

- **As – Built Drawings**

CM-1021
ASPHALT OXIDATION BLOWER
CAPACITY: 54.6 m³/min. (2000 gpm.)
DISCHARGE PRESSURE: 41.1 kPa (6 psig)
MOTOR: 750 hp (75 hp)

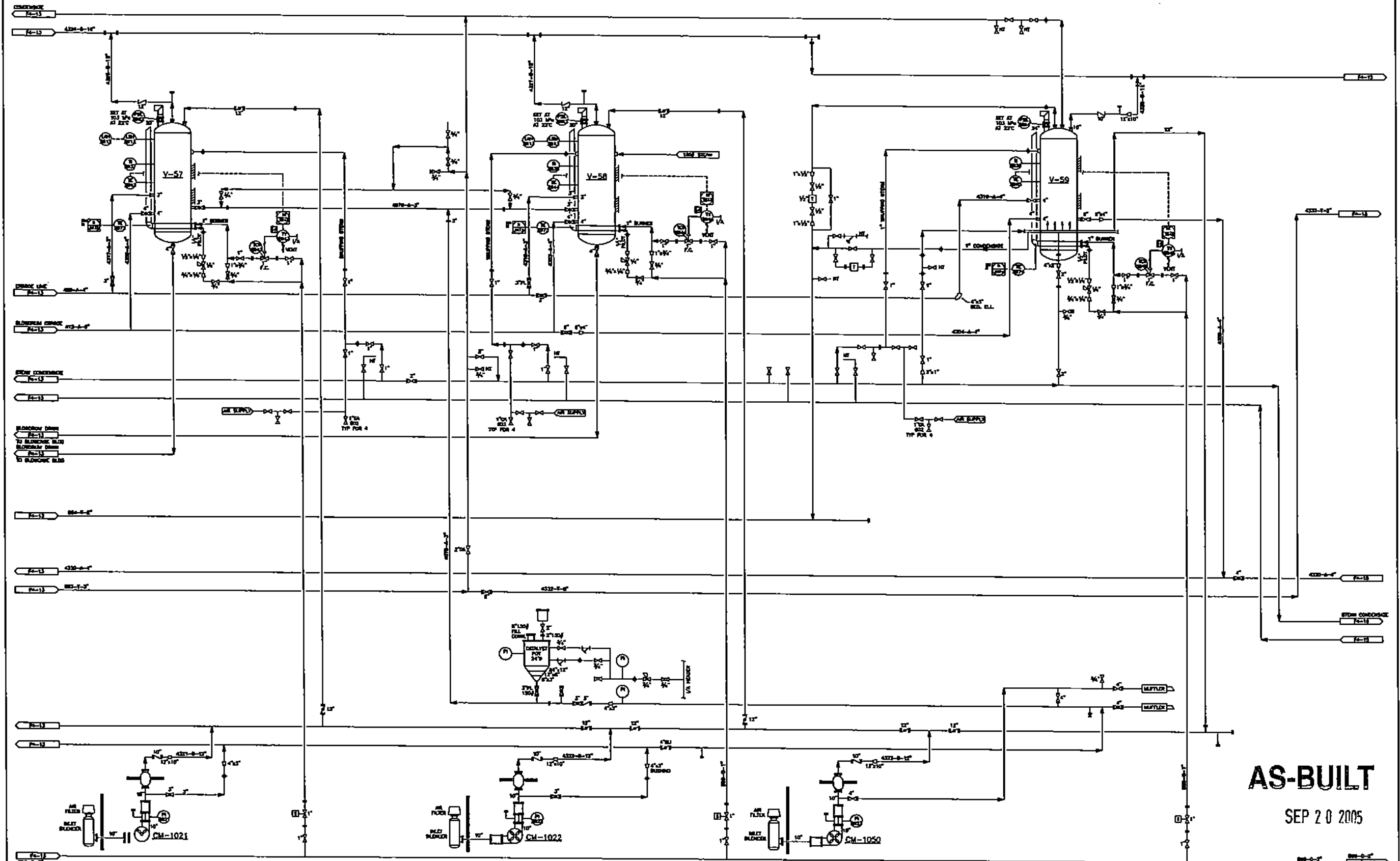
V-57
BLOWDOWN VESSEL
3048mm I.D. x 7620mm T/7

CM-1022
ASPHALT OXIDATION BLOWER
CAPACITY: 54.6 m³/min. (2000 gpm.)
DISCHARGE PRESSURE: 41.1 kPa (6 psig)
MOTOR: 750 hp (75 hp)

V-58
BLOWDOWN VESSEL
3048mm I.D. x 7620mm T/7

CM-1020
ASPHALT OXIDATION BLOWER
CAPACITY: 54.6 m³/min. (2000 gpm.)
DISCHARGE PRESSURE: 41.1 kPa (6 psig)
MOTOR: 1512 hp (150 hp)

V-59
BLOWDOWN VESSEL
3304mm I.D. x 10500mm T/7



AS-BUILT

SEP 20 2005

AS-BUILT IS BASED ON MARK-UPS
PROVIDED BY CLIENT.
FIELD VERIFICATION HAS NOT BEEN
COMPLETED BY INTERIM.

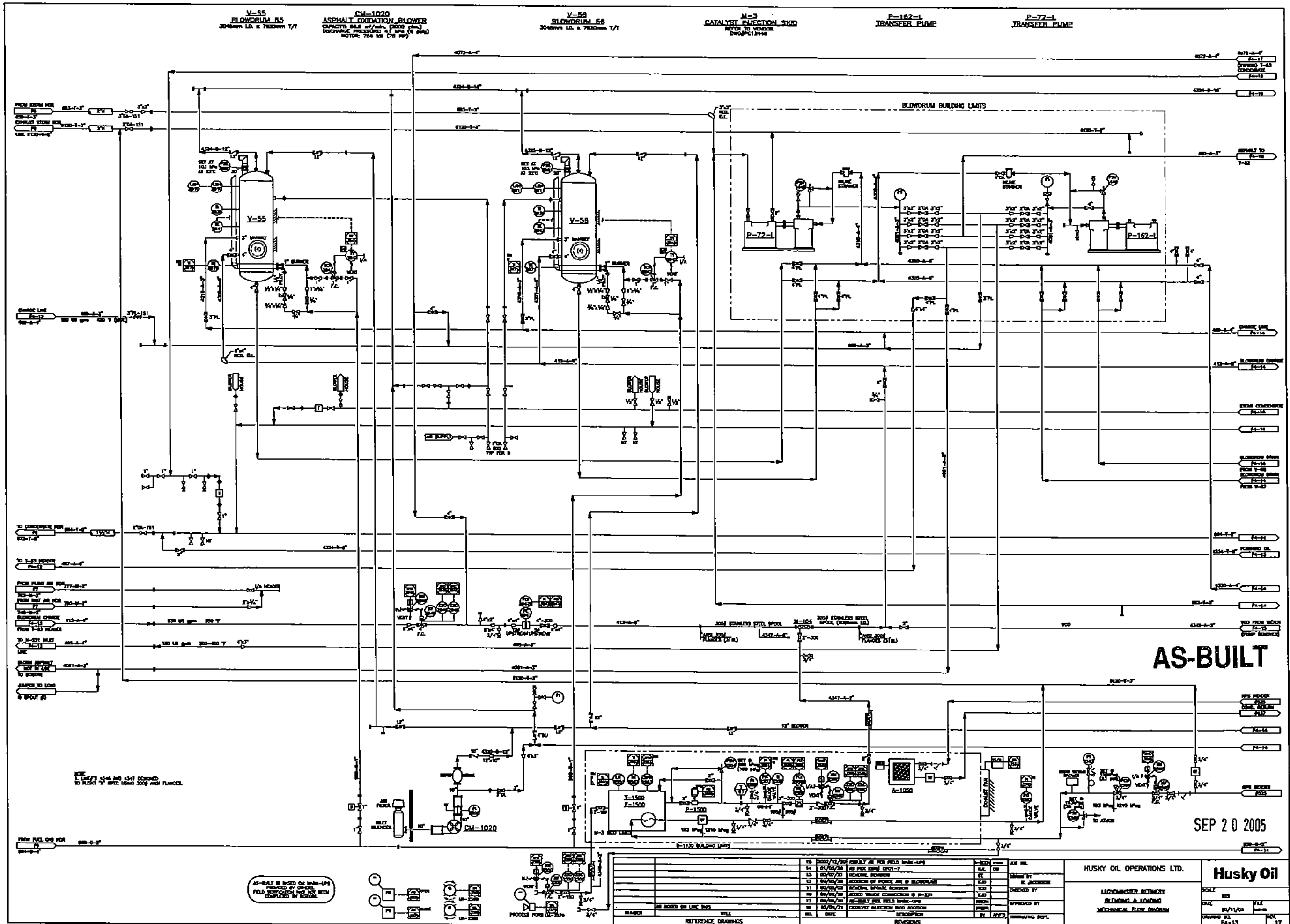
NO.	DATE	DESCRIPTION	BY	APP'D.	REVISIONS
15	2005/12/20	AS-BUILT AS PER FIELD MARK-UPS	W. J. J.	W. J. J.	
14	2005/12/20	AS PER FIELD MARK-UPS	W. J. J.	W. J. J.	
13	2005/12/20	GENERAL REVISION	W. J. J.	W. J. J.	
12	2005/12/20	ADDITION OF PUMP AIR & BLOWDOWN	W. J. J.	W. J. J.	
11	2005/12/20	GENERAL REVISION	W. J. J.	W. J. J.	
10	2005/12/20	ADDED TRUCK CONNECTION @ H-221	W. J. J.	W. J. J.	
9	2005/12/20	AS-BUILT PER FIELD MARK-UPS	W. J. J.	W. J. J.	
8	2005/12/20	GENERAL REVISION	W. J. J.	W. J. J.	
7	2005/12/20	GENERAL REVISION	W. J. J.	W. J. J.	
6	2005/12/20	GENERAL REVISION	W. J. J.	W. J. J.	
5	2005/12/20	GENERAL REVISION	W. J. J.	W. J. J.	
4	2005/12/20	GENERAL REVISION	W. J. J.	W. J. J.	
3	2005/12/20	GENERAL REVISION	W. J. J.	W. J. J.	
2	2005/12/20	GENERAL REVISION	W. J. J.	W. J. J.	
1	2005/12/20	GENERAL REVISION	W. J. J.	W. J. J.	

HUSKY OIL OPERATIONS LTD.

Husky Oil

ILLUMINATOR REFINERY
BLUENESS & LIGNOL
MECHANICAL FLOW DIAGRAM

SCALE: 1/8" = 1'-0"
DATE: 09/11/05
DRAWN BY: W. J. J.
CHECKED BY: W. J. J.
APPROVED BY: W. J. J.
REVISIONS: 17



M-200
SAFETY SHOWER ASSEMBLY
MAKE: ENCON TEMPERED WATER SYSTEM
MODEL: 55003782
SIZE: 8.8m³/hr (30gpm) @
25°C-34°C (78°F-93°F)

M-201
SAFETY SHOWER ASSEMBLY
MAKE: ENCON TEMPERED WATER SYSTEM
MODEL: 55003781
SIZE: 8.8m³/hr (30gpm) @
25°C-34°C (78°F-93°F)

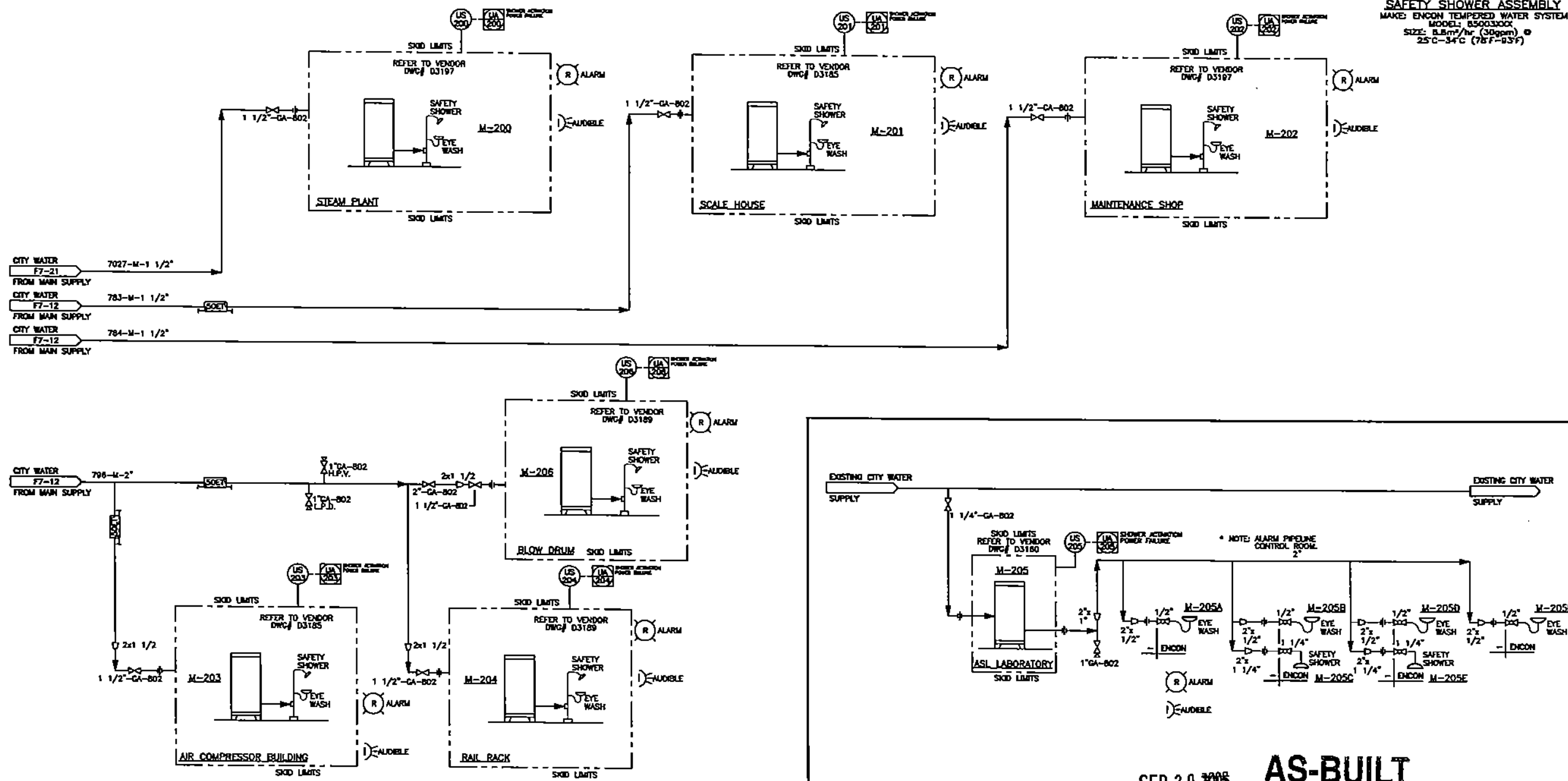
M-202
SAFETY SHOWER ASSEMBLY
MAKE: ENCON TEMPERED WATER SYSTEM
MODEL: 55003782
SIZE: 8.8m³/hr (30gpm) @
25°C-34°C (78°F-93°F)

M-203
SAFETY SHOWER ASSEMBLY
MAKE: ENCON TEMPERED WATER SYSTEM
MODEL: 55003781
SIZE: 8.8m³/hr (30gpm) @
25°C-34°C (78°F-93°F)

M-204
SAFETY SHOWER ASSEMBLY
MAKE: ENCON TEMPERED WATER SYSTEM
MODEL: 55003780
SIZE: 8.8m³/hr (30gpm) @
25°C-34°C (78°F-93°F)

M-205
SAFETY SHOWER ASSEMBLY
MAKE: ENCON TEMPERED WATER SYSTEM
MODEL: 55003780
SIZE: 8.8m³/hr (30gpm) @
25°C-34°C (78°F-93°F)

M-206
SAFETY SHOWER ASSEMBLY
MAKE: ENCON TEMPERED WATER SYSTEM
MODEL: 55003780
SIZE: 8.8m³/hr (30gpm) @
25°C-34°C (78°F-93°F)

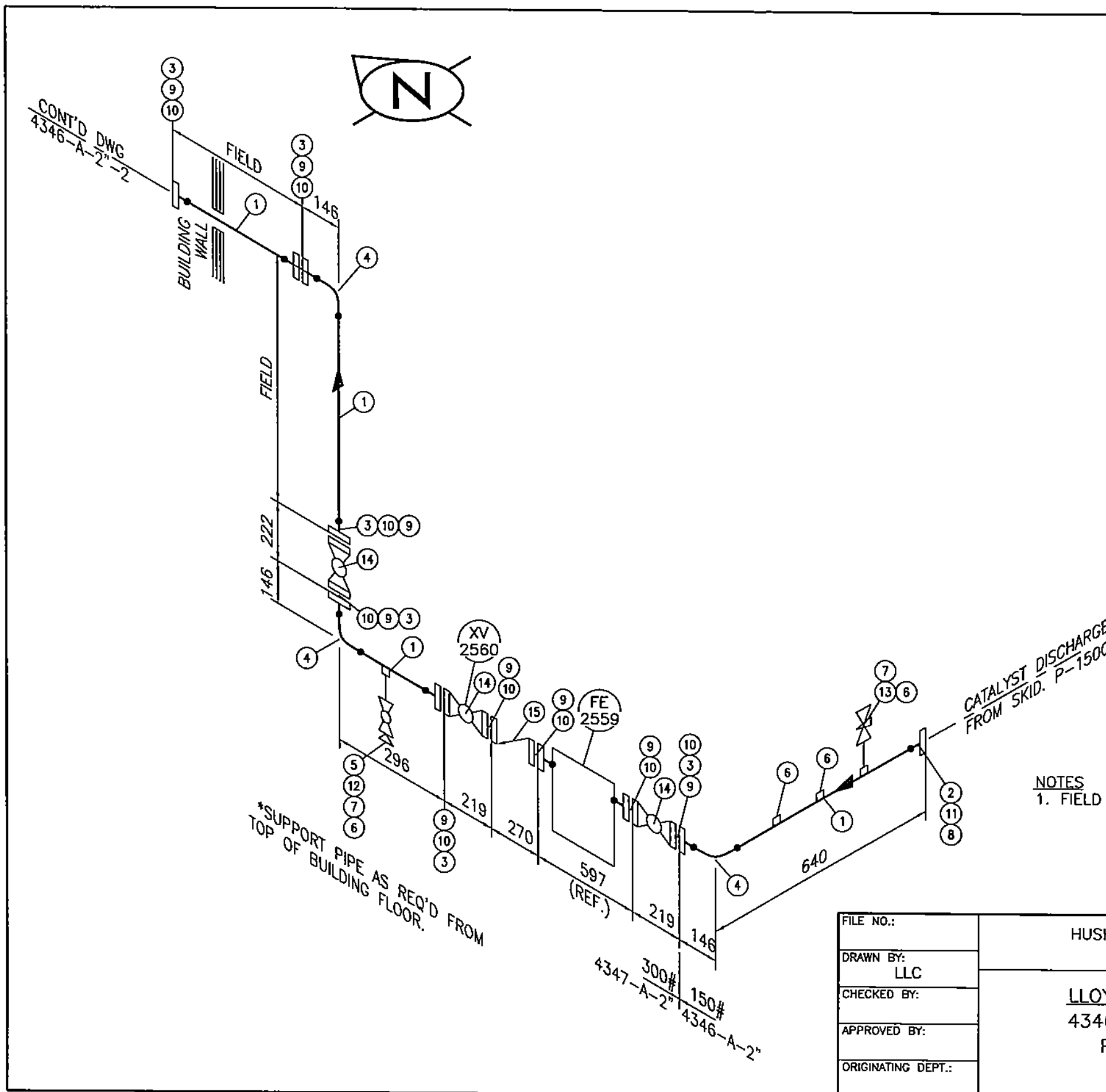


SEP 20 2005 **AS-BUILT**

AS-BUILT IS BASED ON MARK-UPS
PROVIDED BY OTHERS.
FIELD VERIFICATION HAS NOT BEEN
COMPLETED BY INTEGRA.

ASL LABORATORY SAFETY SHOWER/EYE WASH STATIONS

						JOB NO. P0483	HUSKY OIL OPERATIONS LTD.	Husky Oil		
						DRAWN BY LLC			SCALE NTS	
		2	2005/09/20	AS-BUILT PER FIELD MARK-UPS	INTEGRA				DATE 04/10/01	FILE
		1	2005/04/13	M-200 SAFETY SHOWER ADDITION	INTEGRA	ELS				
		0	2005/01/11	ISSUED FOR CONSTRUCTION	INTEGRA	JT				
		B	2004/10/18	ISSUED FOR TENDER	INTEGRA	JT				
		A	2004/10/01	ISSUED FOR APPROVAL	INTEGRA					
NUMBER	TITLE	NO.	DATE	DESCRIPTION	BY	APP'D	ORIGINATING DEPT.	DRAWING NO. F7-25	REV. 2	
REFERENCE DRAWINGS				REVISIONS						



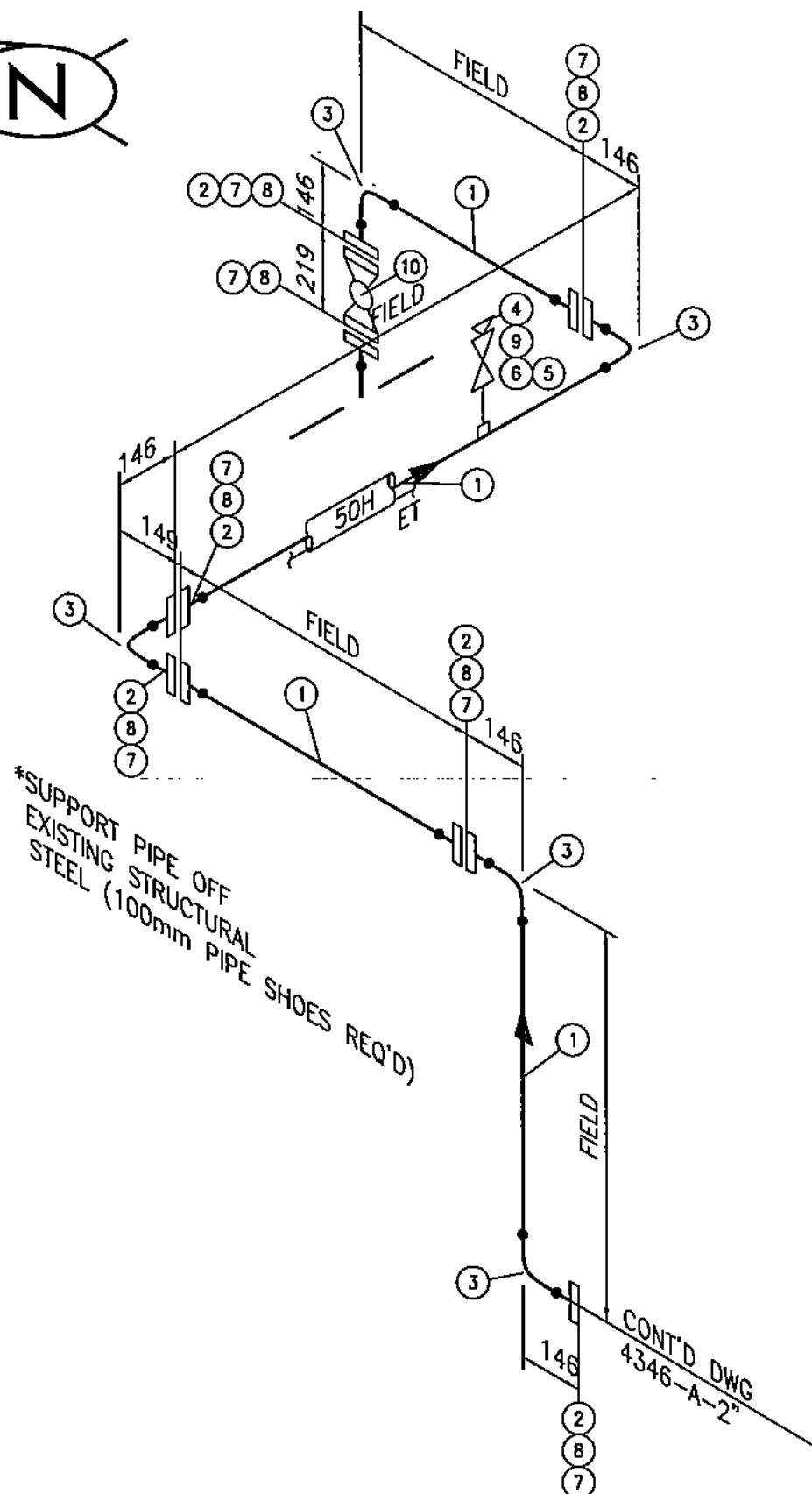
BILL OF MATERIAL							
PIPE							
MK	QTY	SIZE	SCHEDULE	DESCRIPTION	MATERIAL	S/F	
1	3m	60.3mm	40	PIPE SMLS	A312 GR.F316L	S	
FLANGES							
MK	QTY	SIZE	RATING	SCHEDULE	DESCRIPTION	MATERIAL	S/F
2	1	60.3mm	150#	40	FLANGE RF WN	A182 GR.F316L	S
3	7	60.3mm	300#	40	FLANGE RF WN	A182 GR.F316L	S
WELD FITTINGS							
MK	QTY	SIZE	SCHEDULE	DESCRIPTION	MATERIAL	S/F	
4	3	60.3mm	40	ELBOW 90 DEG LR BW	A182 GR.F316L	S	
SCREWED & SOCKET WELD FITTINGS							
MK	QTY	SIZE	RATING	DESCRIPTION	MATERIAL	S/F	
5	1	26.7mm	3000#	PLUG SCREWED	A182 GR.F316L	F	
6	4	26.7mm ON 60.3mm	3000#	THREDOLET	A182 GR.F316L	S	
7	2	26.7mm	80	NIPPLE 100mm LG TBE	A182 GR.F316L	F	
GASKETS							
MK	QTY	SIZE	RATING	DESCRIPTION	MATERIAL	S/F	
8	1	60.3mm	150#	GASKET RF 1/8" SPIRAL WOUND	316L SS	F	
9	9	60.3mm	300#	GASKET RF 1/8" SPIRAL WOUND	316L SS	F	
BOLTS							
MK	QTY	SIZE	DESCRIPTION	MATERIAL	S/F		
10	9 SETS	5/8"x3 1/2"	STUD BOLTS CW/2 NUTS-8/SET	A193 B7 /A194 2H	F		
11	1 SET	5/8"x3 1/4"	STUD BOLTS CW/2 NUTS-4/SET	A193 B7 /A194 2H	F		
VALVES							
MK	QTY	SIZE	RATING	DESCRIPTION	MATERIAL	VALVE TAG	S/F
12	1	26.7mm	800#	BALL VALVE SCREWED	316L SS		F
13	1	26.7mm	6000#	NEEDLE VALVE F&F SCREWED	316L SS		F
14	3	60.3mm	300#	BALL VALVE RED PORT RF	316L SS		F
15	1	60.3mm	300#	CHECK VALVE SWING RF	316L SS		F

FOR
INFORMATION
ONLY

SEP 20 2005

NOTES
1. FIELD VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.

