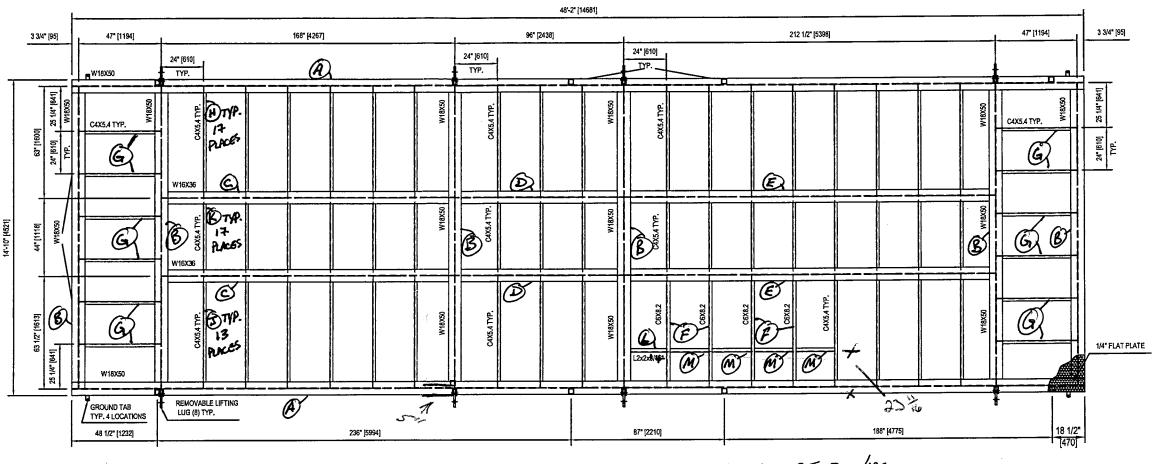
|                       | ,                                     |                                    |
|-----------------------|---------------------------------------|------------------------------------|
| Customer P.O.         |                                       |                                    |
| Kent Steel Job#       | 167                                   |                                    |
| Customer Contact      |                                       | Phone:                             |
|                       |                                       |                                    |
| CUSTO                 | MER PREPARATION                       | AND PAINTING REQUIREMENTS          |
| Substrate Preparation |                                       |                                    |
| SSPC Requirements     | SP-6.                                 |                                    |
| Profile               |                                       |                                    |
| Abrasive              | CLEAN BI                              | JA87                               |
|                       |                                       | ICATION                            |
| Thinner (Material and | Manufacturer):                        |                                    |
| XYLENE                | 12: 1:4                               | CLOVERDALE                         |
| <u> </u>              | 10年18                                 |                                    |
|                       |                                       | IMER                               |
| Type of Primer: HS N  | ON UFFING PRIMER                      | Manufacturer: CLOUERDALE           |
|                       |                                       |                                    |
| Type of Top Coat: P   | suack.                                | CLOUELDALE                         |
| Date: 22 MAY 2017     | Time Start: (5 %)                     | Time Finish:                       |
| Date: Sa WIFF acre    | THIR STAIL 5.00                       | Time Finish: 7200 Cure Time: 1 Hvc |
|                       |                                       |                                    |
| Number of Coats:      | Required DFT:                         | Recorded DFT:                      |
|                       | 1.5                                   | 1.9                                |
| Ambient Temp.: 15°C   | Substrat                              | te Temp.: #5°C Humidity: 38%       |
|                       | . 7                                   | SH COAT(S)                         |
| Date: May 22 2012     | Time Start: 900.                      | Time Finish: 1000 Cure Time:       |
|                       |                                       |                                    |
| N                     | T                                     |                                    |
| Number of Coats:      | Required DFT:                         | Recorded DFT:                      |
| Amhient Temp: 1100    | 1,25                                  | 3.9                                |
| Ambient Temp.: // °C  | Substrat                              | e Temp.: 41° Humidity: 36%         |
|                       |                                       | MENTS                              |
|                       | umer.                                 | S11_I 4254                         |
| BLACK                 | · · · · · · · · · · · · · · · · · · · | S 12D 5306                         |
| T I LENE              |                                       | S 12D 53 79                        |
| Prepared By: DEULO 9  | IAN M Date: 21                        | Alba.                              |
| Inspector.            | Date:                                 | Signature:                         |

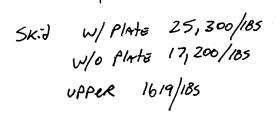
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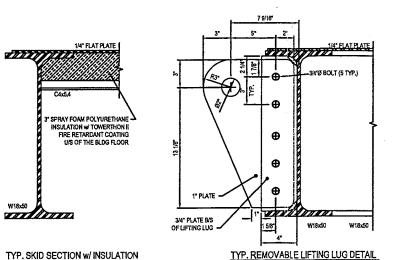