FILE NO.:	HUSKY OIL OPERATIONS LTD.	Husky Oil
DRAWN BY: LLC		
CHECKED BY:	LLOYDMINSTER REFINERY	
APPROVED BY:	4346-A-2"/4347-A-2"	
ORIGINATING DEPT.:	PIPING ISOMETRIC	
		SCALE: N.T.S.
		DATE: 05/04/15
		DRAWING NO.: 4346-A-2"



BILL OF MATERIAL

PIPE							
MK	QTY	SIZE	SCHEDULE	DESCRIPTION	MATERIAL	S/F	
1	8m	60.3mm	40	PIPE SMLS	A312 GR.F316L	S	
FLANGES							
MK	QTY	SIZE	RATING	SCHEDULE	DESCRIPTION	MATERIAL	S/F
2	10	60.3mm	300#	40	FLANGE RF WN	A182 GR.F316L	S
WELD FITTINGS							
MK	QTY	SIZE	SCHEDULE	DESCRIPTION	MATERIAL	S/F	
3	5	60.3mm	40	ELBOW 90 DEG LR BW	A182 GR.F316L	S	
SCREWED & SOCKET WELD FITTINGS							
MK	QTY	SIZE	RATING	DESCRIPTION	MATERIAL	S/F	
4	1	26.7mm	3000#	PLUG SCREWED	A182 GR.F316L	F	
5	1	26.7mm ON 60.3mm	3000#	THREDOLET	A182 GR.F316L	S	
6	1	26.7mm	80	NIPPLE 100mm LG TBE	A182 GR.F316L	F	
GASKETS							
MK	QTY	SIZE	RATING	DESCRIPTION	MATERIAL	S/F	
7	7	60.3mm	300#	GASKET RF 1/8" SPIRAL WOUND	304 SS	F	
BOLTS							
MK	QTY	SIZE	DESCRIPTION	MATERIAL	S/F		
8	7 SETS	5/8"x3 1/2"	STUD BOLTS CW/2 NUTS-8/SET	A193 B7 /A194 2H	F		
VALVES							
MK	QTY	SIZE	RATING	DESCRIPTION	MATERIAL	VALVE TAG	S/F
9	1	26.7mm	800#	GATE VALVE SCREWED	CS		F
10	1	60.3mm	300#	BALL VALVE RED PORT RF	CS		F

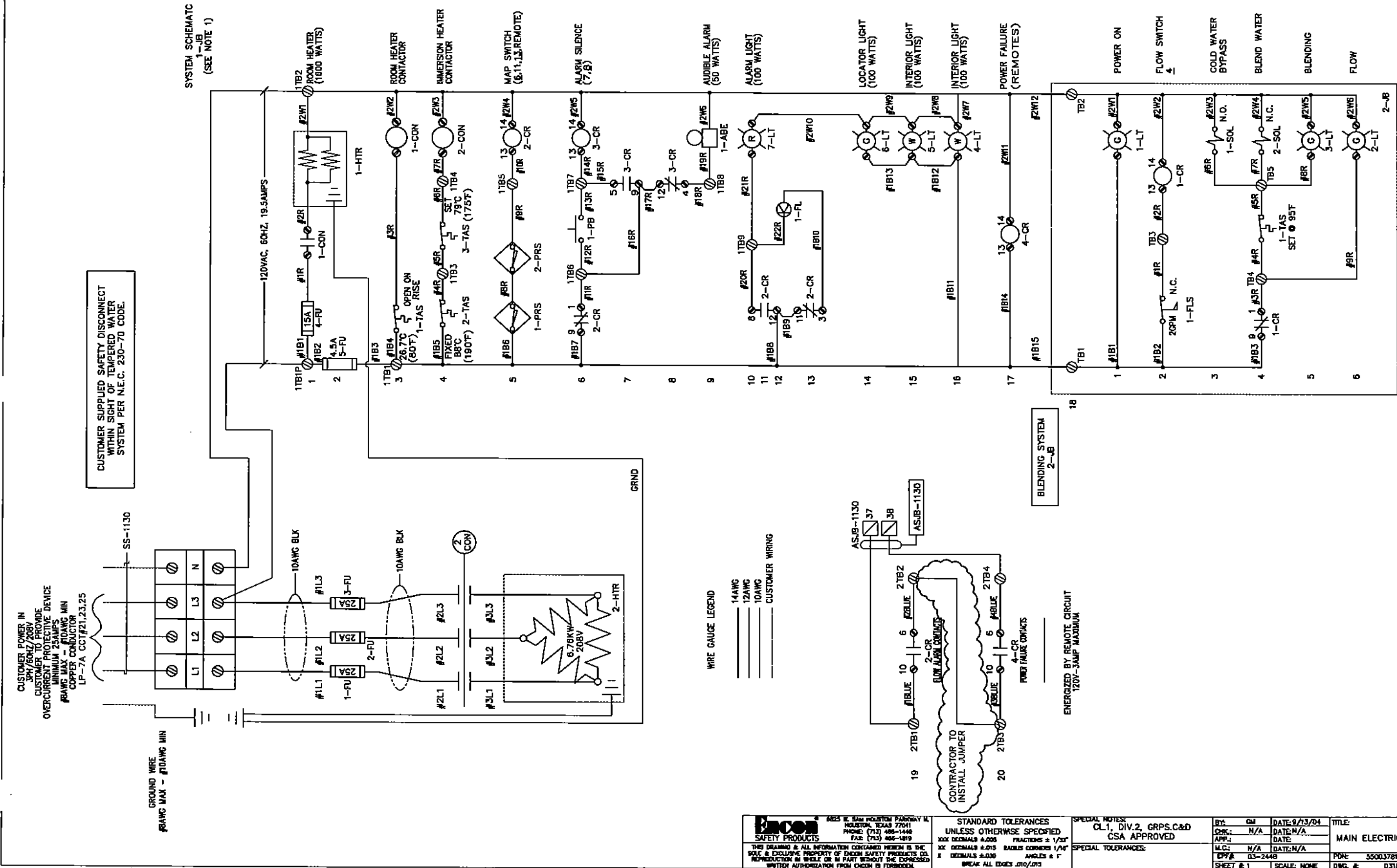
**FOR
INFORMATION
ONLY**

SEP 20 2005

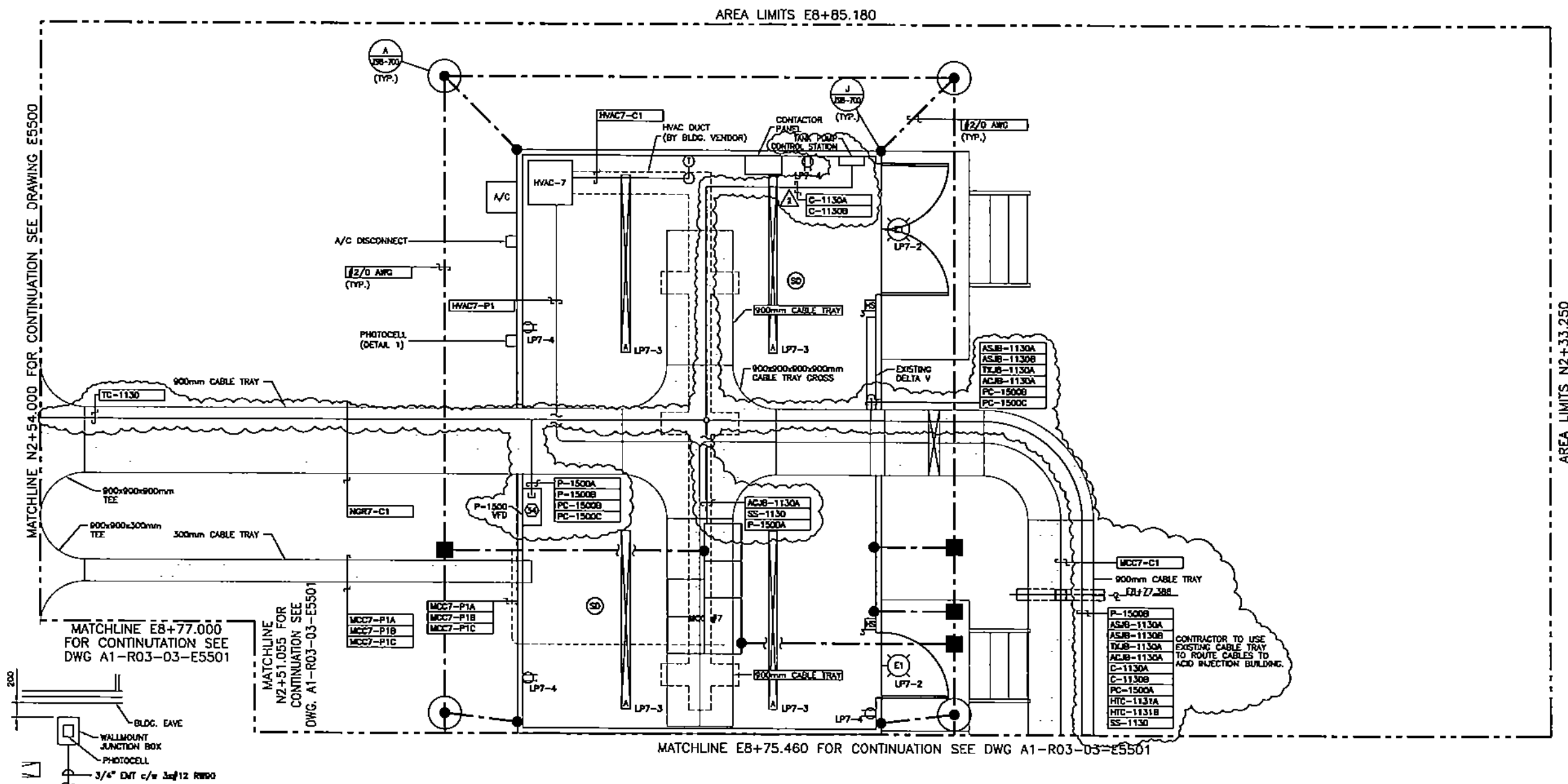
NOTES

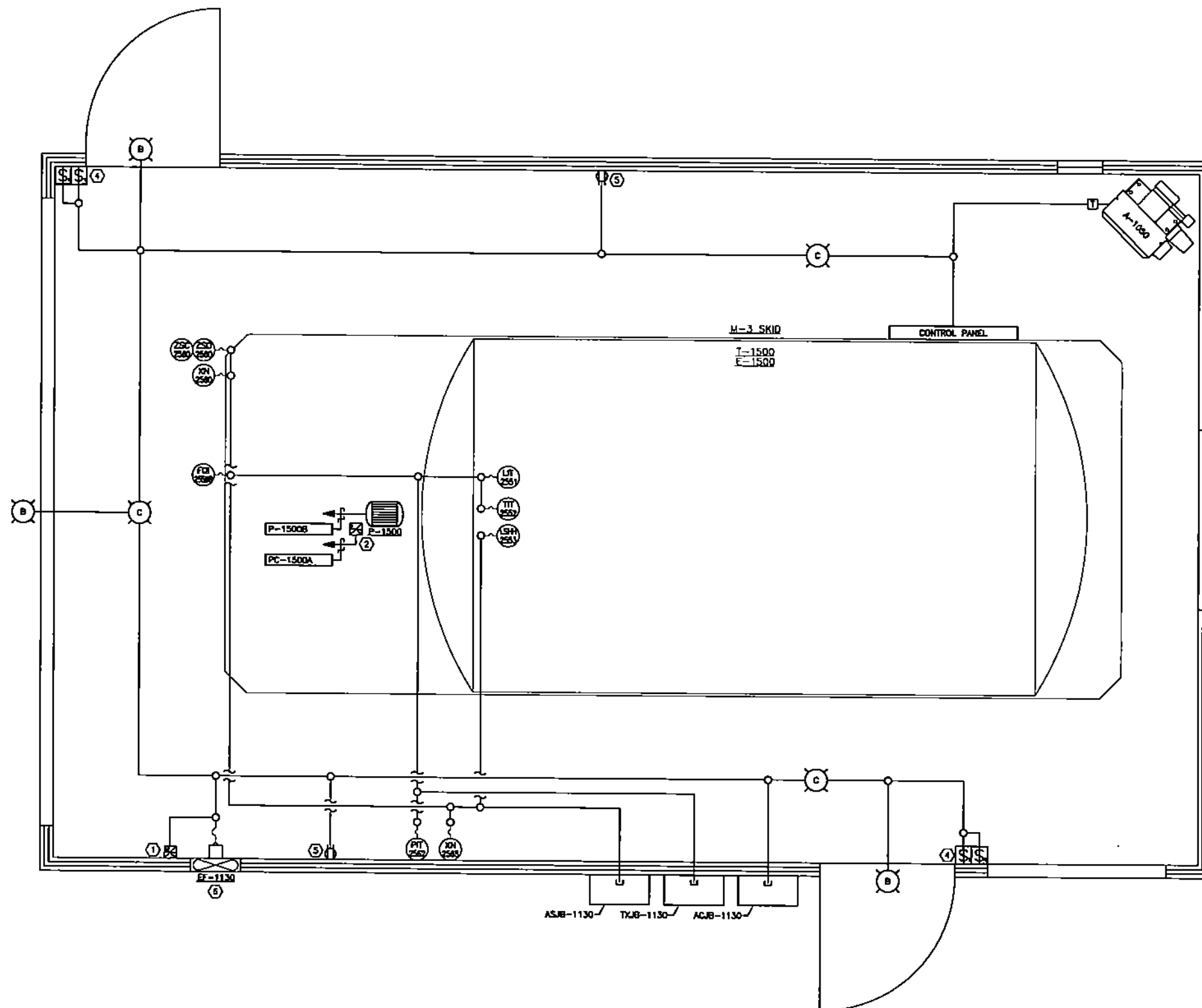
1. FIELD VERIFY ALL DIMENSIONS PRIOR TO CONSTRUCTION.

FILE NO.:	HUSKY OIL OPERATIONS LTD.	Husky Oil SCALE: N.T.S. DATE: 05/04/15 DRAWING NO.: 4346-A-2"-A
DRAWN BY: LLC		
CHECKED BY:	LLOYDMINSTER REFINERY	
APPROVED BY:	4346-A-2"	
ORIGINATING DEPT.:	PIPING ISOMETRIC	



NOTE:
1) SYSTEM SCHEMATIC COMBINES THE SCHEMATICS OF 1-JB AND 2-JB. WIRE AND COMPONENT NUMBER SEQUENCE IS SPECIFIC TO INDIVIDUAL JUNCTION BOXES.

[illegible]



NOTE:
1. FOR BILL OF MATERIALS "O" REFER TO DWG# E372

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

CABLE/ CONDUIT No.	CONDUIT		ROUTING		SERVICE VOLTAGE	MULTICONDUCTOR CABLE			INDIVIDUAL CONDUCTORS			APPROX LENGTH METERS	REFERENCE DRAWINGS	REMARKS
	SIZE	TYPE	FROM	TO		TYPE	No. OF CON.	SIZE AWG	TYPE	QUANTITY	SIZE AWG			
P-1500A	-	-	MCC 7	P-1500 VFD	-	HLTECK 90	3c	#10	-	-	-	-	-	-
P-1500B	-	-	P-1500 VFD	P-1500 ACID INJECTION PUMP	575VAC	HLTECK 90	3c	#10	-	-	-	-	-	-
PC-1500A	-	-	P-1500 VFD	P-1500 CONTROL STATION	24VDC	HLTECK 90	2c	#14	-	-	-	-	-	-
PC-1500B	-	-	DELTA V	P-1500 VFD	24VDC	HLTECK 90	6c	#14	-	-	-	-	-	-
PC-1500C	-	-	DELTA V	P-1500 VFD	24VDC	HLTECK 90	2PR	#18	-	-	-	-	-	NOTE 1
C-1130A	-	-	MCC 7	START/STOP JB-1130	120VAC	HLTECK 90	30c	#14	-	-	-	-	-	-
C-1130B	-	-	MCC 7	START/STOP JB-1130	120VAC	HLTECK 90	20c	#14	-	-	-	-	-	-
ACJB-1130A	-	-	MCC 7	ACJB-1130	120VAC	HLTECK 90	20c	#10	-	-	-	-	-	-
ACJB-1130B	-	-	ACJB-1130	HTC-1130	120VAC	HLTECK 90	3c	#10	-	-	-	-	-	-
ASJB-1130A	-	-	MCC 7	ASJB-1130	120VAC	HLTECK 90	30c	#14	-	-	-	-	-	-
ASJB-1130B	-	-	MCC 7	ASJB-1130	120VAC	HLTECK 90	30c	#14	-	-	-	-	-	-
ASJB-1130C	-	-	ASJB-1130	ASJB-1131	120VAC	HLTECK 90	20c	#14	-	-	-	-	-	-
ASJB-1130D	-	-	ASJB-1130	YN-2946 INSTRUMENTS	120VAC	HLTECK 90	8c	#14	-	-	-	-	-	-
ASJB-1130E	-	-	ASJB-1130	HTC-1130	120VAC	HLTECK 90	4c	#14	-	-	-	-	-	-
ASJB-1130F	-	-	ASJB-1130	HTC-1131	120VAC	HLTECK 90	4c	#14	-	-	-	-	-	-
ASJB-1130G	-	-	ASJB-1130	SAFETY SHOWER	120VAC	HLTECK 90	4c	#14	-	-	-	-	-	-
TXJB-1130A	-	-	MCC 7	TXJB-1130	24VDC	HLTECK 90	12PR	#18	-	-	-	-	-	NOTE 1
TXJB-1130B	-	-	TXJB-1130	FOI-2947B	24VDC	HLTECK 90	2PR	#18	-	-	-	-	-	NOTE 1
TD-1130	-	-	MCC 7	BLOW DRUMS	mV	TYPE K TC CABLE	5PR	-	-	-	-	-	-	NOTE 1
SS-1130	-	-	MCC 7	SAFETY SHOWER	208VAC	HLTECK 90	3c	#8	-	-	-	-	-	-
HTC-1131A	-	-	MCC 7	HTC-1131	208VAC	HLTECK 90	3c	#8	-	-	-	-	-	-
HTC-1131B	-	-	MCC 7	HTC-1131	208VAC	HLTECK 90	3c	#8	-	-	-	-	-	-
HTC-1130-C1	-	-	HTC-1130	SAFETY SHOWER HEAT TRACE	120VAC	HLTECK 90	2c	#10	-	-	-	-	-	-
HTC-1130-C2	-	-	HTC-1130	ACID BUILDING STEAM RETURN HEAT TRACE	120VAC	HLTECK 90	2c	#10	-	-	-	-	-	-
HTC-1130-RTD1	-	-	HTC-1130	SAFETY SHOWER HEAT TRACE RTD	120VAC	HLTECK 90	1TR	#18	-	-	-	-	-	-
HTC-1130-RTD2	-	-	HTC-1130	ACID BUILDING STEAM LINE HEAT TRACE RTD	120VAC	HLTECK 90	1TR	#18	-	-	-	-	-	-
HTC-1131-C1	-	-	HTC-1131	ACID SUPPLY LINE HEAT TRACE	120VAC	HLTECK 90	2c	#8	-	-	-	-	-	-
HTC-1131-C2	-	-	HTC-1131	ACID INJECTION LINE HEAT TRACE	120VAC	HLTECK 90	2c	#8	-	-	-	-	-	-
HTC-1131-RTD1	-	-	HTC-1131	ACID SUPPLY LINE HEAT TRACE RTD	120VAC	HLTECK 90	1TR	#18	-	-	-	-	-	-
HTC-1131-RTD2	-	-	HTC-1131	ACID INJECTION LINE HEAT TRACE RTD	120VAC	HLTECK 90	1TR	#18	-	-	-	-	-	-

NOTE:
1. CONTRACTOR CAN INCREASE THE SIZE OF CABLE PAIRS FOR WHAT IS IN STOCK.

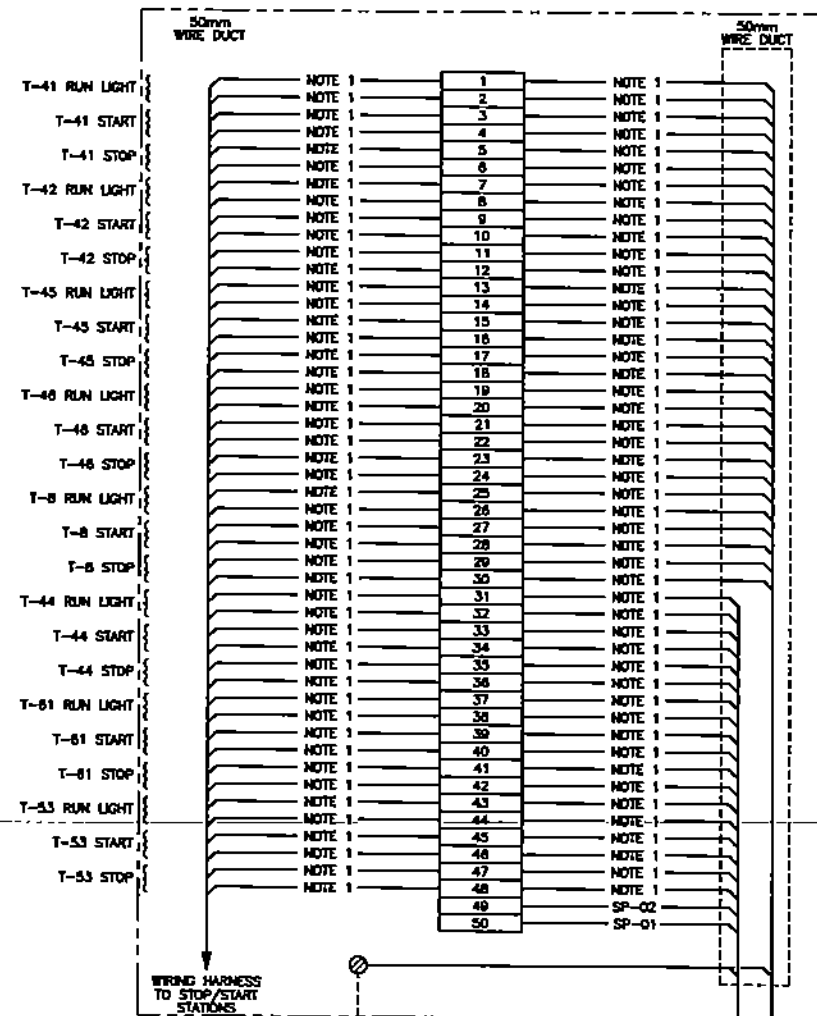
						JOB NO.		HUSKY OIL OPERATIONS LTD.		Husky Oil	
						DRAWN BY TL					
						CHECKED BY		LLOYDMINSTER REFINERY		SCALE NTS	
						APPROVED BY		POWER & CONTROL		DATE 2005/05/02	
						ORIGINATING DEPT.		BLOWDRUM/INCINERATOR		FILE -	
								CABLE & CONDUIT SCHEDULE		DRAWING NO. E371	
										REV. 0	

0	2005/05/04	ACID INJECTION BUILDING ADDITION	TL	WJ
NUMBER	DATE	DESCRIPTION	BY	APP'D
REFERENCE DRAWINGS		REVISIONS		

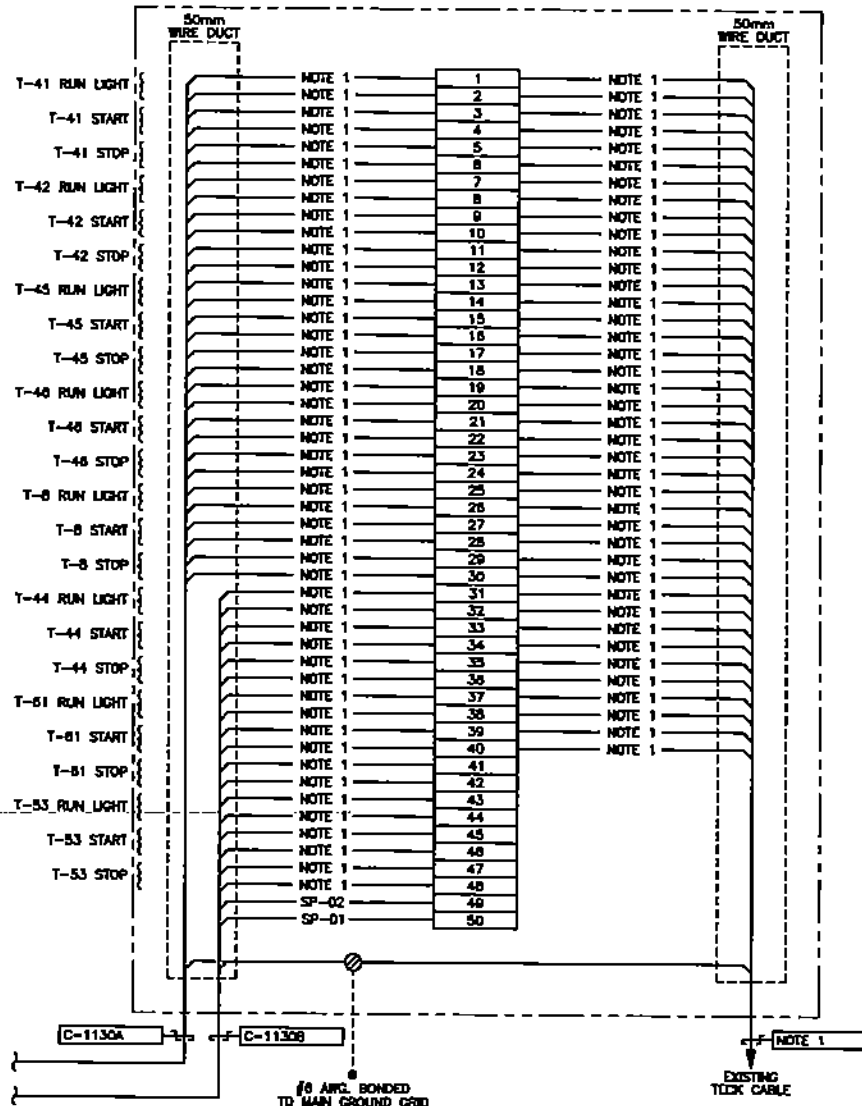
⬡ BILL OF MATERIALS					
MK#	QTY.	DESCRIPTION	CLASSIFICATION	MANUFACTURER/ CATALOGUE NO.	SUPPLIER
1	-	MANUAL MOTOR STARTER c/w OVERLOADS AS REQ'D. LAMACOID NAMEPLATE	CLASS 1 ZONE 1 & 2 GROUPS C,&D	CROUSE-HINDS EDS21093	CONTRACTOR
2	-	PUSH/PULL RED MUSHROOM HEAD MAINTAINED CONTACT c/w 1-NO & 1-NC CONTACTS, LAMACOID NAMEPLATE	NON-CLASSIFIED	BOOFTX84 800T-X821E LEGEND 800T-ITZ ENCLOSURE	CONTRACTOR
3	-	STOP START STATION c/w "OPEN" LEGEND & "CLOSED" LEGEND	NON-CLASSIFIED	ALLEN BRADLEY 800T-2TA - SWITCH 800T-XS31 - LEGEND 800T-XS22 - LEGEND	CONTRACTOR
4	-	3-WAY SWITCH	NON-CLASSIFIED	GENERIC	CONTRACTOR
5	-	RECEPTACLE 120VAC, 15A c/w ENCLOSURE	NON-CLASSIFIED	GENERIC	CONTRACTOR
6	-	WALL EXHAUST FAN 12" 2900CFM	CLASS 1 ZONE 1 & 2 GROUPS A,B,C,&D	CANARM FANS SD12-XPT	OWNER
7	-	ALARM BEACON RED 120VAC	CLASS 1 ZONE 2	FEDERAL SIGNAL 225XST-012-120R	CONTRACTOR
8	-	ALARM BEACON GREEN 120VAC	CLASS 1 ZONE 2	FEDERAL SIGNAL 225XST-012-120G	CONTRACTOR
9	-	PROCESS ALARM HORN 120VAC	CLASS 1 ZONE 2	FEDERAL SIGNAL 300CX-120 c/w RMT-4007 SLOW INTERMITTENT SIREN	CONTRACTOR
10	-	FERRALLOY JUNCTION BOX	CLASS 1 ZONE 2	PYROTENAX PTJB	OWNER
11	-	DIGITRACE 910 1 PT. CONTROLLER	CLASS 1 ZONE 2	PYROTENAX B10*E1FWL*SSR2	OWNER
12	-	DIGITRACE RTD c/w 10' S/S CORRUGATED SHIELD	CLASS 1 ZONE 2	PYROTENAX 225XST-012-024G	OWNER
13	-	ELECTRIC TRACED LABEL	CLASS 1 ZONE 2	PYROTENAX 225XST-012-024G	OWNER
14	-	PIPE STRAP FOR MI CABLE	CLASS 1 ZONE 2	PYROTENAX 225XST-012-024G	OWNER
15	-	600V PYROTENAX DUAL CONDUCTOR MI HEATING CABLE	CLASS 1 ZONE 2	PYROTENAX D/62SP456/137/4317/ 208/7/10NS/X/N34	OWNER
16	-	600V PYROTENAX DUAL CONDUCTOR MI HEATING CABLE	CLASS 1 ZONE 2	PYROTENAX D/62503200/75/2558/ 208/7/12LS/X/N12	OWNER
17	-	600V PYROTENAX DUAL CONDUCTOR MI HEATING CABLE	CLASS 1 ZONE 2	PYROTENAX D/322P4458/1254/2179/ 208/215/X	OWNER
18	-	3HP ABB VFD	NEMA 1	HAMPTON	OWNER
LIGHTING FIXTURES					
A	-	175W MH EXPLOSION PROOF FIXTURE (PENDENT MOUNT)	CLASS 1 ZONE 1	CROUSE HINDS EVLPA192171-5828 OR APPLETON EQUAL	CONTRACTOR
B	-	150W INCANDESCENT FIXTURE (WALL MOUNT)	CLASS 1 ZONE 2	CROUSE HINDS VXBHF15GP OR APPLETON EQUAL	CONTRACTOR
C	-	175W MH EXPLOSION PROOF FIXTURE (PENDENT MOUNT)	CLASS 1 ZONE 2	CROUSE HINDS VAVM2A175GP OR APPLETON EQUAL	CONTRACTOR

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

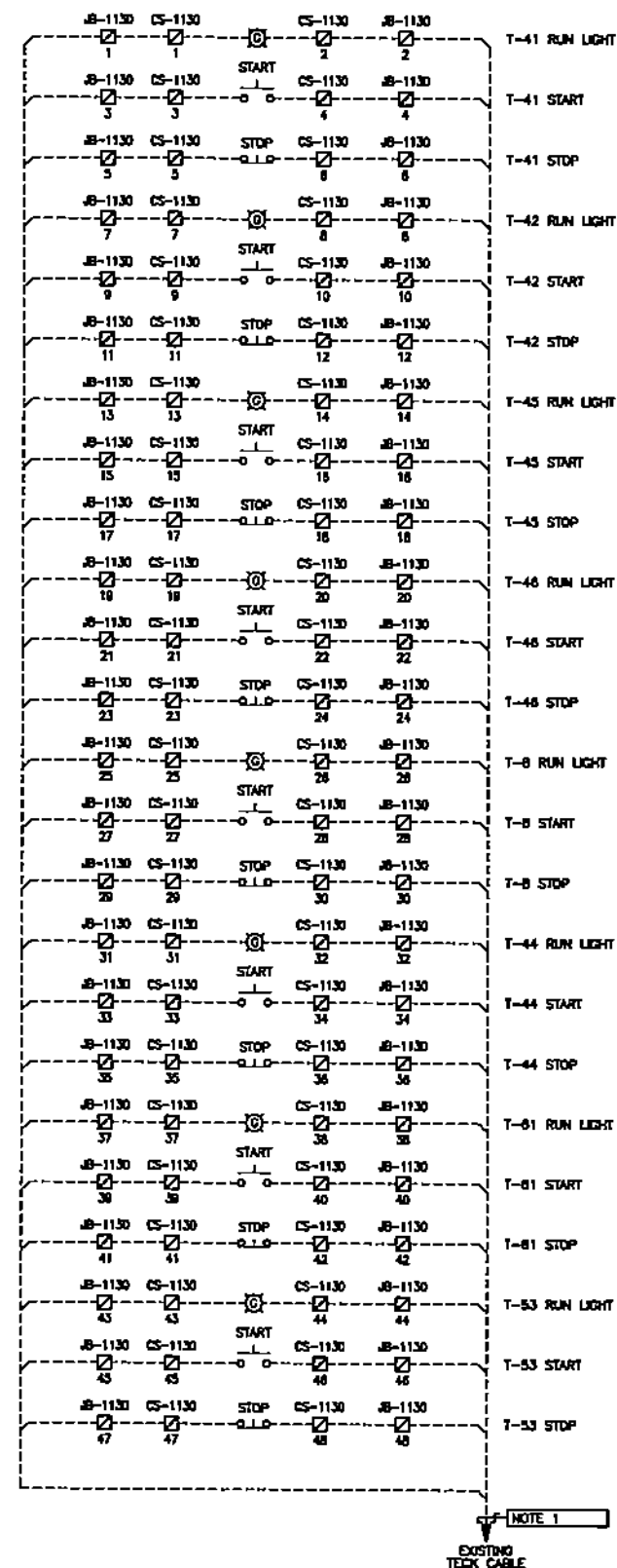
**TANK START/STOP
CONTROL STATION
CS-1130**
HOFFMAN A20H201200RLP



**START/STOP STATION
JUNCTION BOX
JB-1130**
HOFFMAN A-18P1810CHQRP
c/w A-18P18 BACK PANEL

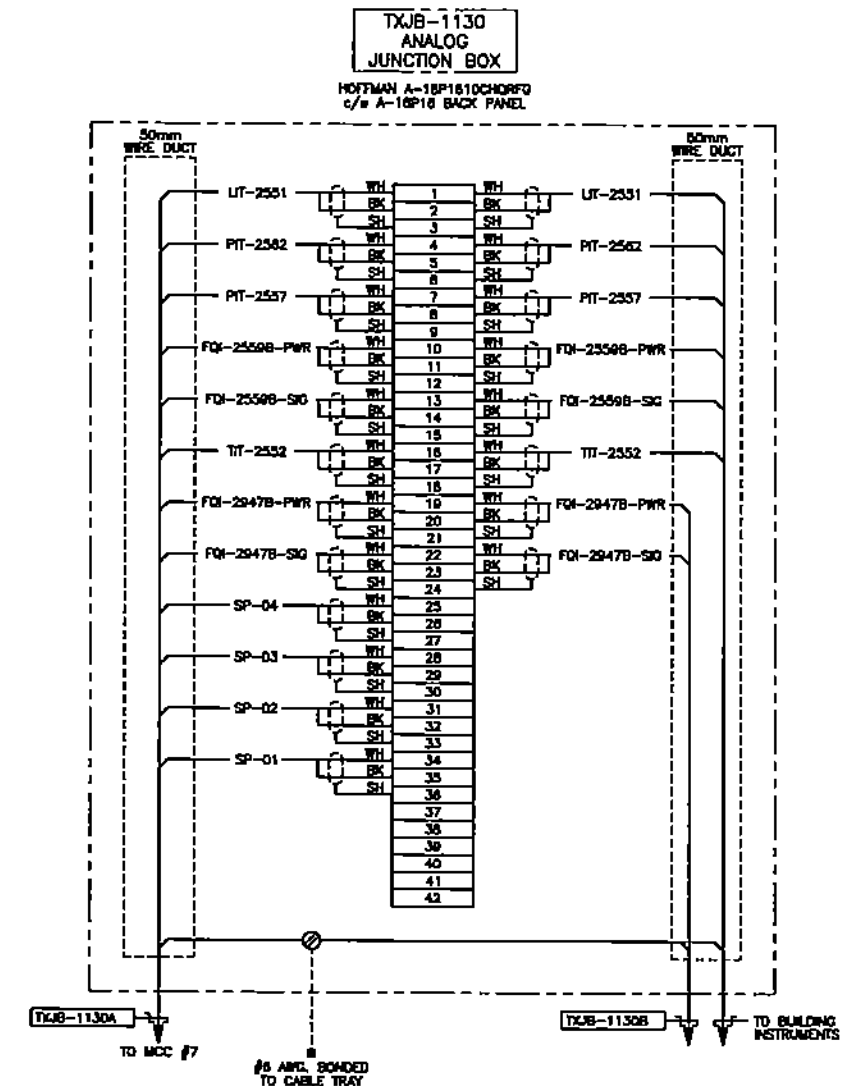
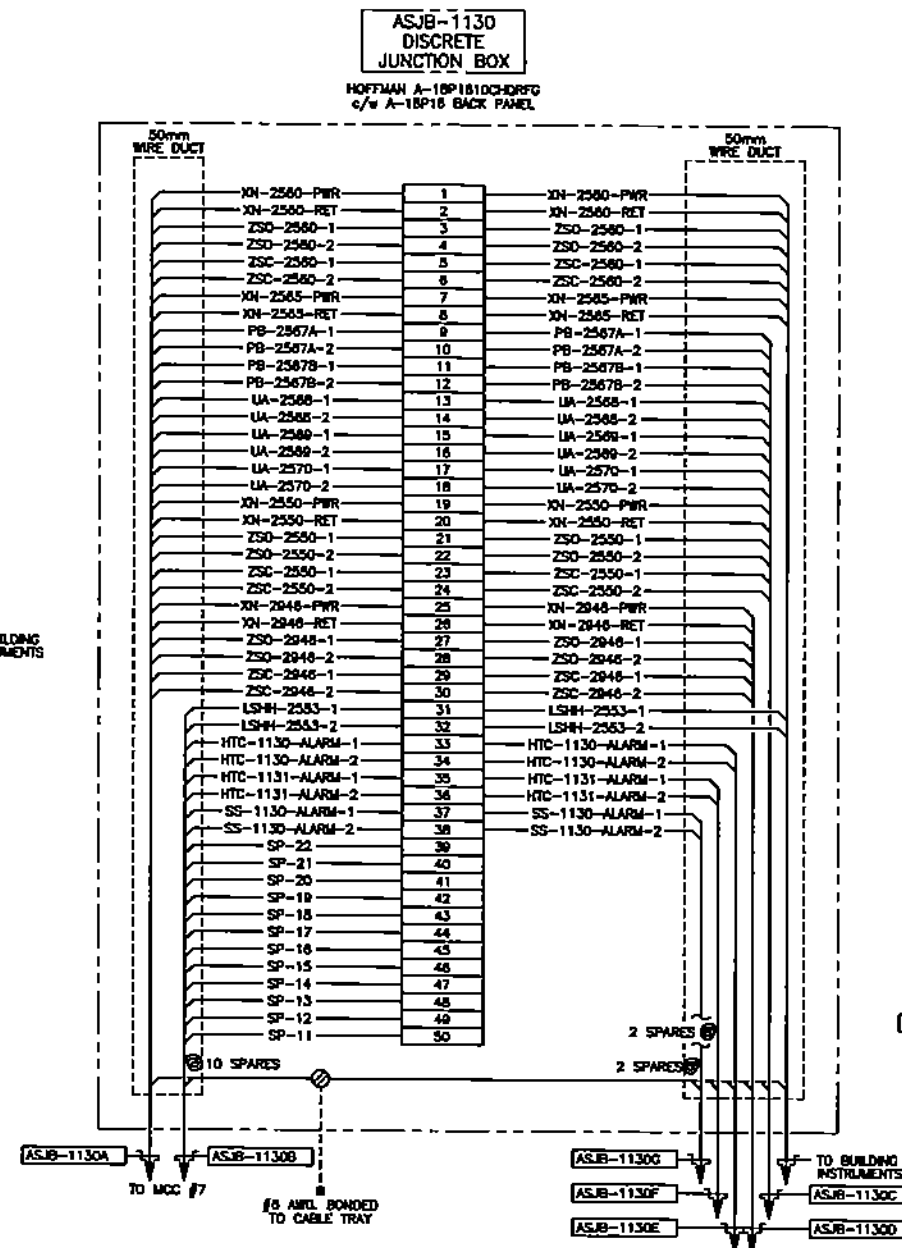
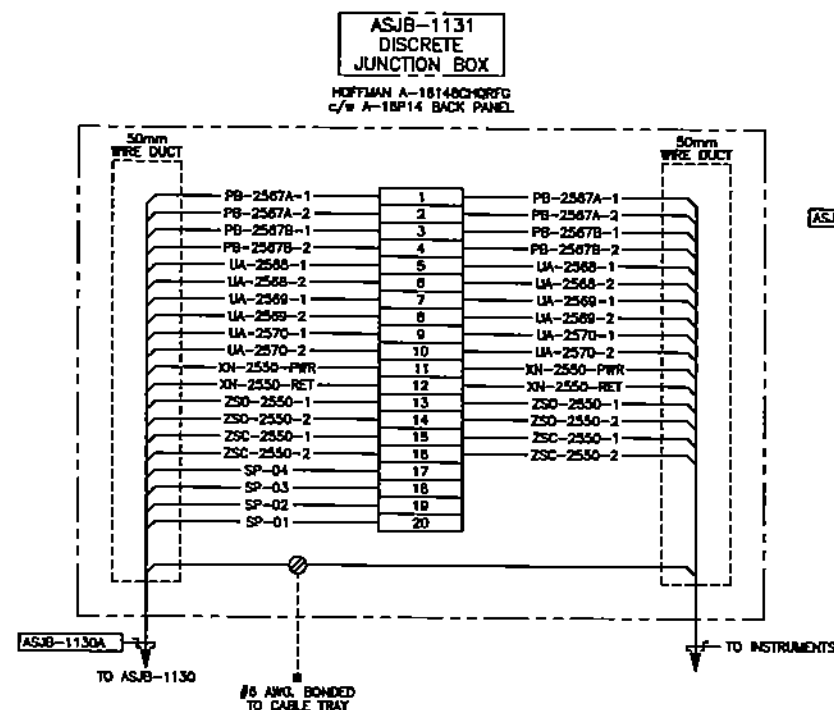
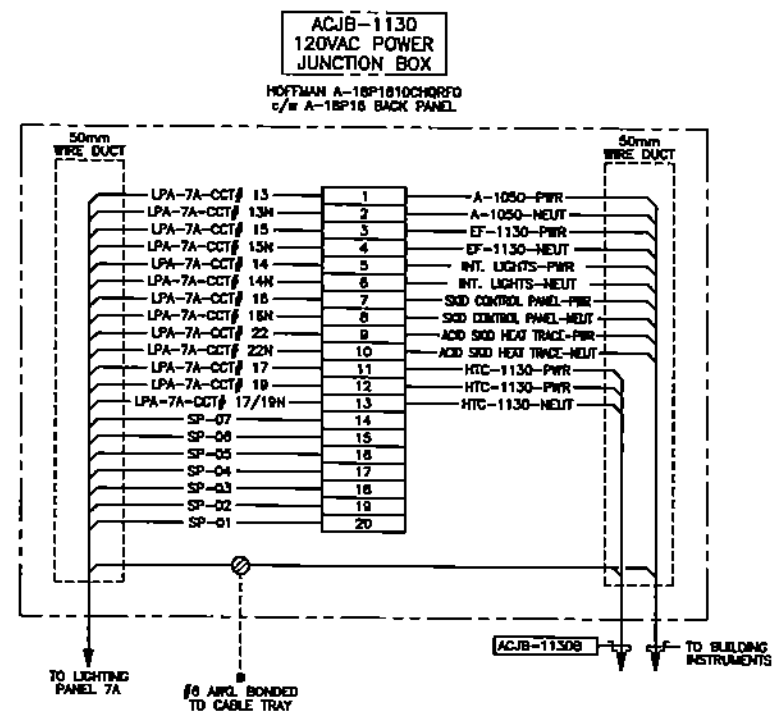


**STOP/START STATION
WIRING SCHEMATIC**

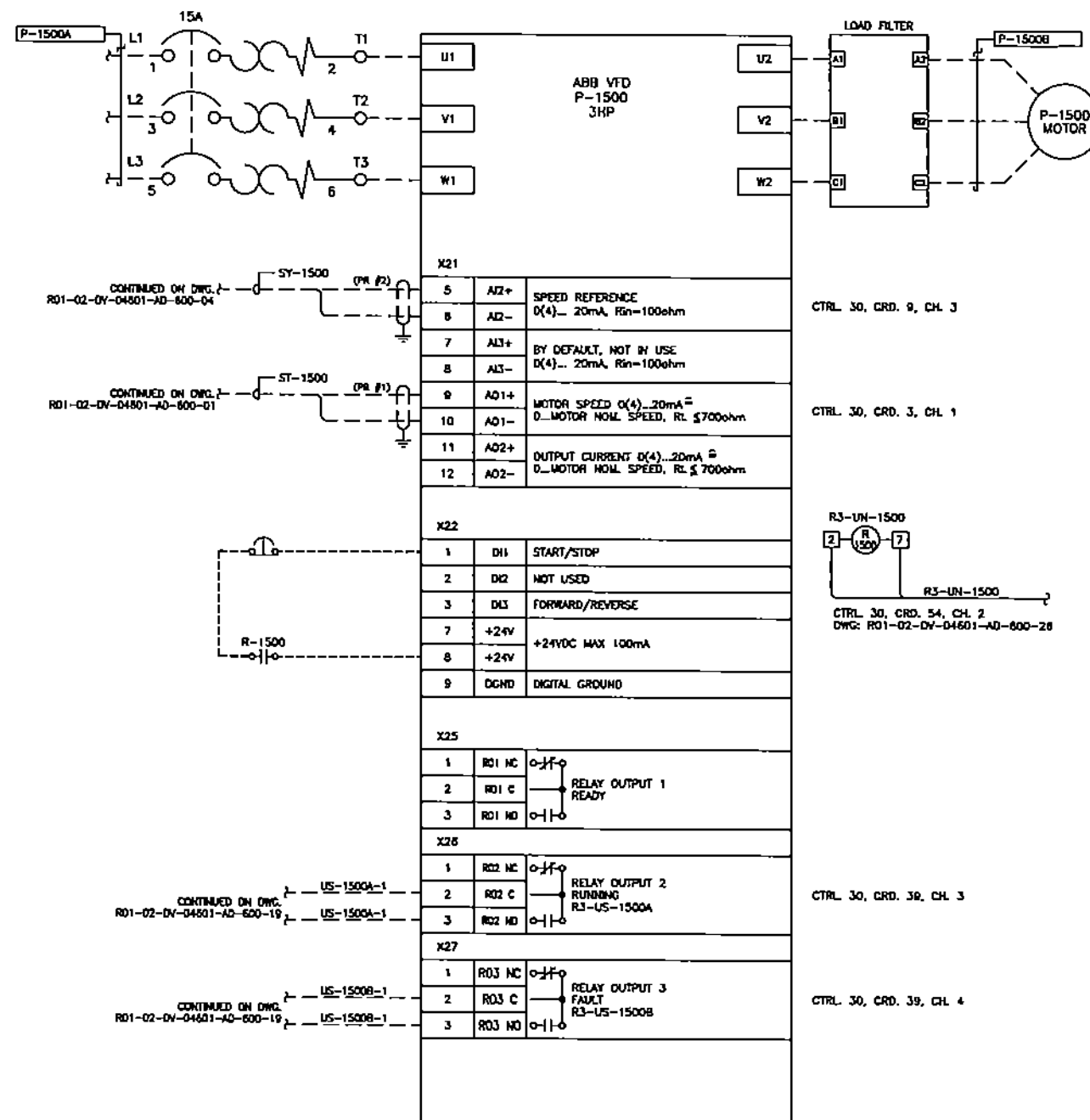


NOTE:
1. CONTRACTOR TO AS-BUILD WIRE NUMBERS.

										TELE CABLE					
										JOB NO.		HUSKY OIL OPERATIONS LTD.		Husky Oil	
										POS10					
										DRAWN BY		TL			
										CHECKED BY					
										APPROVED BY		<u>LLOYDMINSTER REFINERY</u> <u>POWER & CONTROL</u> <u>BLOWDRUM/INCINERATOR</u> <u>CONTROL STATION JUNCTION BOX LAYOUT/SCHEMATIC</u>		SCALE	
														MTS (A1-Size)	
														DATE	
														05/05/02	
										ORIGINATING DEPT.				REV.	
														DRAWING NO.	
														E374	



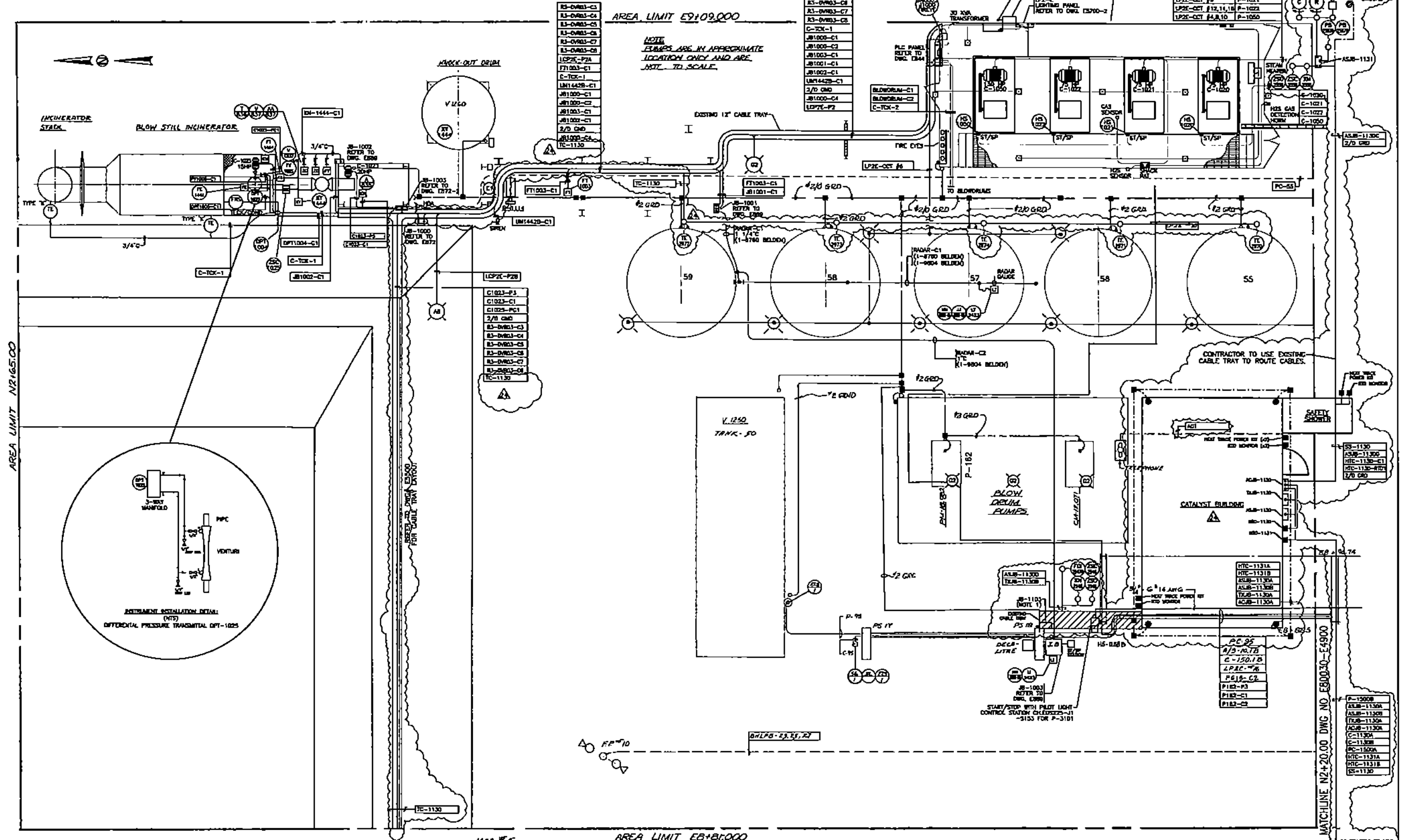
																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																								</
--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	----



P-1500 ACID INJECTION PUMP (3HP)

--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--

AREA LIMIT N2165.00



NO.	DATE	DESCRIPTION	BY	APP'D	ORIGINATING DEPT.
24	2005/05/03	ADD BLOWING BUILDING INSTALLATION	RL	RL	JOB NO.
23	2004/12/17	CHLORINE UPGRADE	RLS	DP	
22	2004/04/22	2004 LIGHTING IMPROVEMENTS	RLS	TDR	DRAWN BY: MAJESTIC
21	2004/01/25	AS BUILT FOR FLASH BACK CONTROL	RL		CHECKED BY:
20	2003/12/20	ADDED FLASH BACK CONTROL	RL		APPROVED BY:
19	2003/12/13	FIELD AS BUILT	RL		
18	2003/08/18	ISSUED FOR BLOWING IMPROVEMENTS	RLS	TDR	
17	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
16	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
15	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
14	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
13	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
12	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
11	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
10	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
9	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
8	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
7	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
6	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
5	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
4	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
3	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
2	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	
1	2003/12/08	WYE-WORK LIGHTING IMPROVEMENTS AS-BUILT	RLS	TDR	

NOTE: EXISTING CONTROL STATION TO BE REMOVED & REPLACED WITH A NEW HARTMAN A-181610CHORFD JUNCTION BOX (AB-1130).