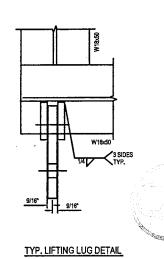


- WELDING SHALL BE IN GENERAL CONFORMANCE WITH CSA
- WELDS TO BE 1/4" CONTINUOUS FILLET WELD UNLESS NOTED. - CHECKER PLATE TO BE STITCH WELDED TO SKID USING 3/16" FILLETS 2" AT 12" INTERVALS.
- CHECKER PLATE SEAMS TO BE WELDED CONTINUOUSLY ON ONE SIDE,
- ALL WORK SHALL GENERALLY CONFORM TO THE LATEST EDITIONS OF THE FOLLOWING CODES AND STANDARDS:
  - \* CSA W47.1-09
  - \* CISC HANDBOOK OF STEEL CONSTRUCTION
- ALL STEEL SHALL BE OF NEW STOCK AND SHALL BE IN ACCORDANCE WITH CSA G40.21-M.
  - \* STRUCTURAL STEEL = GRADE 350W
  - \* CHANNELS & ANGLES = GRADE 300W
  - \* LIFTING LUGS= GRADE 300W
  - \* CHECKER & FLAT PLATE = GRADE 300W
- FILLER METAL SHALL CONFORM TO CSA STD. W48.5-M -E4802C-6-CH.
- 3"-R20 SPRAY FOAM POLYURETHANE INSULATION w/ TOWERTHON II FIRE RETARDANT COATING U/S OF THE BLDG
- FLOOR -1/4" FLAT PLATE DECKING W/ ANTI-SLIP PAINT
- SSPC-SP-6 SURFACE PREPARATION
- PRIME WITH ONE COAT OF CLOVERDALE 710 SERIES PRIMER
- TOPCOAT WITH ONE COAT OF CLOVERDALE 74 SERIES INDUSTRIAL ENAMEL
- STANDARD QC PACKAGE
- FINISH COLOR IS TO BE BLACK







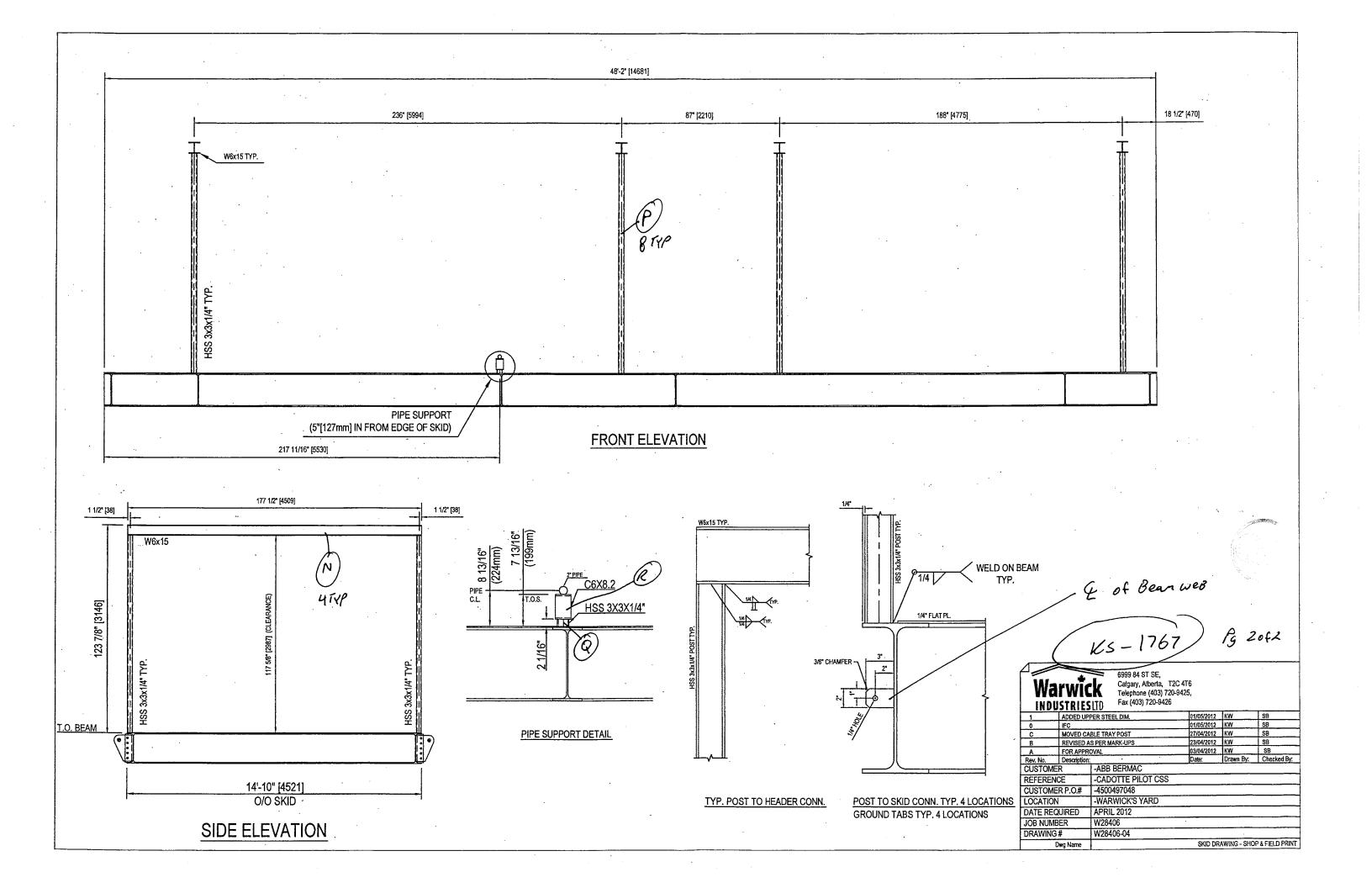


6999 84 ST SE, Calgary, Alberta, T2C 4T6 Telephone (403) 720-9425,

Fax (403) 720-9426 INDUSTRIESLTD MOVED CABLE TRAY POST 7/04/2012 KW REVISED AS PER MARK-UPS 23/04/2012 KW -FOR APPROVAL -03/04/2012 I-KW Rev. No. Description I-ABB BERMAC -CADOTTE PILOT CSS

CUSTOMER CUSTOMER P.O.# -4500497048 -WARWICK'S YARD LOCATION DATE REQUIRED | -APRIL 2012 JOB NUMBER W28406

DRAWING# W28406-03 SKID DRAWING - SHOP & FIELD PRINT Dwg Name



# Certificate of Registration

This is to certify that QUASAR has certified:

## Warwick Industries Ltd.

Plants: 6999 - 84th Street SE, Calgary, AB T2C 4T6 / Gar-Don Steel Industries Ltd., 1308 - 8 Street, Nisku, AB T9E 7M1
Design Office: Laviolette Engineering Ltd., 11729 105 Ave. NW, # 101, Edmonton, AB T6G 1N4

to the Certification Standard:

## CAN/CSA A660-10

"Certification of Manufacturers of Steel Building Systems"

Initial Registration 26 January 2010

Date of Issue 2 March 2012

Date of Expiry 26 January 2013

Certificate Number WARWI0

**Scope**: Self framing steel buildings - design and manufacture of sheet metal parts, design and supply of steel skids and structural steel (where applicable) and erection of buildings.



Registrar





Refer to www.cwbgroup.org for current certification status.

### **SHIPPING BILL**

Customer:

Wawick Industries

Project:

ABB / Bermac Pick Up

Date: May 22, 2012

Kent Steel Job # KS 1767 Customers Job #: W28406

Site: Attn:

Customers PO#: P12093

| Quantity      | <u>Mark</u> | CHECKED<br>BY | TOTAL<br>WEIGHT | Description                         |
|---------------|-------------|---------------|-----------------|-------------------------------------|
| 1             |             |               | 24,000          | 14'10" x 48'2" Skid (Paint - Black) |
| 8             |             |               |                 | Lift Lugs                           |
| 40            |             |               |                 | 5/8" x 4" A325 Bolts                |
|               |             |               |                 |                                     |
|               |             |               |                 |                                     |
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|               |             |               |                 |                                     |
|               |             |               |                 |                                     |
|               |             |               | 1               |                                     |
|               |             | 1 TOTAL ₽     | 24,000          | lbs.                                |
| CUSTOMER SIGI | NATURE · N  | Leas          |                 | PRINT NAME :                        |
|               |             | - 0           | <del> </del>    |                                     |
| DRIVER SIGNAT | UKE: 111    | 7. LL 2 ~     | _               | PRINT NAME :                        |
| TRUCKING COM  | PANY:       | NTRE          | _               | LOAD SAFETY DRIVER INITIAL :        |