HUSKY OIL OPERATIONS LTD.

ILLUSTRATION REFINERY EXPANSION

ELECTRICAL PLAN OF BLOWN ASPHALT AREA

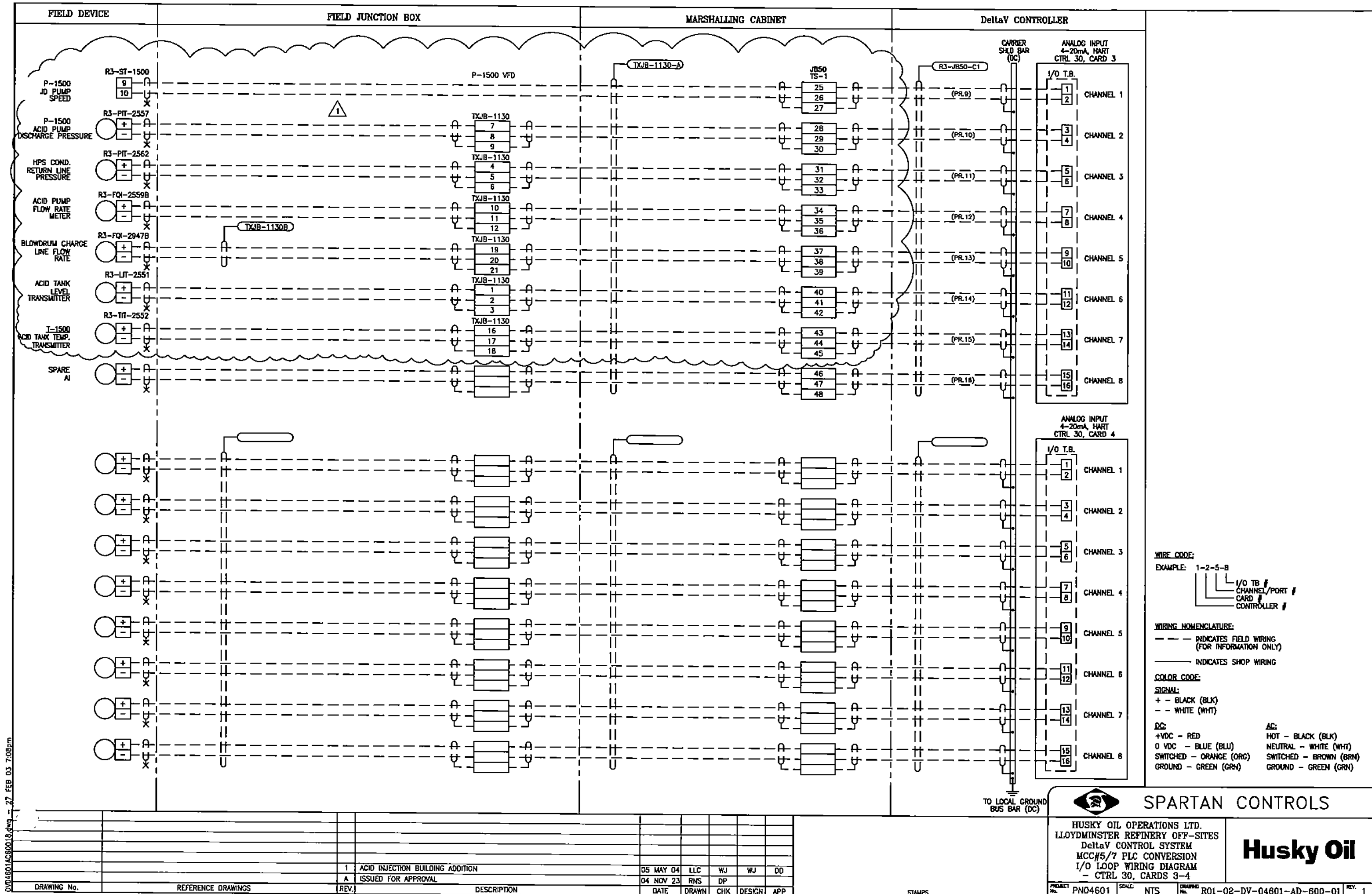
SCALE: 1/20

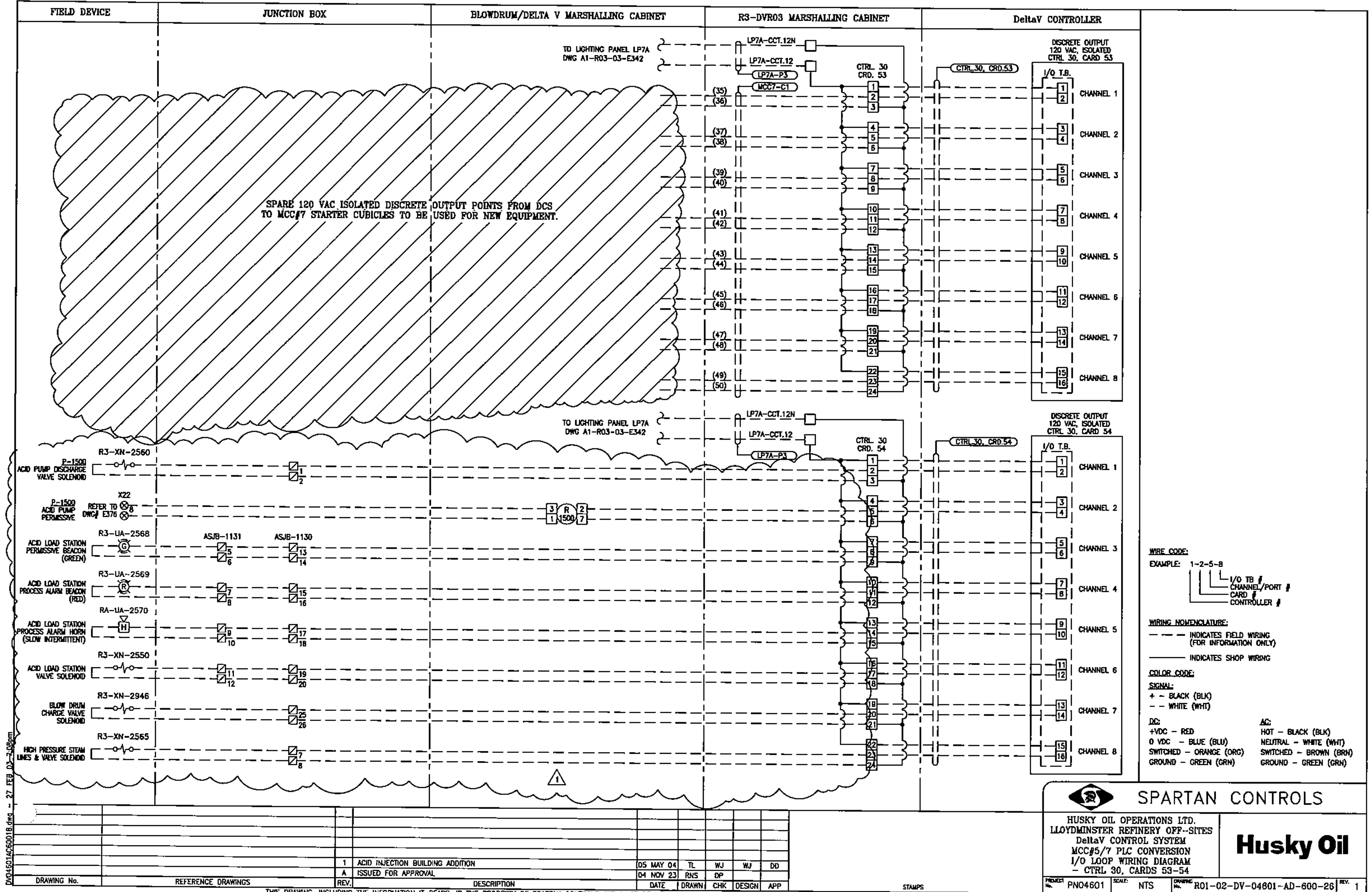
DATE: 03/02/08

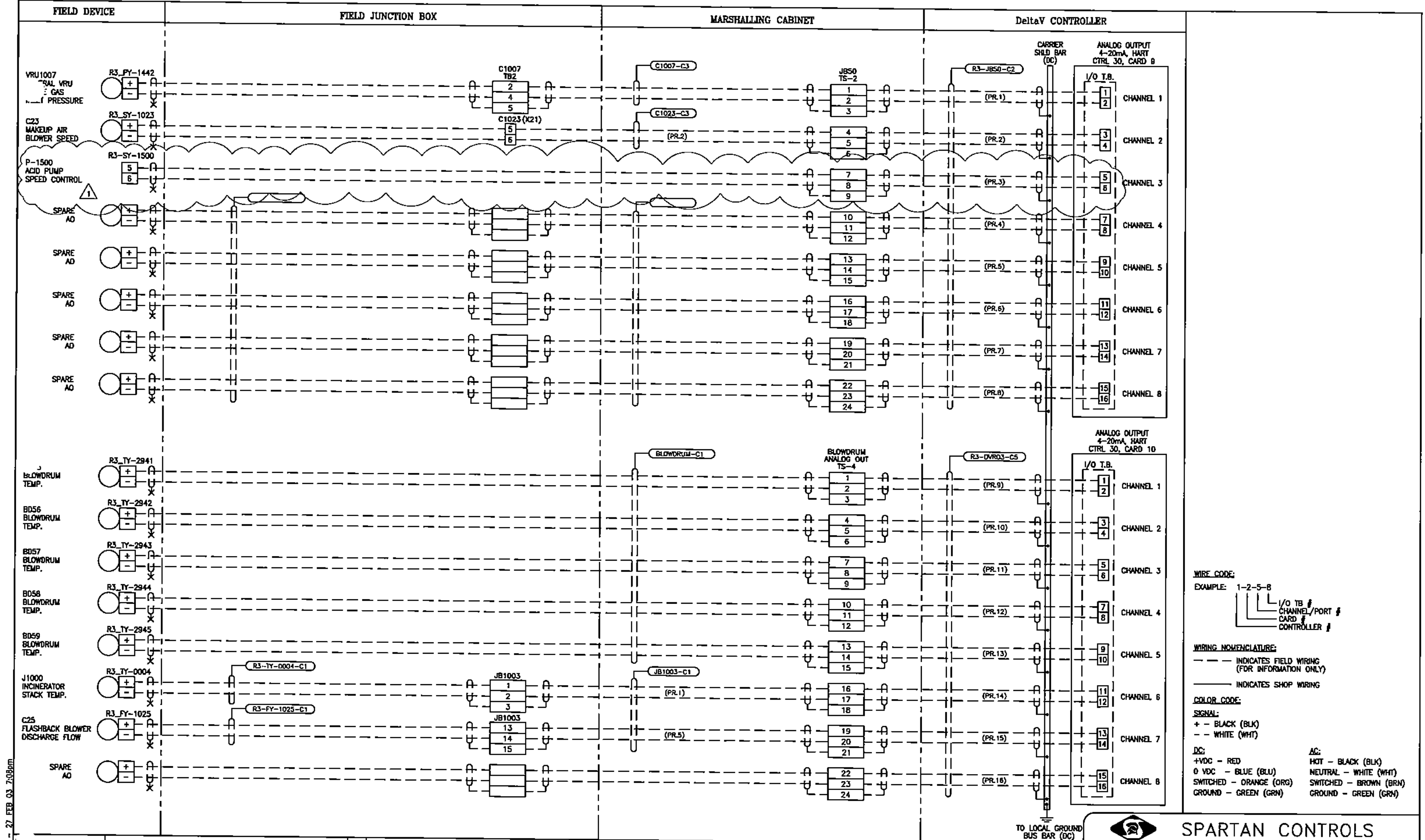
DRAWING NO.: E-80030-E5700

REV: 24

Husky Oil



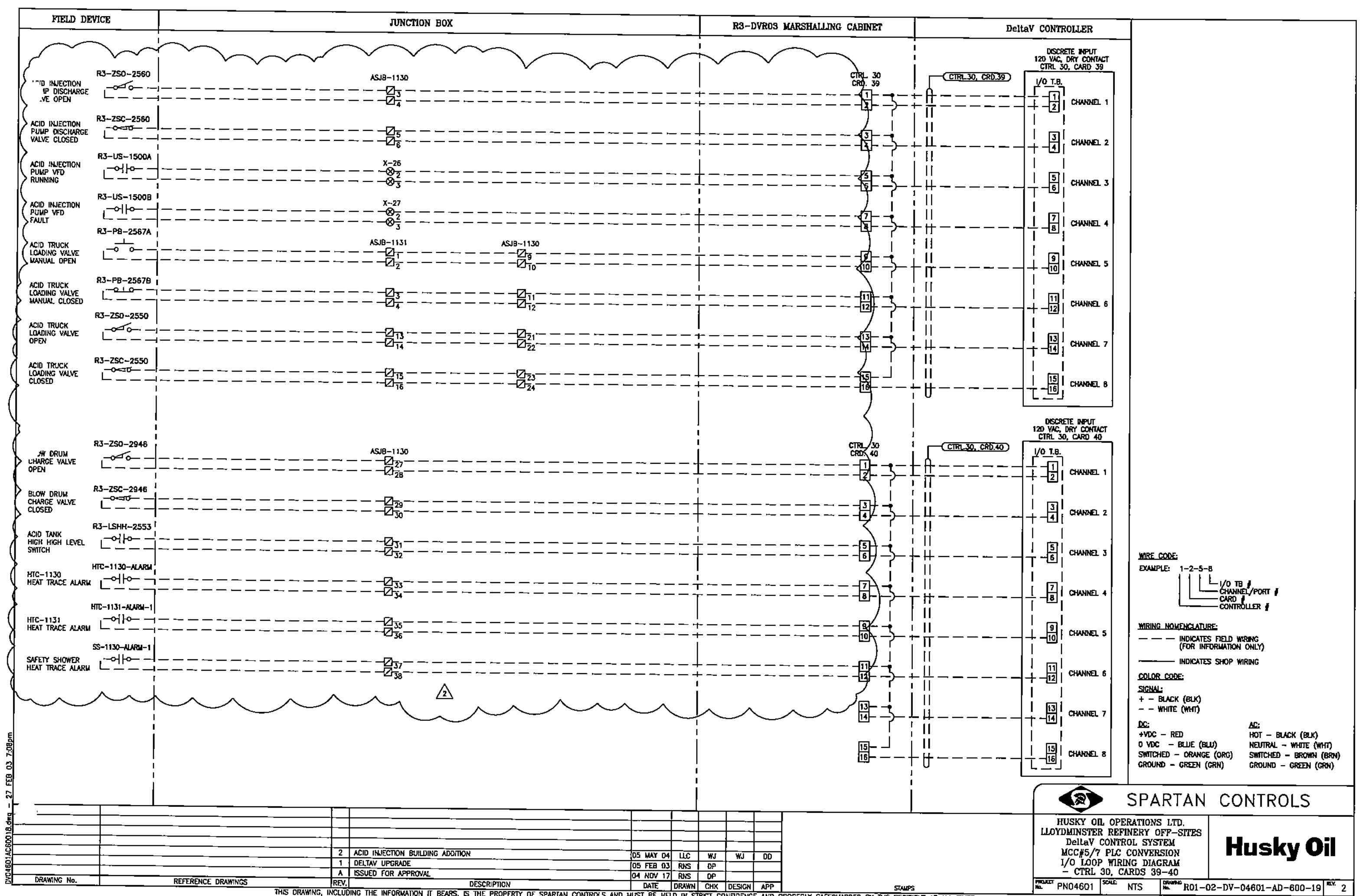


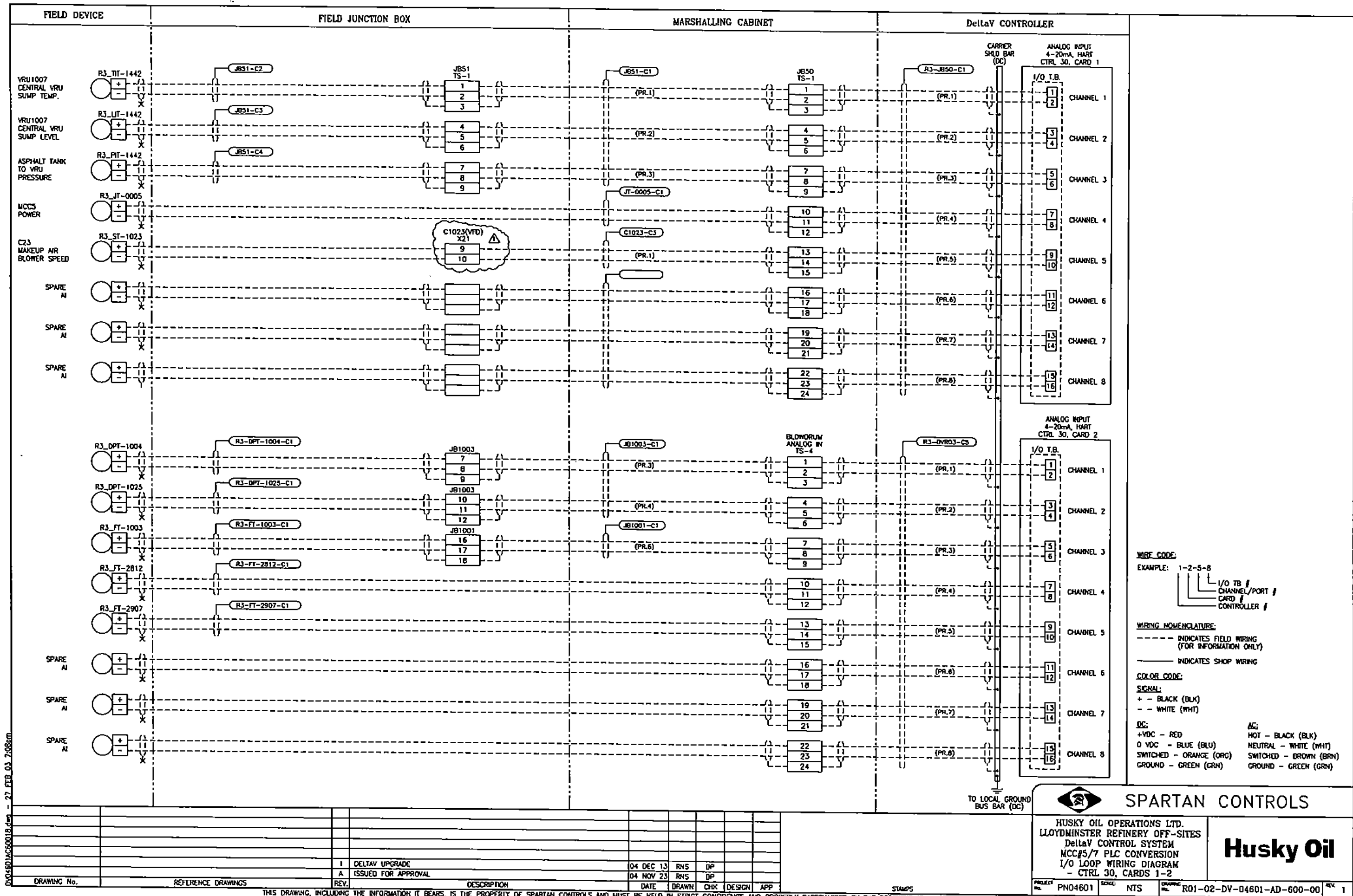


DRAWING No.		REFERENCE DRAWINGS		REV.		DESCRIPTION		DATE		DRAWN		CHK		DESIGN		APP		STAMPS		PROJECT No.		SCALE		DRAWING No.		REV.	
				1		ACID INJECTION BUILDING ADDITION		05 MAY 03		LLC		WJ		WJ		DD				PN04601		NTS		R01-02-DV-04801-AD-800-04		1	
				A		ISSUED FOR APPROVAL		04 NOV 23		RNS		DP															

THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.

D:\04601\AC60018.dwg - 27 FEB 03 2:08PM





04601AD6001B.dwg - 27 FEB 03 7:08pm

THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.

FIELD DEVICE

DeltaV CONTROLLER

BLANK CAP
CTRL 30, CARD 5

BLANK CAP
CTRL 30, CARD 6

WIRE CODE:

EXAMPLE: 1-2-5-8

I/O TB #

CHANNEL/PORT #

CARD #

CONTROLLER #

WIRING NOMENCLATURE:

----- INDICATES FIELD WIRING
(FOR INFORMATION ONLY)

----- INDICATES SHOP WIRING

COLOR CODE:

SIGNAL:

+ - BLACK (BLK)

- - WHITE (WHT)

DC:

+VOC - RED

0 VOC - BLUE (BLU)

SWITCHED - ORANGE (ORG)

GROUND - GREEN (GRN)

AC:

HOT - BLACK (BLK)

NEUTRAL - WHITE (WHT)

SWITCHED - BROWN (BRN)

GROUND - GREEN (GRN)

SPARTAN CONTROLS

HUSKY OIL OPERATIONS LTD.
LLOYDMINSTER REFINERY OFF-SITES
DeltaV CONTROL SYSTEM
MCC#5/7 PLC CONVERSION
I/O LOOP WIRING DIAGRAM
- CTRL 30, CARDS 5-6

Husky Oil

PROJECT
PNO4601

SCALE
NTS

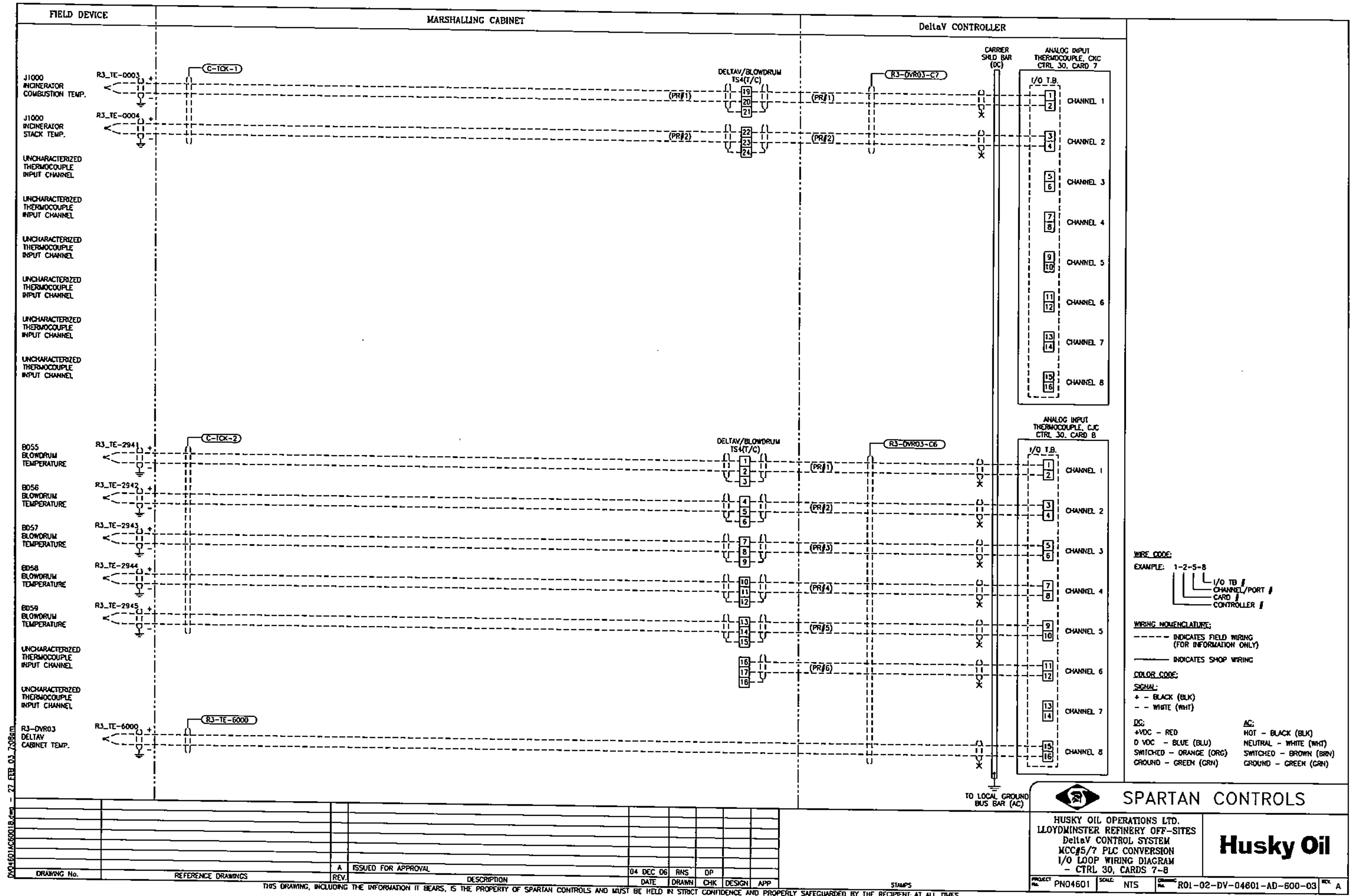
DRAWING
R01-02-DV-04601-AD-800-02

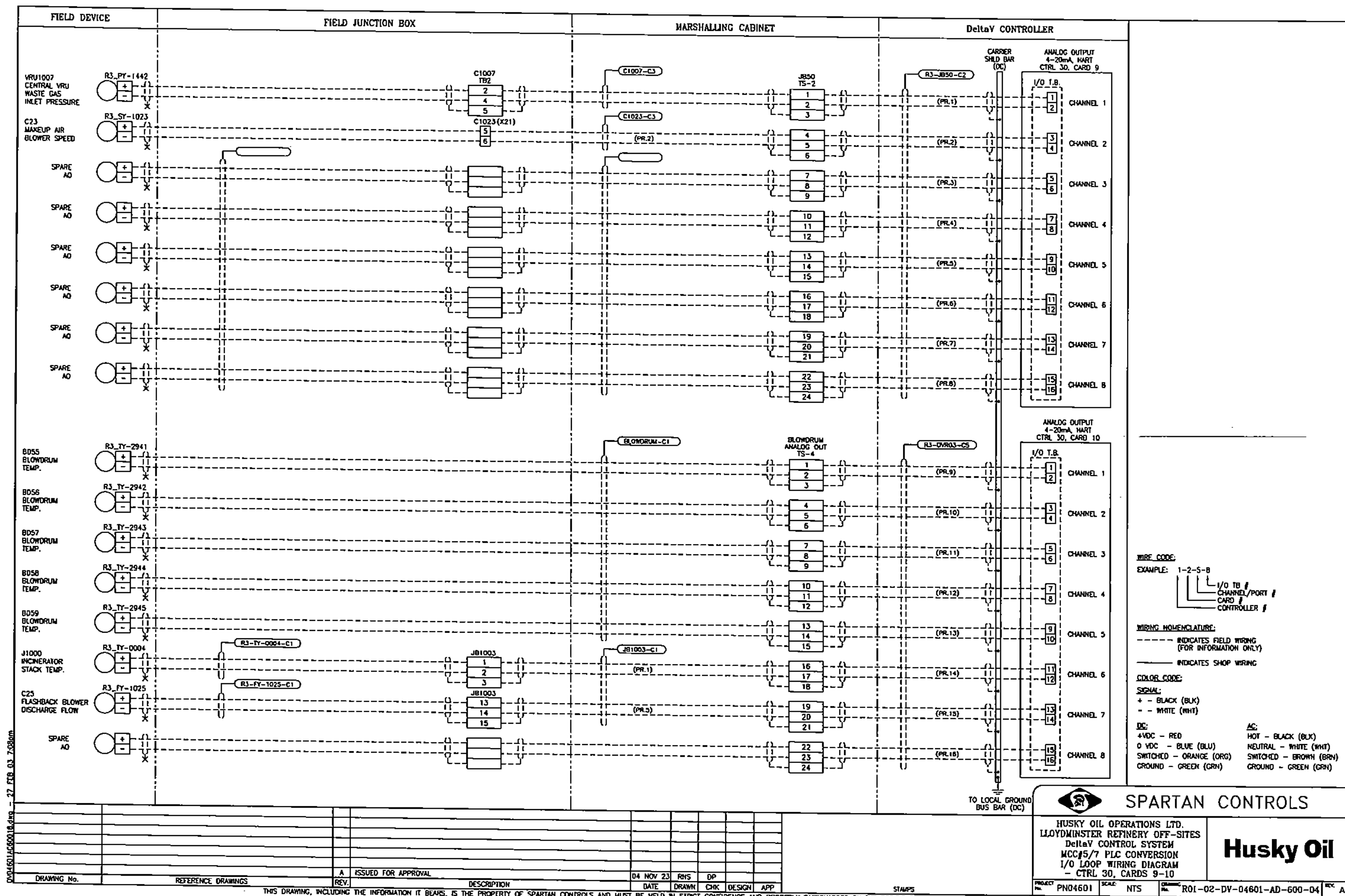
REV
A

DRAWING No.	REFERENCE DRAWINGS	REV.	DESCRIPTION	DATE	DRAWN	CHK	DESIGN	APP
		A	ISSUED FOR APPROVAL	04 NOV 17	RHS	DP		

THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.

D:\04601\AC50018.dwg - 27 FEB 03 7:08pm





D:\04601\0460010.dwg - 27 FEB 03 7:09pm

FIELD DEVICE		DeltaV CONTROLLER	
		BLANK CAP CTRL 30, CARD 11	
		BLANK CAP CTRL 30, CARD 12	

WIRE CODE:
EXAMPLE: 1-2-5-8

I/O TB /
CHANNEL/PORT /
CARD /
CONTROLLER /


WIRING NOMENCLATURE:
- - - - - INDICATES FIELD WIRING
(FOR INFORMATION ONLY)
————— INDICATES SHOP WIRING

COLOR CODE:
SIGNAL:
+ - BLACK (BLK)
- - WHITE (WHT)

DC:
+VOC - RED
0 VOC - BLUE (BLU)
SWITCHED - ORANGE (ORG)
GROUND - GREEN (GRN)

AC:
HOT - BLACK (BLK)
NEUTRAL - WHITE (WHT)
SWITCHED - BROWN (BRN)
GROUND - GREEN (GRN)

DRAWING No.		REFERENCE DRAWINGS		REV.		DESCRIPTION		DATE		DRAWN		CHK		DESIGN		APP		STAMPS	
				A		ISSUED FOR APPROVAL		04 NOV 17		RNS		DP							

**SPARTAN CONTROLS**

HUSKY OIL OPERATIONS LTD.
LLOYDMINSTER REFINERY OFF-SITES
DeltaV CONTROL SYSTEM
MCC#5/7 PLC CONVERSION
I/O LOOP WIRING DIAGRAM
- CTRL 30, CARDS 11-12

Husky Oil

PROJECT No.	PN04601	SCALE	NTS	DRAWING No.	R01-02-DV-04601-AD-600-05	REV.	A
-------------	---------	-------	-----	-------------	---------------------------	------	---

THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.

D:\04601\AC60018.dwg - 27 FEB 03 7:06pm

FIELD DEVICE		DeltaV CONTROLLER	
		BLANK CAP CTRL 30, CARD 13	
		BLANK CAP CTRL 30, CARD 14	


WIRE CODE:
EXAMPLE: 1-2-5-8
I/O TB /
CHANNEL / PORT
CARD
CONTROLLER

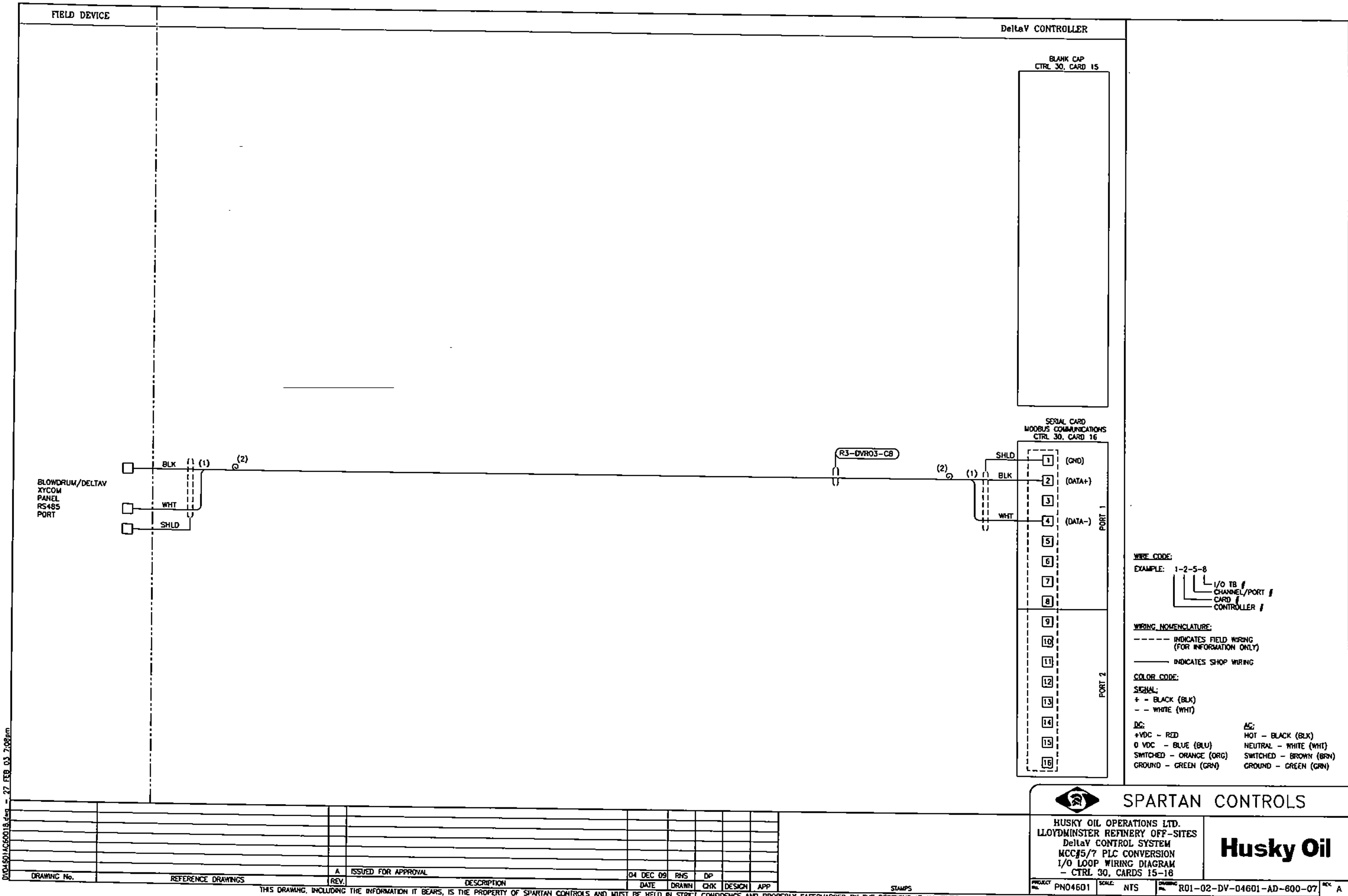
WIRING NOMENCLATURE:
----- INDICATES FIELD WIRING
(FOR INFORMATION ONLY)
———— INDICATES SHOP WIRING

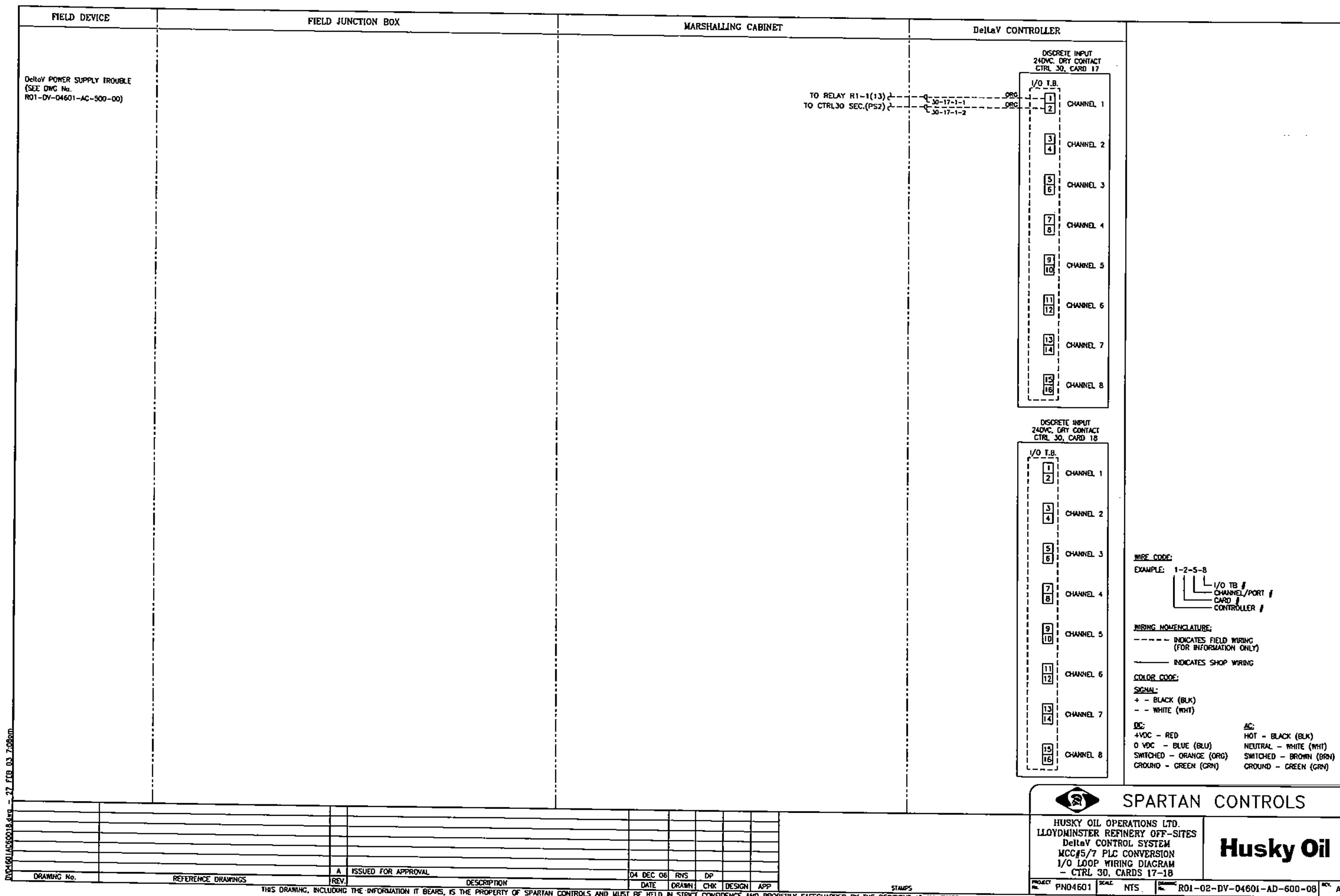
COLOR CODE:
SIGNAL:
+ - BLACK (BLK)
- - WHITE (WHT)

DC:
+VDC - RED
0 VDC - BLUE (BLU)
SWITCHED - ORANGE (ORG)
GROUND - GREEN (GRN)

AC:
HOT - BLACK (BLK)
NEUTRAL - WHITE (WHT)
SWITCHED - BROWN (BRN)
GROUND - GREEN (GRN)

												SPARTAN CONTROLS															
										HUSKY OIL OPERATIONS LTD. LLOYDMINSTER REFINERY OFF-SITES DeltaV CONTROL SYSTEM MCC#5/7 PLC CONVERSION I/O LOOP WIRING DIAGRAM - CTRL 30, CARDS 13-14		Husky Oil															
DRAWING No.		REFERENCE DRAWINGS		REV.		DESCRIPTION		DATE		DRAWN		CHK		DESIGN		APP		STAMPS		PROJECT PN04601		SCALE NTS		DRAWING R01-02-DV-04601-AD-600-06		REV A	
THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.																											





FIELD DEVICE

DeltaV CONTROLLER

BLANK CAP
CTRL 30, CARD 19

BLANK CAP
CTRL 30, CARD 20

WIRE CODE:

EXAMPLE: 1-2-5-B

I/O TB #

CHANNEL/PORT #

CARD #

CONTROLLER #

WIRING NOMENCLATURE:

----- INDICATES FIELD WIRING
(FOR INFORMATION ONLY)

----- INDICATES SHOP WIRING

COLOR CODE:

SIGNAL:

+ - BLACK (BLK)

- - WHITE (WHT)

DC:

+VDC - RED

0 VDC - BLUE (BLU)

SWITCHED - ORANGE (ORG)

GROUND - GREEN (GRN)

AC:

HOT - BLACK (BLK)

NEUTRAL - WHITE (WHT)

SWITCHED - BROWN (BRN)

GROUND - GREEN (GRN)

SPARTAN CONTROLS

HUSKY OIL OPERATIONS LTD.
LLOYDMINSTER REFINERY OFF-SITES
DeltaV CONTROL SYSTEM
MCC#5/7 PLC CONVERSION
I/O LOOP WIRING DIAGRAM
- CTRL 30, CARDS 19-20

Husky Oil

DRAWING No.

REFERENCE DRAWINGS

REV. A

ISSUED FOR APPROVAL

04 NOV 17

RHS

DP

DATE

DRAWN

CHK

DESIGN

APP

STAMPS

PROJECT PND4601

SCALE NTS

DRAWING R01-02-DV-04801-AD-600-03

REV. A

THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.

D:\04601\AC50018.dwg - 27 FEB 03 7:06pm

BLANK CAP
CTRL 30, CARD 21

BLANK CAP
CTRL. 30. CARD 22

WIRE CODE:

EXAMPLE: 1-2-5-8

I/O TB
 CHANNEL/PORT
 CARD
 CONTROLLER

WIRING NOMENCLATURE:

----- INDICATES FIELD WIRING
(FOR INFORMATION ONLY)

———— INDICATES SHOP WIRING

COLOR CODE:

SIGNAL:
+ - BLACK (BLK)
- - WHITE (WHT)

DC:

+VDC - RED
0 VDC - BLUE (BLU)
SWITCHED - ORANGE (ORG)
GROUND - GREEN (GRN)

AC:

HOT - BLACK (BLK)
NEUTRAL - WHITE (WHT)
SWITCHED - BROWN (BRN)
GROUND - GREEN (GRN)



SPARTAN CONTROLS

HUSKY OIL OPERATIONS LTD.
-LLOYDMINSTER REFINERY OFF-SITES
DeltaV CONTROL SYSTEM
MCC#5/7 PLC CONVERSION
I/O LOOP WIRING DIAGRAM
- CTRL 30. CARDS 21-22

Husky Oil

DRAWING No.

REFERENCE DRAWINGS

	A
--	---

ISSUED FOR APPROVAL

[illegible]

04 NOV 17
DATE

RNS
DRAWN

DP
CHK

0654

CU	AP

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

STALPS

PROJECT	PN04501
---------	---------

SCALE: NTS

Q11-02-DV-04601-AD-600-10

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
---	---	---	---	---	---	---	---	---	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	----	-----

REV.	DESCRIPTION	DATE	DRAWN	CHK	DESIGN	APP	STAMPS
THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.							

D:\04601\AC50018.dwg - 27 FEB 03 7:08pm

FIELD DEVICE		DeltaV CONTROLLER	
		<div>BLANK CAP CTRL 30, CARD 23</div> <div>BLANK CAP CTRL 30, CARD 24</div>	

WIRE CODE:
EXAMPLE: 1-2-5-8

I/O TB /
CHANNEL/PORT /
CARD /
CONTROLLER /


WIRING NOMENCLATURE:
----- INDICATES FIELD WIRING
(FOR INFORMATION ONLY)
————— INDICATES SHOP WIRING

COLOR CODE:
SIGNAL:
+ - BLACK (BLK)
- - WHITE (WHT)

DC:
+VDC - RED
0 VDC - BLUE (BLU)
SWITCHED - ORANGE (ORG)
GROUND - GREEN (GRN)

AC:
HOT - BLACK (BLK)
NEUTRAL - WHITE (WHT)
SWITCHED - BROWN (BRN)
GROUND - GREEN (GRN)

DRAWING No.	REFERENCE DRAWINGS	REV	DESCRIPTION	DATE	DRAWN	CHK	DESIGN	APP
		A	ISSUED FOR APPROVAL	04 NOV 17	RYS	DP		

**SPARTAN CONTROLS**

HUSKY OIL OPERATIONS LTD.
LLOYDMINSTER REFINERY OFF-SITES
DeltaV CONTROL SYSTEM
MCC#5/7 PLC CONVERSION
I/O LOOP WIRING DIAGRAM
- CTRL 30, CARDS 23-24

Husky Oil

PROJECT No. PN04601	SCALE NTS	DRAWING No. R01-02-DV-04601-AD-600-11	REV A
------------------------	--------------	--	----------

BLANK CAP
CTRL 30, CARD 25

BLANK CAP
CTRL 30, CARD 26

EXAMPLE: 1-2-3-8

EXAMPLE: 1-2-3-8

I/O TB
CHANNEL/PORT
CARD
CONTROLLER

----- INDICATES FIELD WIRING
(FOR INFORMATION ONLY)
_____ INDICATES SHOP WIRING

SIGNAL:
+ - BLACK (BLK)
- - WHITE (WHT)

DC:	AC:
+VDC - RED	HOT - BLACK (BLK)
0 VDC - BLUE (BLU)	NEUTRAL - WHITE (WHT)
SWITCHED - ORANGE (ORG)	SWITCHED - BROWN (BRN)
GROUND - GREEN (GRN)	GROUND - GREEN (GRN)



SPARTAN CONTROLS

HUSKY OIL OPERATIONS LTD.
LLOYDMINSTER REFINERY OFF-SITES
DeltaV CONTROL SYSTEM
MCC#5/7 PLC CONVERSION
I/O LOOP WIRING DIAGRAM
- CTRL 30, CARDS 25-26

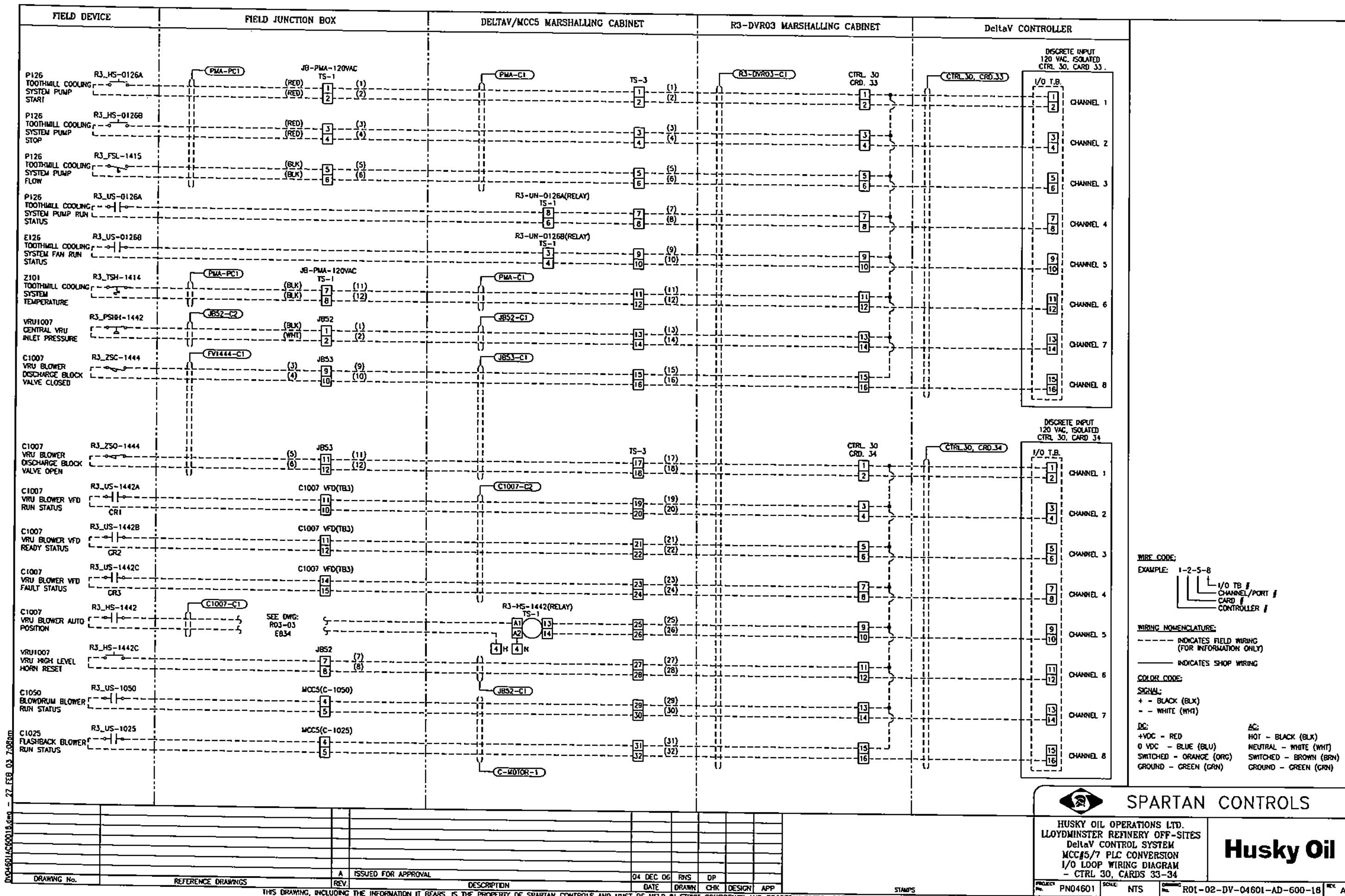
Husky Oil

[illegible]

STUDY

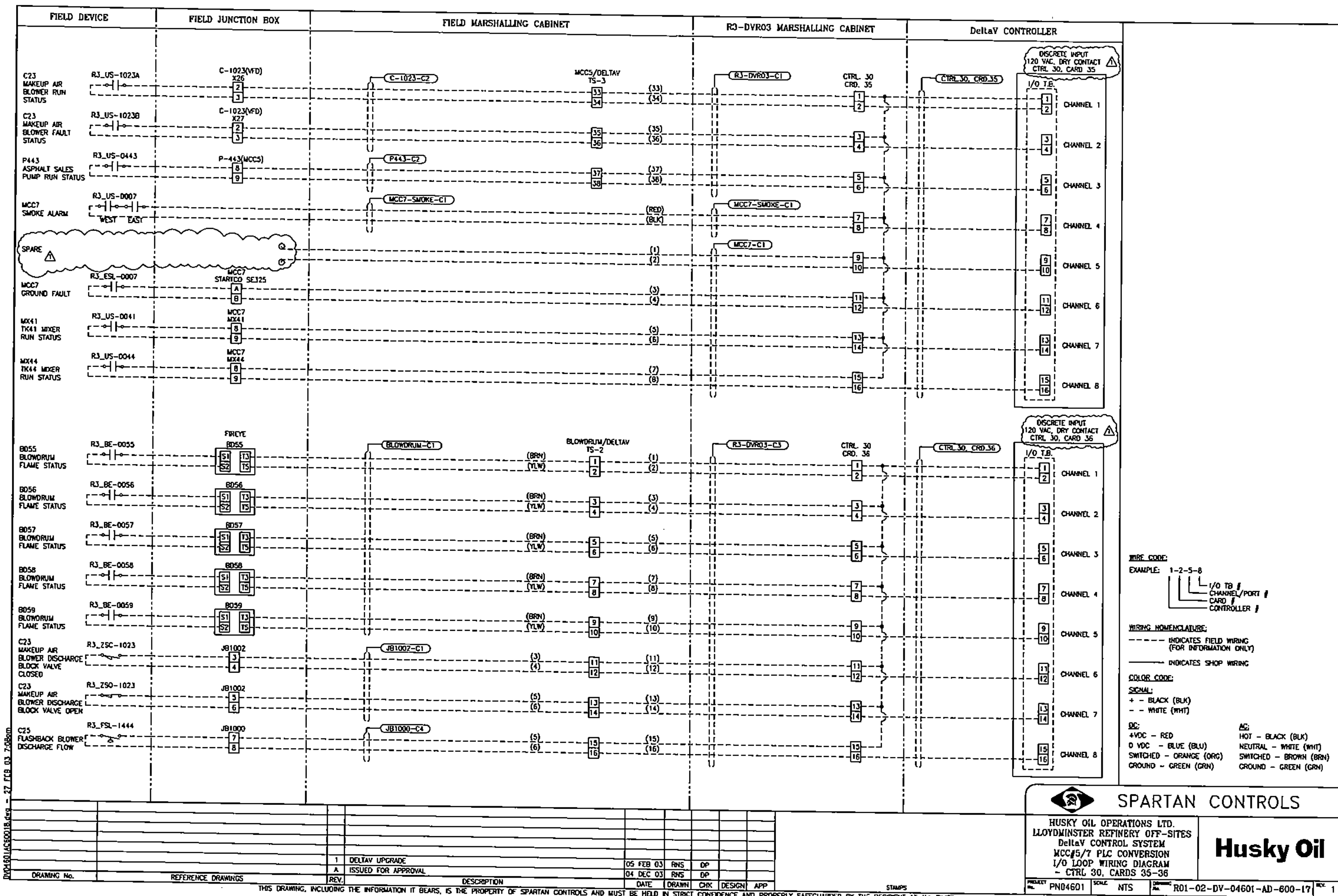
PROJECT 77	PN04601	SCALE	NTS	Dynamic	R01-02-DV-04601-AD-600-12	REV
---------------	---------	-------	-----	---------	---------------------------	-----

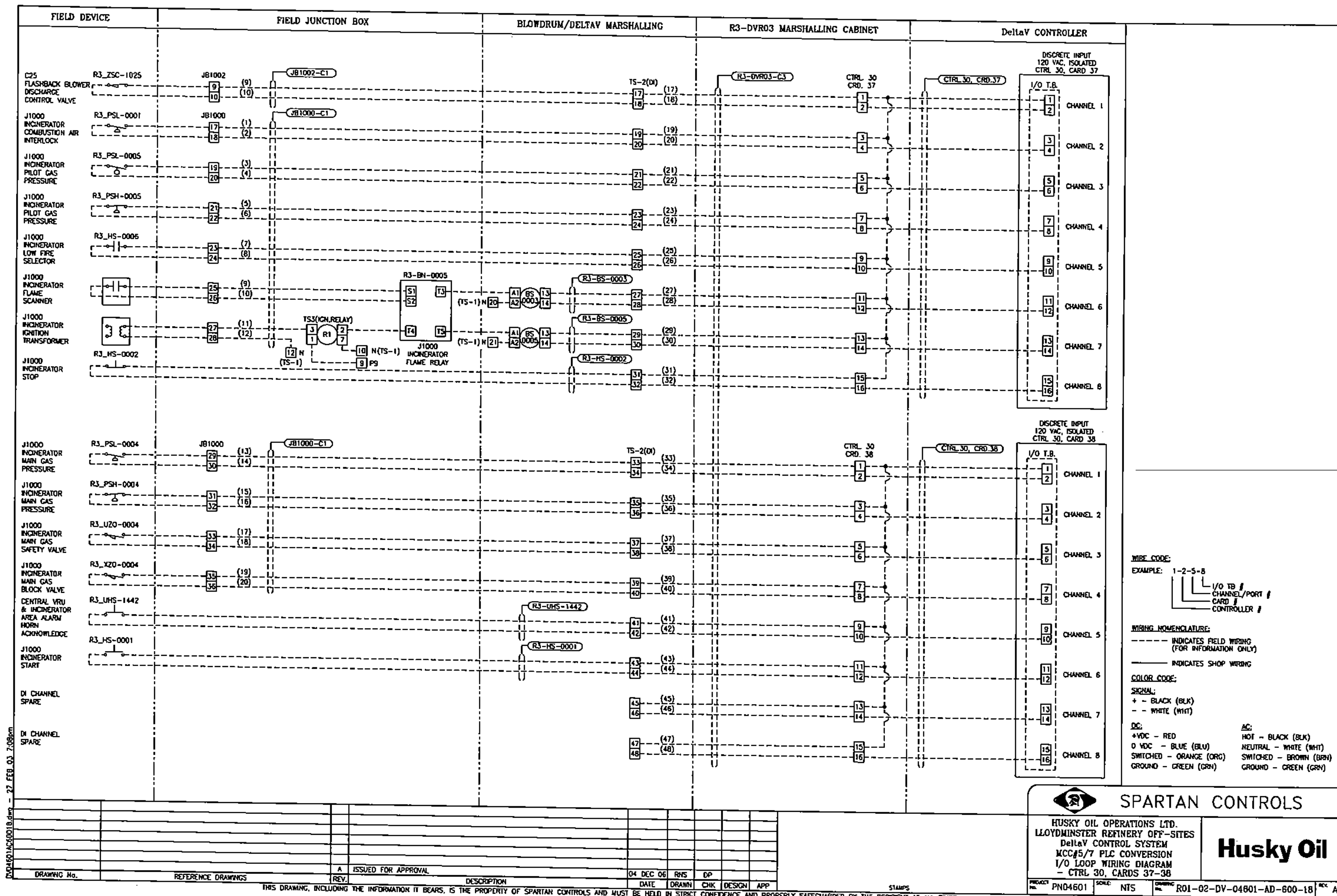
REV.	DESCRIPTION	DATE	DRAWN	CHK	DESIGN	APP	STAMPS
THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.							



D:\04601\AS60018.dwg - 27 FEB 03 7:08pm

THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.





FIELD DEVICE

DeltaV CONTROLLER

BLANK CAP
CTRL 30, CARD 41

BLANK CAP
CTRL 30, CARD 42

WIRE CODE:

EXAMPLE: 1-2-5-B

I/O TB #
 CHANNEL/PORT #
 CARD #
 CONTROLLER #

WRONG NOMENCLATURE:

----- INDICATES FIELD WIRING
(FOR INFORMATION ONLY)

— INDICATES SHOP WIRING

COLOR CODE:

SIGNAL:
+ - BLACK (BLK)
- - WHITE (WHT)

DC:

4VDC - RED
0 VDC - BLUE (BLU)
SWITCHED - ORANGE (ORG)
GROUND - GREEN (GRN)

AC:

HOT - BLACK (BLK)
NEUTRAL - WHITE (WHT)
SWITCHED - BROWN (BRN)
GROUND - GREEN (GRN)



SPARTAN CONTROLS

HUSKY OIL OPERATIONS LTD.
LLOYDMINSTER REFINERY OFF-SITES
DeltaV CONTROL SYSTEM
MCC#5/7 PLC CONVERSION
I/O LOOP WIRING DIAGRAM
- CTRL 30, CARDS 41-42

Husky Oil

DRAWING No.

REFERENCE DRAWINGS

	人
	00

ISSUED FOR APPROVAL

DESCRIPTION

04 NOV 17

	RMS
--	-----

3	
---	--

DP

[illegible]

STAMPS

PROJECT No.	PN04601
----------------	---------

SCALE:	NTS
--------	-----

801-02-DV-04801-AD-600-20

	REV.
--	------

REV.	DESCRIPTION	DATE	DRAWN	CHK	DESIGN	APP	STAMPS
THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.							

FIELD DEVICE		DeltaV CONTROLLER																	
		BLANK CAP CTRL 30, CARD 43																	
		BLANK CAP CTRL 30, CARD 44																	
		<p>WIRE CODE: EXAMPLE: 1-2-5-8</p> <p>I/O TB / CHANNEL/PORT / CARD / CONTROLLER /</p> <p>WIRING NOMENCLATURE: ----- INDICATES FIELD WIRING (FOR INFORMATION ONLY) ————— INDICATES SHOP WIRING</p> <p>COLOR CODE: SIGNAL: + - BLACK (BLK) - - WHITE (WHT)</p> <p>DC: +VDC - RED 0 VDC - BLUE (BLU) SWITCHED - ORANGE (ORG) GROUND - GREEN (GRN)</p> <p>AC: HOT - BLACK (BLK) NEUTRAL - WHITE (WHT) SWITCHED - BROWN (BRN) GROUND - GREEN (GRN)</p>																	
		<p>SPARTAN CONTROLS</p> <p>HUSKY OIL OPERATIONS LTD. LLOYDMINSTER REFINERY OFF-SITES DeltaV CONTROL SYSTEM MCC#5/7 PLC CONVERSION I/O LOOP WIRING DIAGRAM - CTRL 30, CARDS 43-44</p> <p>Husky Oil</p>																	
DRAWING No.		REFERENCE DRAWINGS		REV.		DESCRIPTION		DATE		DRAWN		CHK		DESIGN		APP		STAMPS	
				A		ISSUED FOR APPROVAL		04 NOV 17		RNS		DP							

THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.

04601AC001B.dwg - 27 FEB 03 7:08pm

[illegible]

0104501AC60018.dwg - 27 FEB 03 7:09pm

DeltaV CONTROLLER

Page 11 of 11

I/O TB
CHANNEL/PORT
CARD
CONTROLLER

— INDICATES SHOP WIRING

SIGNAL:
+ - BLACK (BLK)
- - WHITE (WHT)

+VDC - RED
0 VDC - BLUE (BLU)
SWITCHED - ORANGE (ORG)
GROUND - GREEN (GRN)

HOT - BLACK (BLK)
NEUTRAL - WHITE (WHT)
SWITCHED - BROWN (BRN)
GROUND - GREEN (GRN)



HUSKY OIL OPERATIONS LTD.
LLOYDMINSTER REFINERY OFF-SITES
DeltaV CONTROL SYSTEM
MCC#5/7 PLC CONVERSION
I/O LOOP WIRING DIAGRAM
- CTRL 30. CARDS 47-48

Husky Oil

		A	ISSUED FOR APPROVAL	04 NOV 17	RMS	DP		
DRAWING No.	REFERENCE DRAWINGS	REV.	DESCRIPTION	DATE	DRAWN	CHEK	DESIGN	APPROVED

STAMP

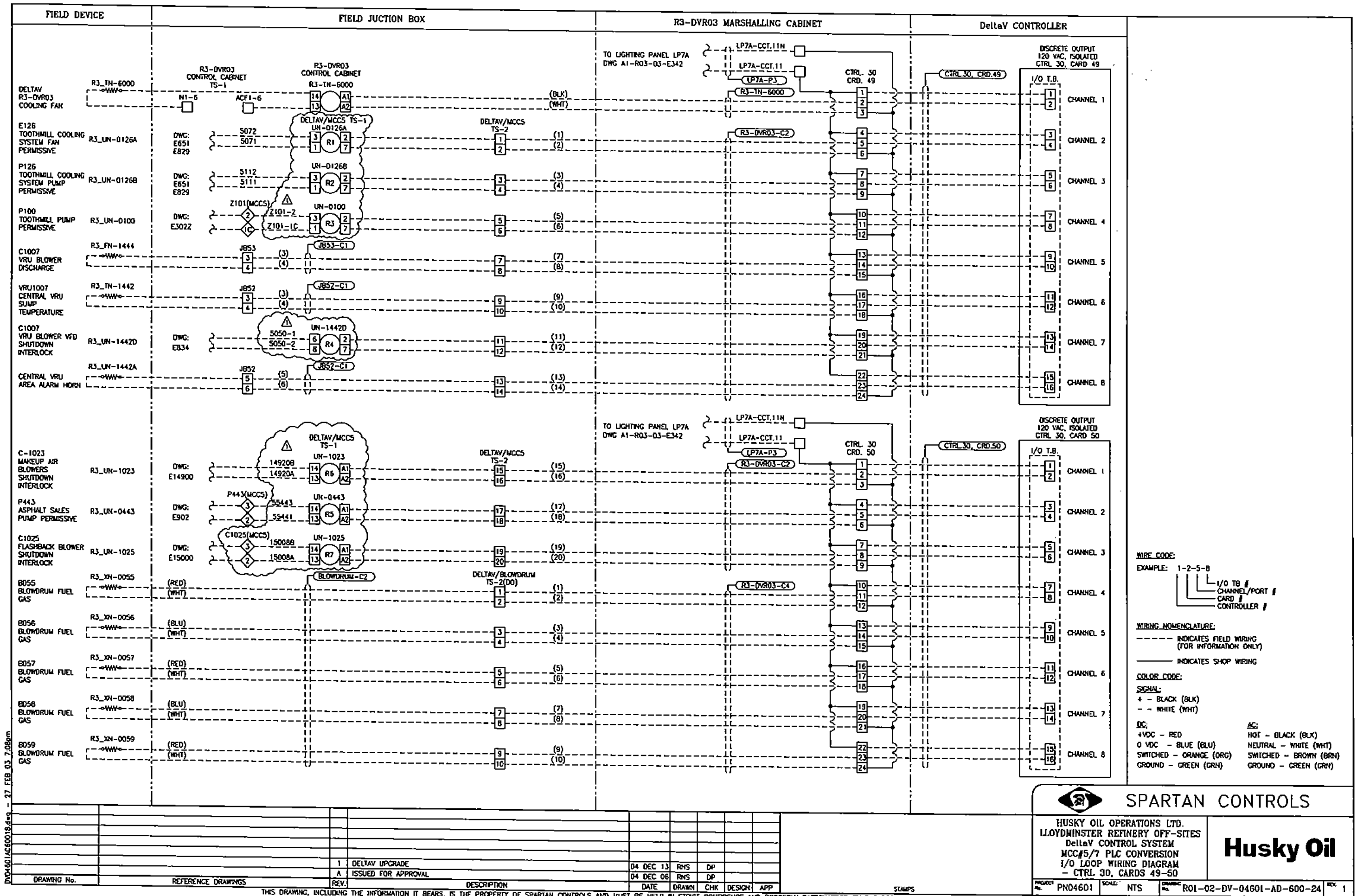
PROJECT No.	PN04601
----------------	---------

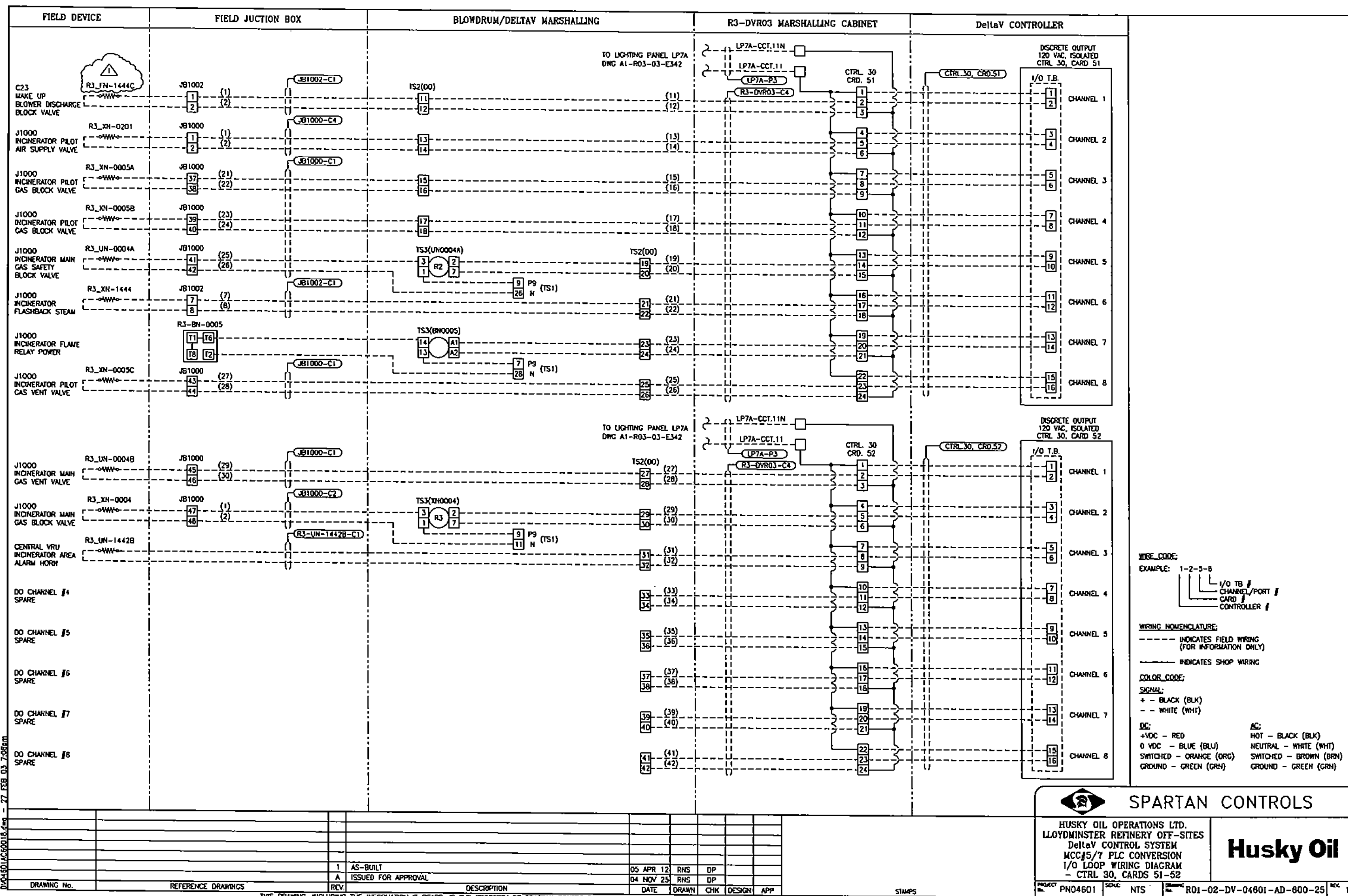
5044-	NTS
-------	-----

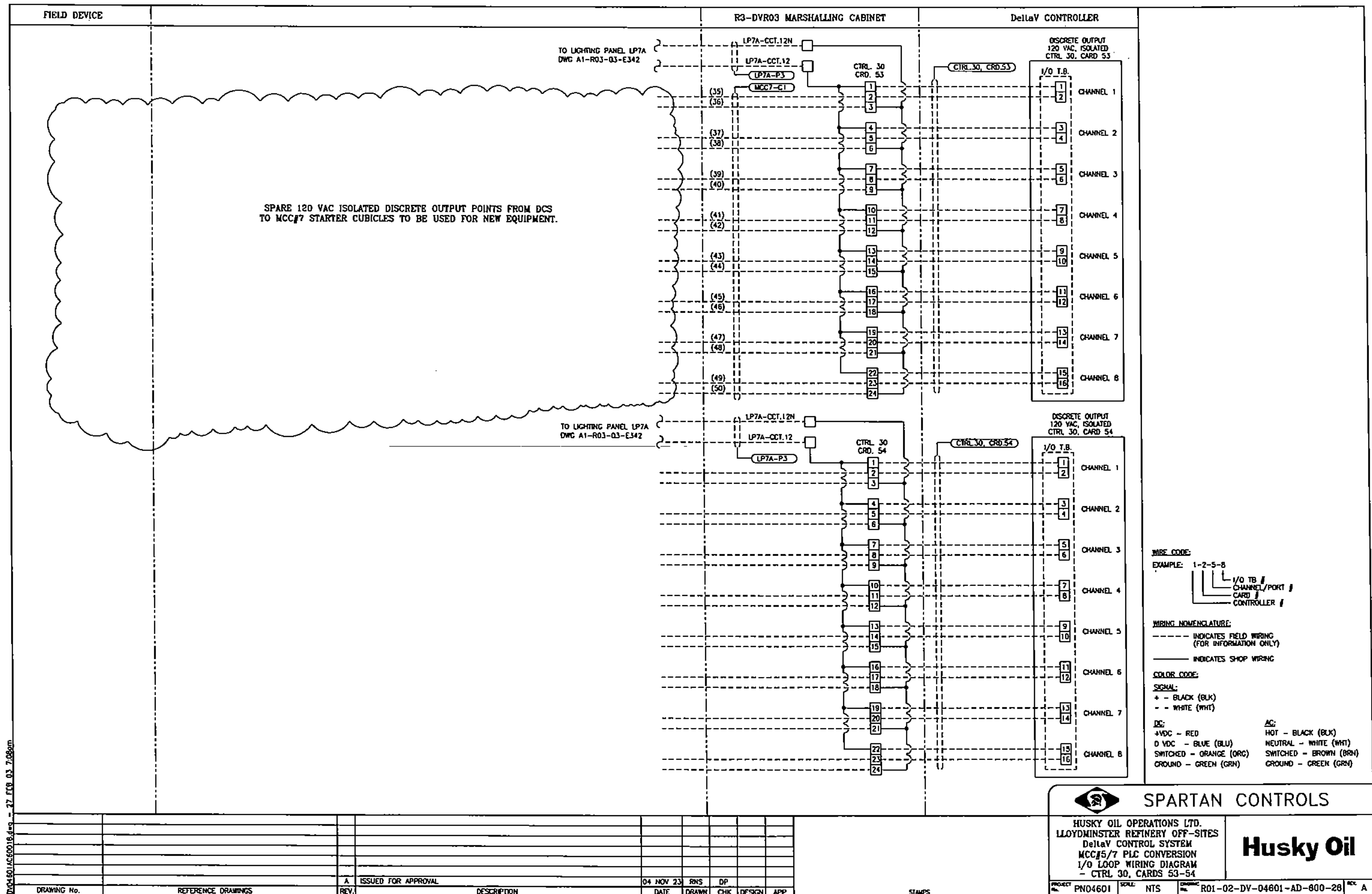
CLASSIC
No. R01-02-DV-04801-AD-600-23

REV. A

REV.	DESCRIPTION	DATE	DRAWN	CHK	DESIGN	APP	STAMPS
THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES							



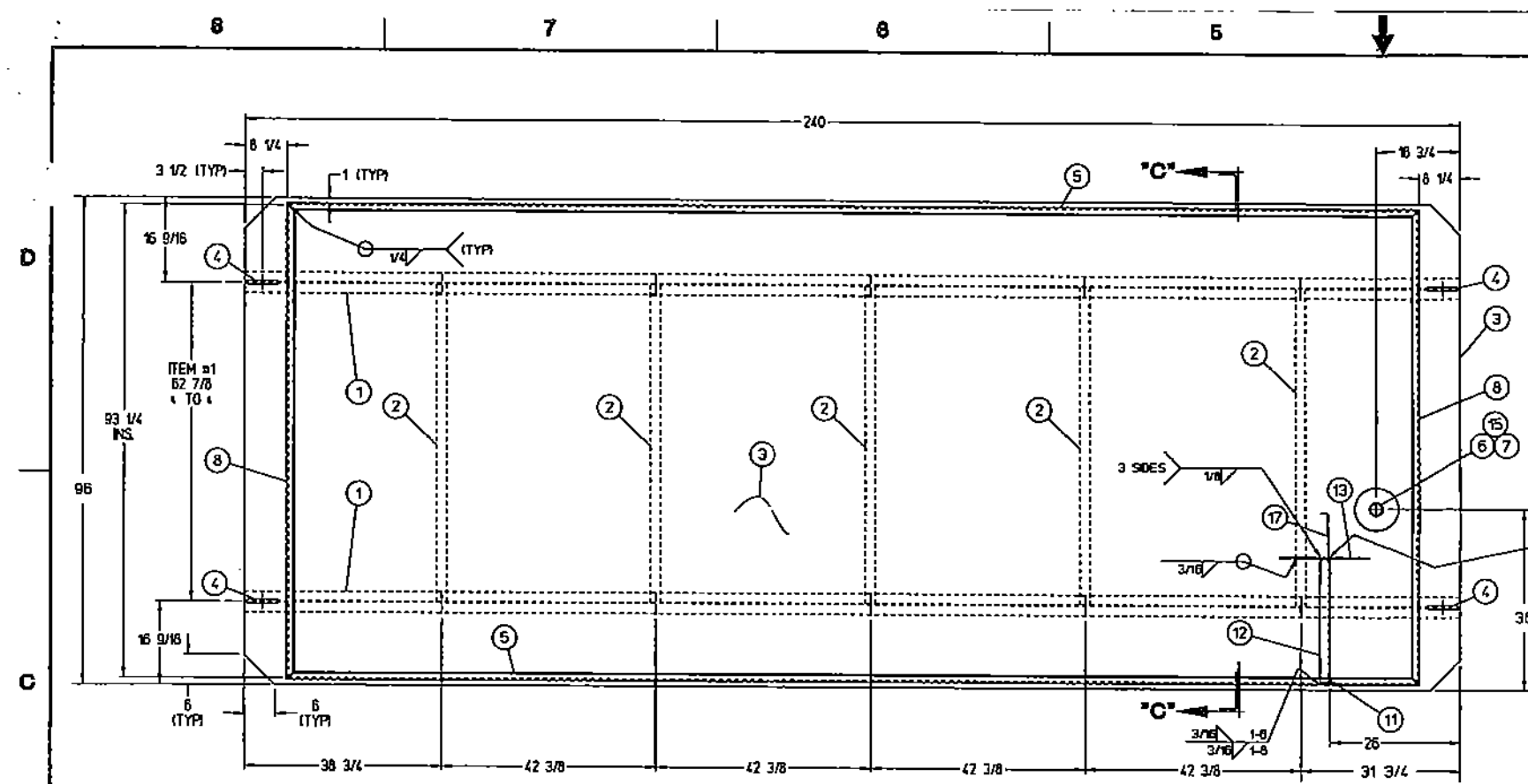




D:\MIS\AS60018.dwg - 27 FEB 03 7:08pm

THIS DRAWING, INCLUDING THE INFORMATION IT BEARS, IS THE PROPERTY OF SPARTAN CONTROLS AND MUST BE HELD IN STRICT CONFIDENCE AND PROPERLY SAFEGUARDED BY THE RECIPIENT AT ALL TIMES.





NOTES:

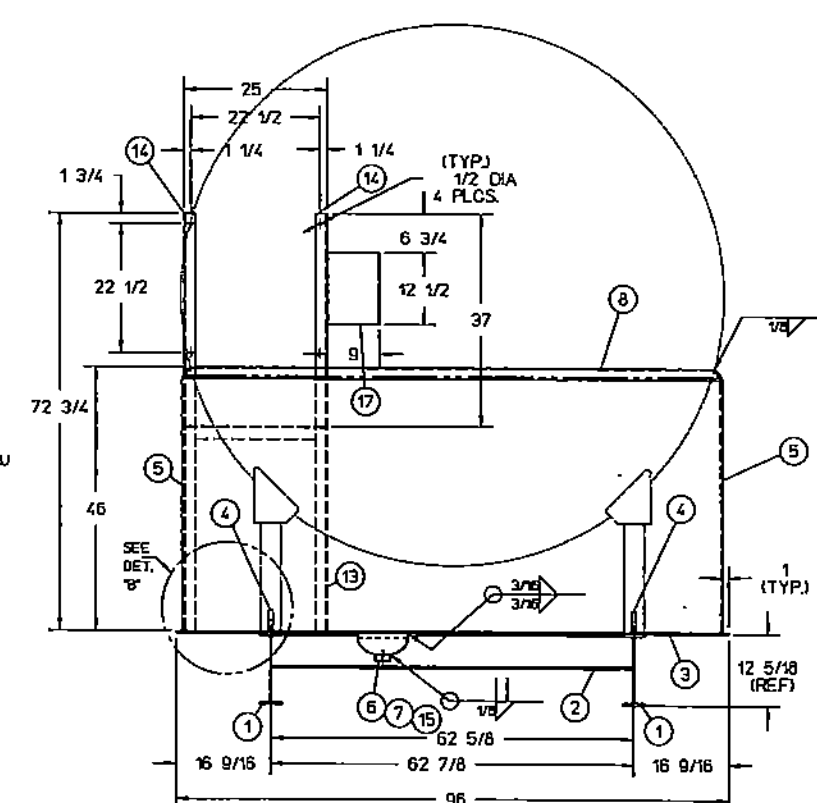
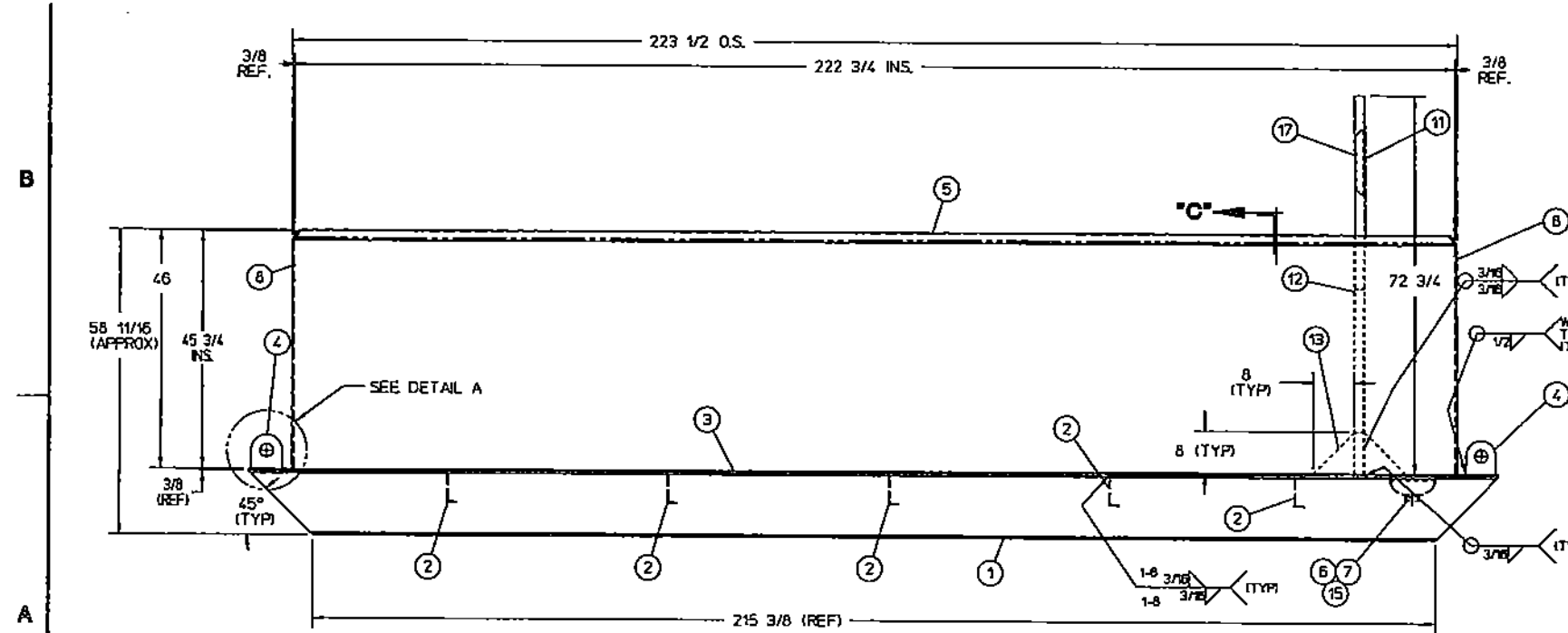
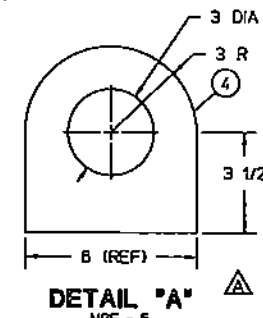
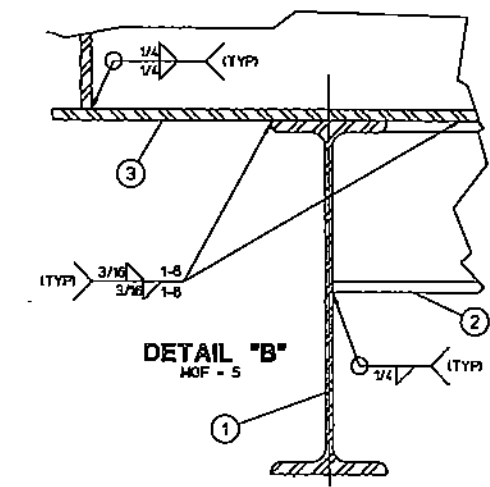
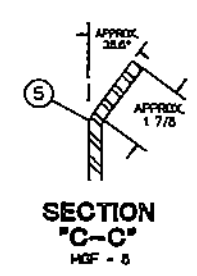
1. ALL WELD SPLATTER, RUST AND MILL SCALE MUST BE REMOVED FROM CARBON STEEL SURFACES. THOROUGHLY CLEAN ALL SURFACES INCLUDING WELDS, ABRASION OR OTHERWISE DEFECTIVE AREAS PER STEEL STRUCTURES PAINTING COUNCIL (SSPC) SP-9-03 POWER TOOL CLEANING.
2. PAINT ALL CARBON STEEL SURFACES WITH ONE COAT OF PRIMER AND A FINISH COAT, BOTH COATS TO BE 2 MILS THICK DRY.
3. ESTIMATED WEIGHT OF SUPPORT ASSEMBLY - 7,500 LBS.
4. DYE TEST CONTAINMENT TANK WELDS PER PROCEDURE ENDED.
5. TANK CONTAINMENT VOLUME IS 4,700 GALLONS.

CUST NO.	ITEM NO.	NO. REQD.	PART NO.	DESCRIPTION	DRAWING NO.
	1	200W		SUPPORT ASSY 4000 GAL MODEL "SHW" W/CONTAINMENT TANK C/S	PC12445 D
	1	2	200W298788	SUPPORT BEAM W12x22 HRCS	
	2	5	202W298788	SUPPORT CHANNEL C6x8.2 HRCS	
	3	1	203W298788	FLOOR .375" HRCS 96"x240"	
	4	4	204W298788	LUG LIFTING .75" THK x 6" WIDE HRCS	DET A
	5	2	205W298788	TANK CONTAINMENT SIDE .375" C/S	
	6	1	005W298788	COUPLING HALF 2"NPT C/S 3000#	
	7	1	0801178	PLUG PIPE 2"NPT CS SO HD OR HEX HD	
	8	2	206W298788	TANK CONTAINMENT END .375" C/S	
	9	A/R	9827764	PAINT PRIMER WILKO #492-43 UNIVERSAL ALKID HS GRAY	NOTE #2
	10	A/R	9825820	PAINT TOP COAT WILKO #721-95 WILKOTHANE HS WHITE	NOTE #2
	11	2	211W/218W	SUPPORT CONTROL BOX 2"x2"x.25" ANGLE C/S 72.75" LG (1 RM 1 L.H)	
	12	1	212W/268788	BRACE SUPPORT CONTROL BOX 2"x2"x.25" ANGLE C/S 21" LG	
	13	1	213W/268788	BUSSET .1875" THK C/S	
	14				
	15	1	004W298788	SUMP 8" SCH 40 C/S PIPE CAP WELDED	
	16				
	17	1	217W	MTG BRACKET FREQ DRIVE .1875" C/S FORMED 9"x15"x12.5" LG W/ 1" NOTCHED CORNERS	

CERTIFIED CORRECT AND RELEASED FOR FABRICATION

FABRICATION WILL BE IN ACCORDANCE WITH THIS DRAWING. ANY FURTHER CHANGES WILL BE REVIEWED FOR COST AND DELIVERY ADJUSTMENTS.

PALL MUELLER COMPANY



THIS DESIGN & THIS DRAWING ARE THE PROPRIETARY PROPERTY OF "RHODIA INC." AND ARE NOT TO BE DISTRIBUTED TO OTHERS WITHOUT THE EXPRESS PERMISSION OF "RHODIA INC."



SEPA FROM DWD NO. FP14403

REVISIONS		BY		DATE		DESCRIPTION	
1	CHANGE	MVL	03/08/05	1	1	1	1
2	CHANGE	MVL	03/08/05	2	2	2	2
3	CHANGE	MVL	03/08/05	3	3	3	3
4	CHANGE	MVL	03/08/05	4	4	4	4
5	CHANGE	MVL	03/08/05	5	5	5	5
6	CHANGE	MVL	03/08/05	6	6	6	6
7	CHANGE	MVL	03/08/05	7	7	7	7
8	CHANGE	MVL	03/08/05	8	8	8	8
9	CHANGE	MVL	03/08/05	9	9	9	9
10	CHANGE	MVL	03/08/05	10	10	10	10
11	CHANGE	MVL	03/08/05	11	11	11	11
12	CHANGE	MVL	03/08/05	12	12	12	12
13	CHANGE	MVL	03/08/05	13	13	13	13
14	CHANGE	MVL	03/08/05	14	14	14	14
15	CHANGE	MVL	03/08/05	15	15	15	15
16	CHANGE	MVL	03/08/05	16	16	16	16
17	CHANGE	MVL	03/08/05	17	17	17	17
18	CHANGE	MVL	03/08/05	18	18	18	18
19	CHANGE	MVL	03/08/05	19	19	19	19
20	CHANGE	MVL	03/08/05	20	20	20	20
21	CHANGE	MVL	03/08/05	21	21	21	21
22	CHANGE	MVL	03/08/05	22	22	22	22
23	CHANGE	MVL	03/08/05	23	23	23	23
24	CHANGE	MVL	03/08/05	24	24	24	24
25	CHANGE	MVL	03/08/05	25	25	25	25
26	CHANGE	MVL	03/08/05	26	26	26	26
27	CHANGE	MVL	03/08/05	27	27	27	27
28	CHANGE	MVL	03/08/05	28	28	28	28
29	CHANGE	MVL	03/08/05	29	29	29	29
30	CHANGE	MVL	03/08/05	30	30	30	30
31	CHANGE	MVL	03/08/05	31	31	31	31
32	CHANGE	MVL	03/08/05	32	32	32	32
33	CHANGE	MVL	03/08/05	33	33	33	33
34	CHANGE	MVL	03/08/05	34	34	34	34
35	CHANGE	MVL	03/08/05	35	35	35	35
36	CHANGE	MVL	03/08/05	36	36	36	36
37	CHANGE	MVL	03/08/05	37	37	37	37
38	CHANGE	MVL	03/08/05	38	38	38	38
39	CHANGE	MVL	03/08/05	39	39	39	39
40	CHANGE	MVL	03/08/05	40	40	40	40
41	CHANGE	MVL	03/08/05	41	41	41	41
42	CHANGE	MVL	03/08/05	42	42	42	42
43	CHANGE	MVL	03/08/05	43	43	43	43
44	CHANGE	MVL	03/08/05	44	44	44	44
45	CHANGE	MVL	03/08/05	45	45	45	45
46	CHANGE	MVL	03/08/05	46	46	46	46
47	CHANGE	MVL	03/08/05	47	47	47	47
48	CHANGE	MVL	03/08/05	48	48	48	48
49	CHANGE	MVL	03/08/05	49	49	49	49
50	CHANGE	MVL	03/08/05	50	50	50	50
51	CHANGE	MVL	03/08/05	51	51	51	51
52	CHANGE	MVL	03/08/05	52	52	52	52
53	CHANGE	MVL	03/08/05	53	53	53	53
54	CHANGE	MVL	03/08/05	54	54	54	54
55	CHANGE	MVL	03/08/05	55	55	55	55
56	CHANGE	MVL	03/08/05	56	56	56	56
57	CHANGE	MVL	03/08/05	57	57	57	57
58	CHANGE	MVL	03/08/05	58	58	58	58
59	CHANGE	MVL	03/08/05	59	59	59	59
60	CHANGE	MVL	03/08/05	60	60	60	60
61	CHANGE	MVL	03/08/05	61	61	61	61
62	CHANGE	MVL	03/08/05	62	62	62	62
63	CHANGE	MVL	03/08/05	63	63	63	63
64	CHANGE	MVL	03/08/05	64	64	64	64
65	CHANGE	MVL	03/08/05	65	65	65	65
66	CHANGE	MVL	03/08/05	66	66	66	66
67	CHANGE	MVL	03/08/05	67	67	67	67
68	CHANGE	MVL	03/08/05	68	68	68	68
69	CHANGE	MVL	03/08/05	69	69	69	69
70	CHANGE	MVL	03/08/05	70	70	70	70
71	CHANGE	MVL	03/08/05	71	71	71	71
72	CHANGE	MVL	03/08/05	72	72	72	72
73	CHANGE	MVL	03/08/05	73	73	73	73
74	CHANGE	MVL	03/08/05	74	74	74	74
75	CHANGE	MVL	03/08/05	75	75	75	75
76	CHANGE	MVL	03/08/05	76	76	76	76
77	CHANGE	MVL	03/08/05	77	77	77	77
78	CHANGE	MVL	03/08/05	78	78	78	78
79	CHANGE	MVL	03/08/05	79	79	79	79
80	CHANGE	MVL	03/08/05	80	80	80	80
81	CHANGE	MVL	03/08/05	81	81	81	81
82	CHANGE	MVL	03/08/05	82	82	82	82
83	CHANGE	MVL	03/08/05	83	83	83	83
84	CHANGE	MVL	03/08/05	84	84	84	84
85	CHANGE	MVL	03/08/05	85	85	85	85
86	CHANGE	MVL	03/08/05	86	86	86	86
87	CHANGE	MVL	03/08/05	87	87	87	87
88	CHANGE	MVL	03/08/05	88	88	88	88
89	CHANGE	MVL	03/08/05	89	89	89	89
90	CHANGE	MVL	03/08/05	90	90	90	90
91	CHANGE	MVL	03/08/05	91	91	91	91
92	CHANGE	MVL	03/08/05	92	92	92	92
93	CHANGE	MVL	03/08/05	93	93	93	93
94	CHANGE	MVL	03/08/05	94	94	94	94
95	CHANGE	MVL	03/08/05	95	95	95	95
96	CHANGE	MVL	03/08/05	96	96	96	96
97	CHANGE	MVL	03/08/05	97	97	97	97

CERTIFIED CORRECT AND
RELEASED FOR FABRICATION

FABRICATION WILL BE IN ACCORDANCE WITH
THIS DRAWING. ANY FURTHER CHANGES WILL
BE REVIEWED FOR COST AND DELIVERY
ADJUSTMENTS.

PAUL MUELLER COMPANY

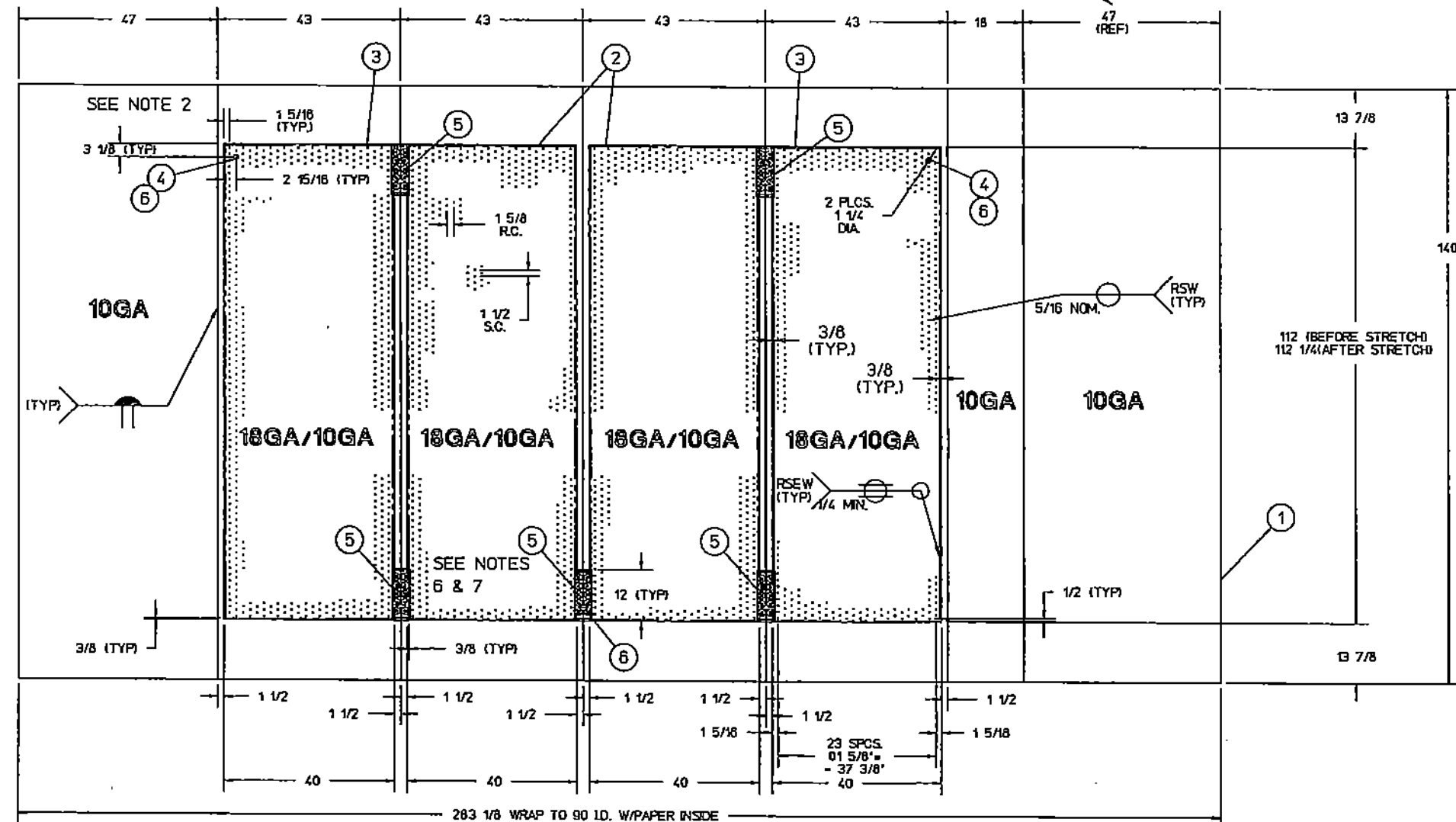
- NOTES:
1. ALL DIMENSIONS ARE IN INCHES UNLESS SPECIFIED OTHERWISE.
 2. INSTALL TEMP-PLATE FITTINGS PER 9901822 B & 9901840 B.
 3. FOR DYE TEST REQUIREMENTS SEE ISO PROCEDURE ENO 103
 4. INFLATE AT ASSEMBLY, OK TO INFLATE THROUGH FITTINGS
BEFORE INSTALLING DIMPLE HEADERS.
 5. OBSERVE BOTH SIDES OF PANEL DURING INFLATION
FOR ABNORMAL BULGING.
 6. INSTALL DIMPLE HEADERS PER 9900872 B.
 7. INSTALL FITTING IN DIMPLE HEADER PER 9900872 C (DET. E).
 8. MAIN ASSY. DWG. PC12443 D.
 9. 800 PSI MAXIMUM HYDRO INFLATION PSI PERTAINS ONLY TO
THE HEAT TRANSFER JACKET.
 10. REGISTRATION FOR CRN IS REQUIRED.
PROVINCE: ALBERTA
 11. H. D. H. T. IS 0 DEG F. @ 28 PSI.
 12. ALL WELDING TO BE DONE BY ASME CERTIFIED WELDERS.
 13. TEMP-PLATE SURFACES TO BE POLISHED IN SHEET
POLISHER TO REMOVE HEAT TINT.

CUST NO.	ITEM NO.	NO. REQ'D	PART NO.	DESCRIPTION	DRAWING NO.
		1		SHELL ASSY INNER 4000 SHW 90"ID	PC12444 C
1	1	102W		SHELL ASSY INNER 4000 GAL "SHW" 100A 316L S/S	
2	2	170W		T/P ASSY 18/100A 316L S/S	
3	2	171W		T/P ASSY 18/100A 316L S/S	
4	2	(REF)		CHAIR T-PL 1.25 316L SS SCH40 PIPE (4 - LEG) (9828688)	9901840 B
5	5	(REF)		HEADER DIMPLE DBL FLOW 12"LG 316L S/S 2B SA240 (9822988)	9900872 B
6	3	(REF)		CONNECTION TEMP-PLATE 1.25" SCH40 316L S/S PIPE	

THIS DESIGN & THIS DRAWING ARE THE
PROPRIETARY PROPERTY OF "RHODIA INC."
AND ARE NOT TO BE DISTRIBUTED TO
OTHERS WITHOUT THE EXPRESS
PERMISSION OF "RHODIA INC."



HUSKY OIL OPERATIONS LIMITED
LLOYDMINSTER, AB
CUSTOMER ORDER #4500132462



TEST PLATE NO:	MA-384A (SEE NOTE #10)
TEMP-PLATE TYPE:	<input checked="" type="checkbox"/> INFL. <input type="checkbox"/> DIMPLED <input type="checkbox"/> DEFORMED
ROW AND SPOT SPACINGS ON INFLATED TYPE CANNOT EXCEED 1/8"	MORE THAN DIMENSIONS SHOWN ON THIS DRAWING FOR ASME EQUIPMENT. (REF. SECT. VII DIV. 1, APP. 17)
MACHINE NOT: SPOT WELDS	SEAM WELDS
PROTECTIVE PAINT:	
SURFACES TO BE PAINTED:	
TRIM EDGES:	<input type="checkbox"/> ENDS ONLY <input type="checkbox"/> ALL EDGES
MATERIAL FINISHES	WELD FINISHES
INTERIOR	2B
EXTERIOR	2B
ASME 1" STAMPED	<input type="checkbox"/> ASME DESIGNED (No Stamp)
NON ASME	<input type="checkbox"/> ASME MATERIAL & WELDING (No Stamp)
SPECIFICATIONS	TOP HEAD
DESIGN PRESSURE PSI	28
DESIGN TEMP. ° F	270
MAX. HYDROSTATIC INFLATION PSI	NOTE #9
HYDROSTATIC TEST PSI	36
MAX. PNEUMATIC INFLATION PSI	
PNEUMATIC TEST PSI	
FILLOW DEPTH INCHES	.100
HEATING MEDIUM	STEAM
COOLING MEDIUM	NONE
DEHYDRATION (per S.O.P. 23-B)	NO
TEMP-PLATE CONTACT AREA (S.F.)	121.56
TEMP-PLATE VOLUME CUFT.	.714
QUANTITY:	ONE (1) PER ASSY

APPROVED BY : STEVE MACKEY 03/28/05

SEPA FROM DWG. NO.
FP13813

ALL MATERIALS OR COMPONENT PARTS CALLED OUT ON THIS DRAWING SHALL BE AS SPECIFIED OR APPROVED EQUAL.			
This drawing and any print thereof is the property of the PAUL MUELLER CO. Springfield, Mo., and is subject to return on request of this company. The information shown is confidential and the recipient by accepting this drawing agrees not to use any information contained thereon in any manner which will be detrimental to the PAUL MUELLER CO.			
DATE	BY	DATE	BY
03/28/05	MVL	03/28/05	MVL
CHANGE	SY	DATE	BY
DRAWN BY		SALES ORDER/MODEL	
M. MAHY		332063 SHW	
DATE		3-08-05	
REVIEWED BY		SCALE	
JIM FERGUSON		9/16" = 4000 GAL	
DATE		03/10/05	
TITLE		SHELL ASSY INNER W/TEMP-PLATE	
		DRAWING NO. PC12444 C	



NOTES:

1. ALL DIMENSIONS ARE IN INCHES UNLESS SPECIFIED OTHERWISE.
2. REMOVE PAINT FROM PANEL UNDER GROUND BAR.
3. MAKE ALL LABELS FOR INTERIOR PANEL OR BOX EXTERIOR AS INDICATED BY TEXT, FOR EXAMPLE: TEXT BLACK LETTERS ON A WHITE ADHESIVE BACKING.
4. SEE DWG 8S0711 D ELECTRICAL SCHEMATIC.
5. DO NOT RIVET DATA PLATE INTO POSITION UNTIL STAMPED PER WIRING SCHEMATIC DRAWING. STORE DATA PLATE AND RIVETS INSIDE CONTROL BOX UNTIL DATA PLATE INFORMATION IS RECEIVED. THEN STAMP AND ATTACH DATA PLATE TO BOX.

**CERTIFIED CORRECT AND
RELEASED FOR FABRICATION**

FABRICATION WILL BE IN ACCORDANCE WITH
THIS DRAWING. ANY FURTHER CHANGES WILL
BE REVIEWED FOR COST AND DELIVERY
ADJUSTMENTS.

PAUL MUELLER COMPANY

[illegible]

LEGEND

DISCONNECT

CIRCUIT BREAKER

LIMIT

LIQUID LEVEL

PRESSURE

TEMPERATURE

FLOW (WATER)

SELECTOR

CONNECTIONS

CONTACTS

COILS

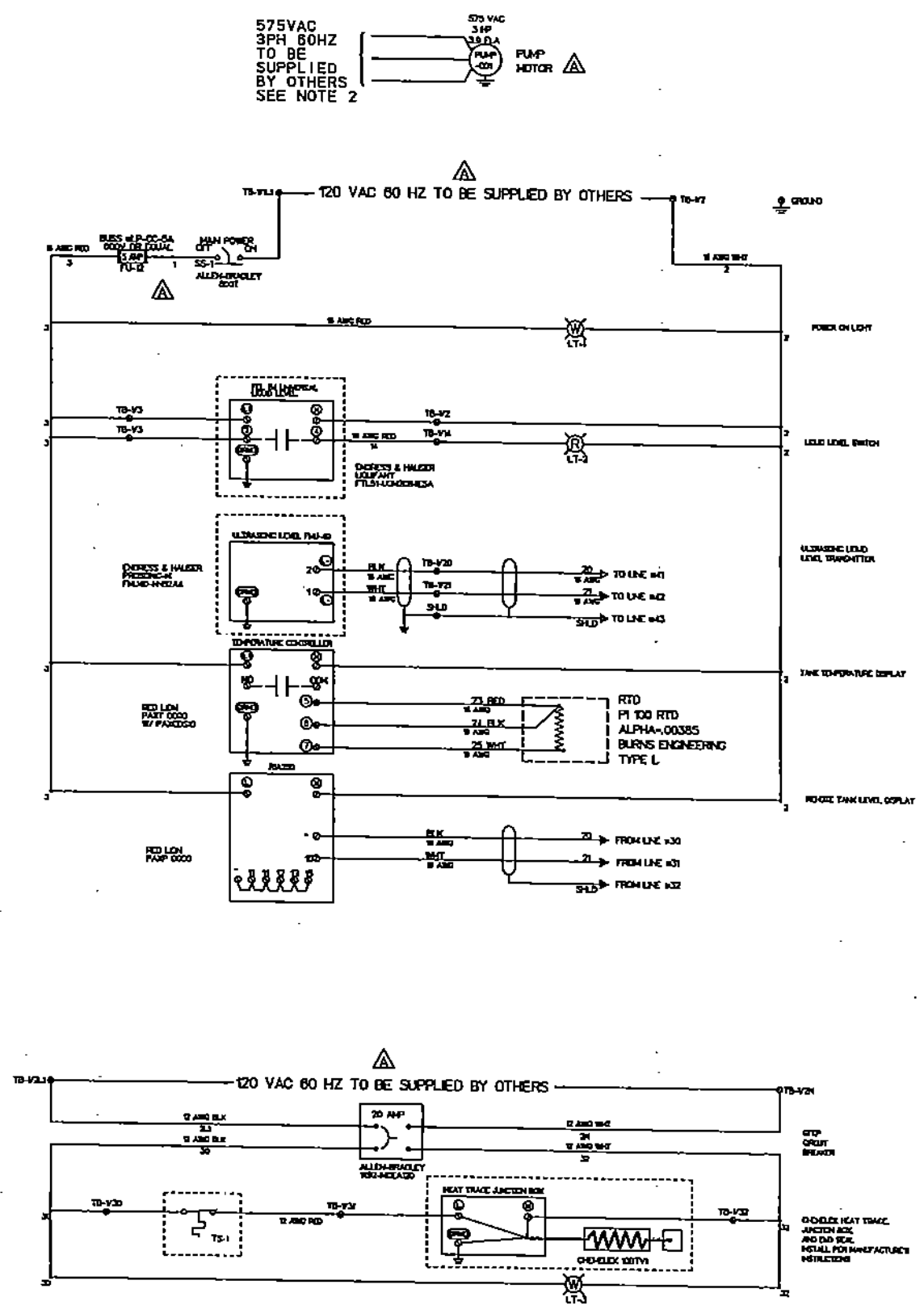
MOTORS

MISC

REMARKS

BS07096

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
20
21
22
23
24
25
26
27
28
29
30
31
32
33
34
35
36
37
38
39
40
41
42
43
44
45
46
47
48
49
50
51
52
53
54
55
56
57
58
59
60



CUST NO.	ITEM NO.	NO. REQ'D	PART NO.	DESCRIPTION	DRAWING NO.
----------	----------	-----------	----------	-------------	-------------

TB-1/00
TERMINAL BLOCK/WIRE NO. IDENTIFICATION

- NOTES:**
1. ALL ENFORCED ELECTRICAL CODES MUST BE FOLLOWED DURING THE INSTALLATION, SERVICE AND/OR OPERATION OF THIS EQUIPMENT.
 2. PROPERLY SIZED DISCONNECT SWITCH, OVERLOAD, GROUND FAULT, AND SHORT CIRCUIT PROTECTION TO BE SUPPLIED AND INSTALLED BY OTHERS. ALL MOTOR CONTROL TO BE SUPPLIED AND INSTALLED BY OTHERS.

MUELLER

MODEL []

SERIAL NUMBER 332063

VOLTS 120 PH 1 HZ 60

KVA 0.0 LRG. MTR. AMPS NA

DIAGRAM NUMBER BS0711 D

Control Circuit
FLA = 5 Amps

MUELLER

MODEL []

SERIAL NUMBER 332063

VOLTS 120 PH 1 HZ 60

KVA 1.0 LRG. MTR. AMPS NA

DIAGRAM NUMBER BS0711 D

Heat Trace Circuit
FLA = 18 Amps

MUELLER

MODEL []

SERIAL NUMBER 332063

VOLTS 575 PH 3 HZ 60

KVA 3.0 LRG. MTR. AMPS 3.0

DIAGRAM NUMBER BS0711 D

Pump Motor Circuit
FLA = 3.9 Amps

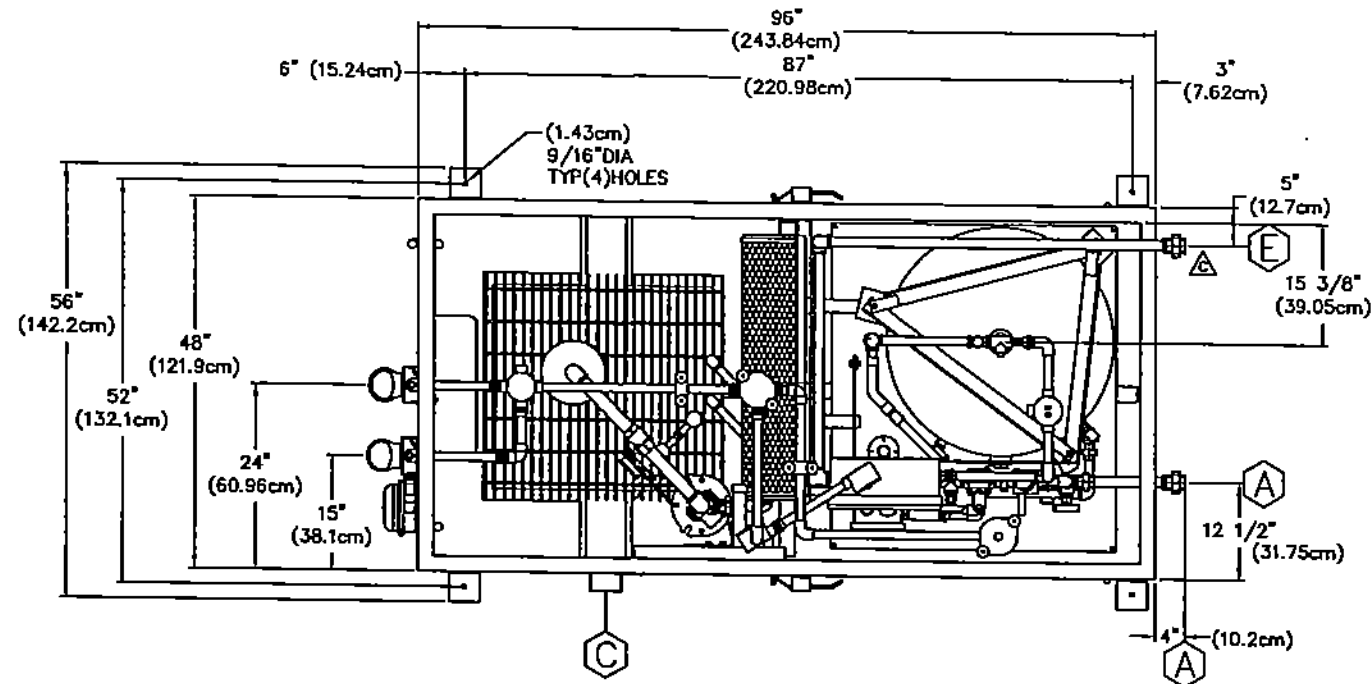
CERTIFIED CORRECT AND RELEASED FOR FABRICATION

FABRICATION WILL BE IN ACCORDANCE WITH THIS DRAWING. ANY FURTHER CHANGES WILL BE REVIEWED FOR COST AND DELIVERY ADJUSTMENTS.

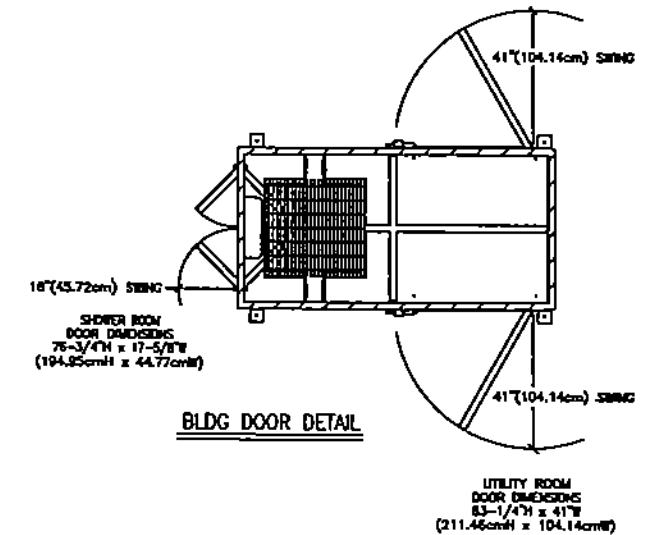
PAUL MUELLER COMPANY

ALL MATERIALS OR COMPONENT PARTS CALLED OUT ON THIS DRAWING SHALL BE AS SPECIFIED OR APPROVED EQUAL			
REVISIONS	DATE	BY	DATE
A	03/15/05	MEM	03/15/05
SYN	CHANGE	BY	DATE
DRAWN BY: M. HARTY DATE: 03/15/05 REVIEWED BY: RUSSELL LINDSEY DATE: 03/15/05 TITLE: ELECTRICAL SCHEMATIC DRAFTING NO.: BS07111 D			

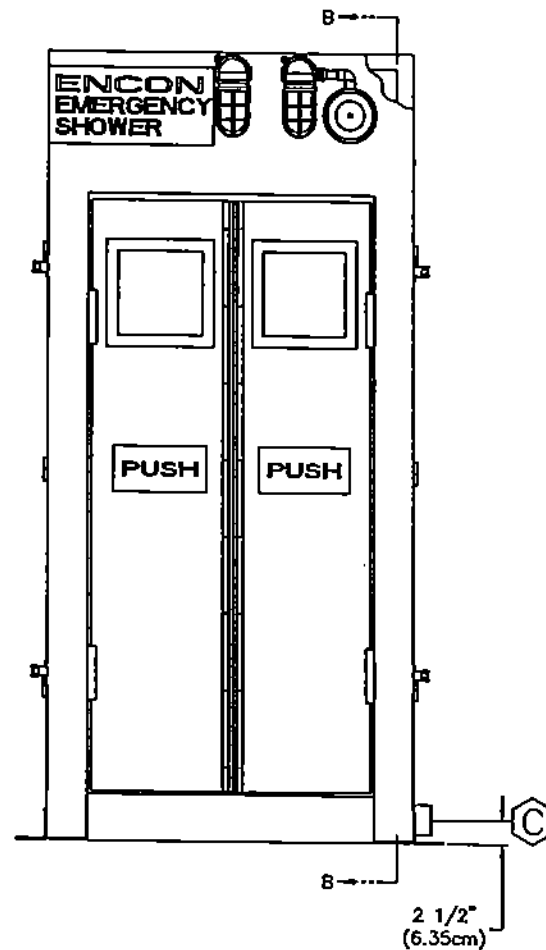
(E)	1 1/4" (3.18cm) FNPT	AUXILIARY SHOWER
(D)	3/4" (1.91cm) FNPT	REMOTE ALARM
(C)	3" (7.62cm) SLIP	RIGHT DRAIN
(B)	3/4" (1.91cm) FNPT	ELECT. POWER IN @ 208V
(A)	1 1/2" (3.81cm) FNPT	COLD WATER INLET
	SIZE	DESCRIPTION
CUSTOMER CONNECTIONS		
NOTE: ALL INTERFACE DIMENSIONS ± 1/2" (1.27cm)		



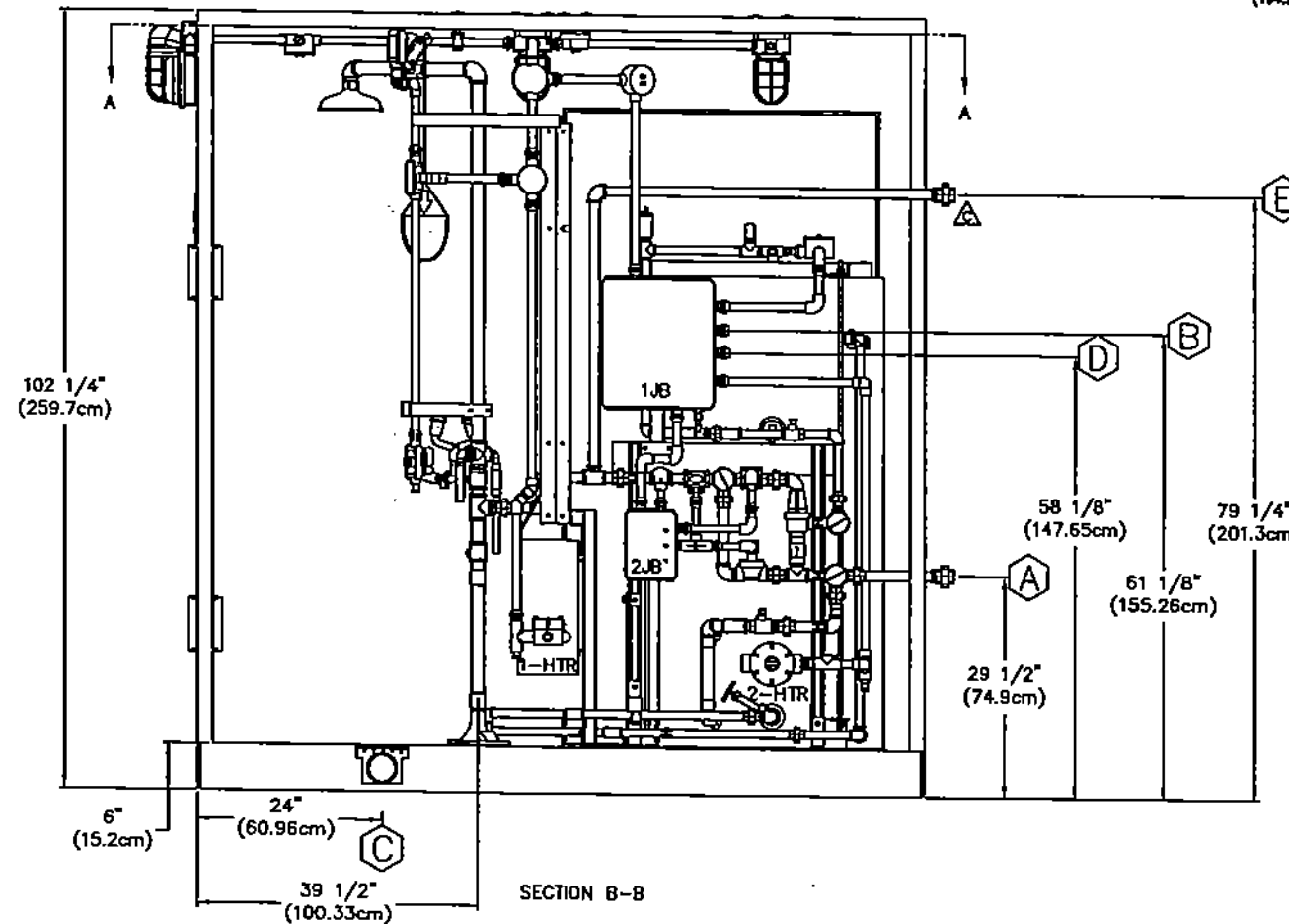
SECTION A-A



**FOR
INFORMATION
ONLY**




FRONT VIEW



SECTION B-B

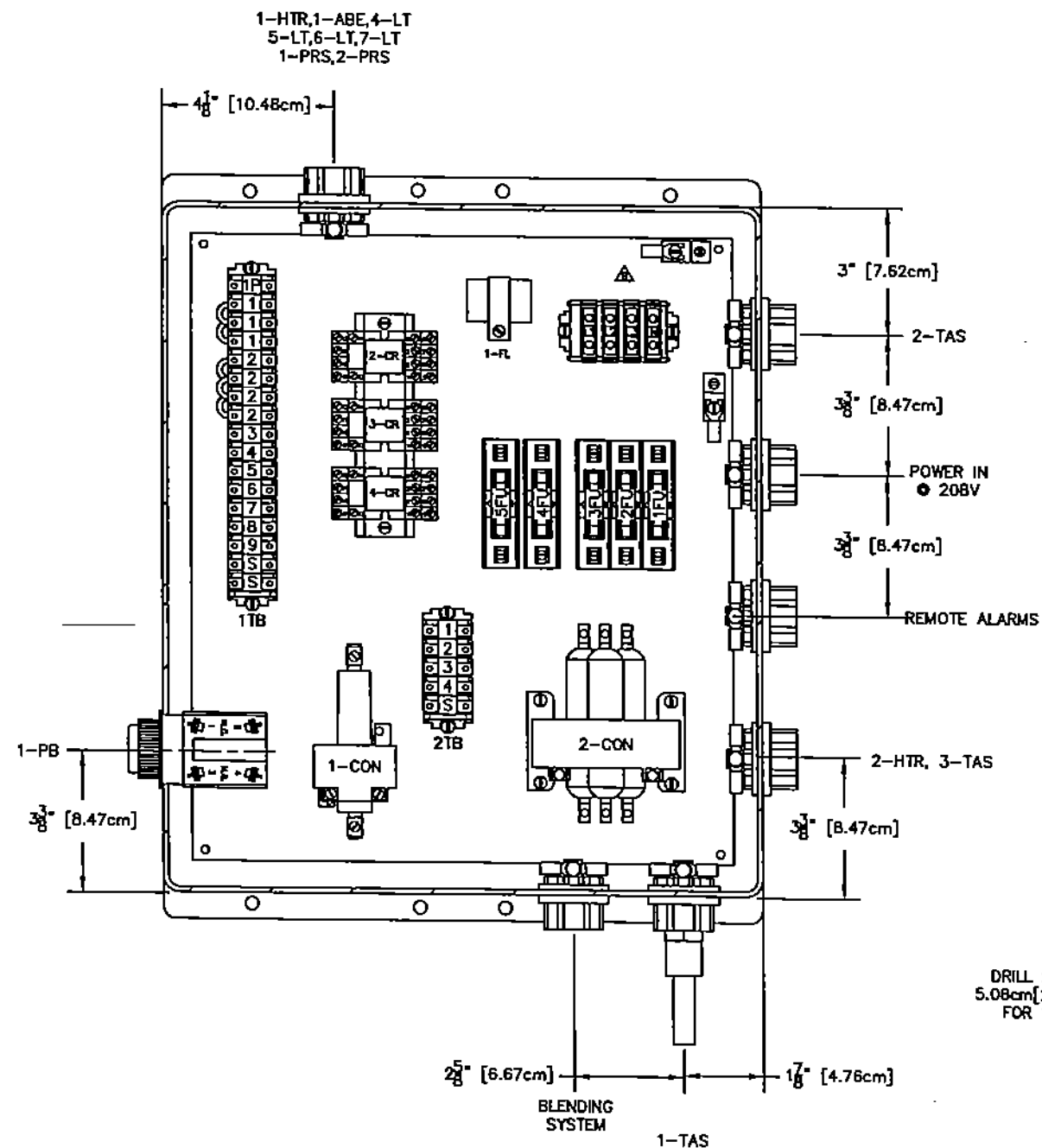
SHEET DIRECTORY	
DESCRIPTION	DRAWING No.
GENERAL ARRANGEMENT	D11450
ELECTRICAL SCHEMATIC	D11450
JOY BOX LAYOUT	D11450
E.B.D.	D11450
COMB GALS. SH/ZE	D11450
FLOW SWITCH C101	C0554

HUSKY OIL OPERATIONS LTD
P.O. NO. 4500124217
ITEM NO. 0040
TEMPERED WATER SYSTEM CHEMICAL BUILDING

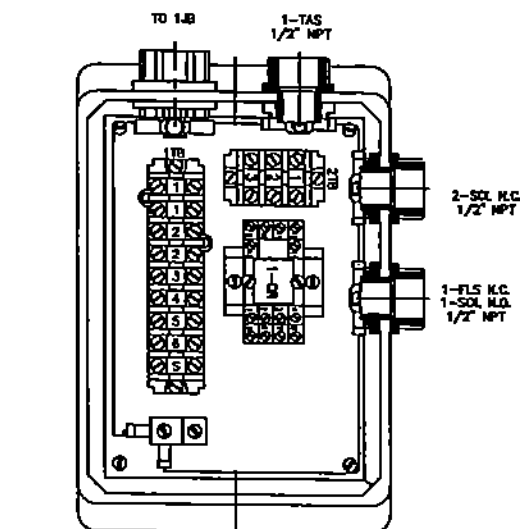
 2825 W. EAM HOUSTON PARKWAY N. HOUSTON, TEXAS 77041 PHONE: (713) 468-1440 FAX: (713) 468-1810 THIS DRAWING & ALL INFORMATION CONTAINED HEREIN IS THE SOLE & EXCLUSIVE PROPERTY OF ENCON SAFETY PRODUCTS CO.	STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED XXX DECIMALS & .005 FRACTIONS & 1/32" XX DECIMALS & .015 RADIUS CORNERS 1/16" X DECIMALS & .010 ANGLES ± 1°		SPECIAL NOTES CL1, DIV.2, GRP.C&D CSA APPROVED SPECIAL TOLERANCES:		TEMPERED WATER SYSTEM CHEMICAL BUILDING BY: CM DATE: 9/13/04 CHK: N/A DATE: N/A APP: VRG DATE: 9/20/04 U.C.: N/A DATE: N/A		TITLE: ARCTIC EMERGENCY SHOWER SYSTEM GENERAL ARRANGEMENT

REV	DESCRIPTION	DATE	BY	CHKD	APPD	DATE	BY	CHKD	APPD
1	REVISED TO ADD 1/2" NPT	01/04/04	GM	N/A	N/A	01/04/04	N/A	N/A	N/A

FUSE TABLE	
1FU	25AMP
2FU	25AMP
3FU	25AMP
4FU	15AMP
5FU	4.5 AMP



COMPONENT LAYOUT FOR 1JB



COMPONENT LAYOUT FOR 2JB

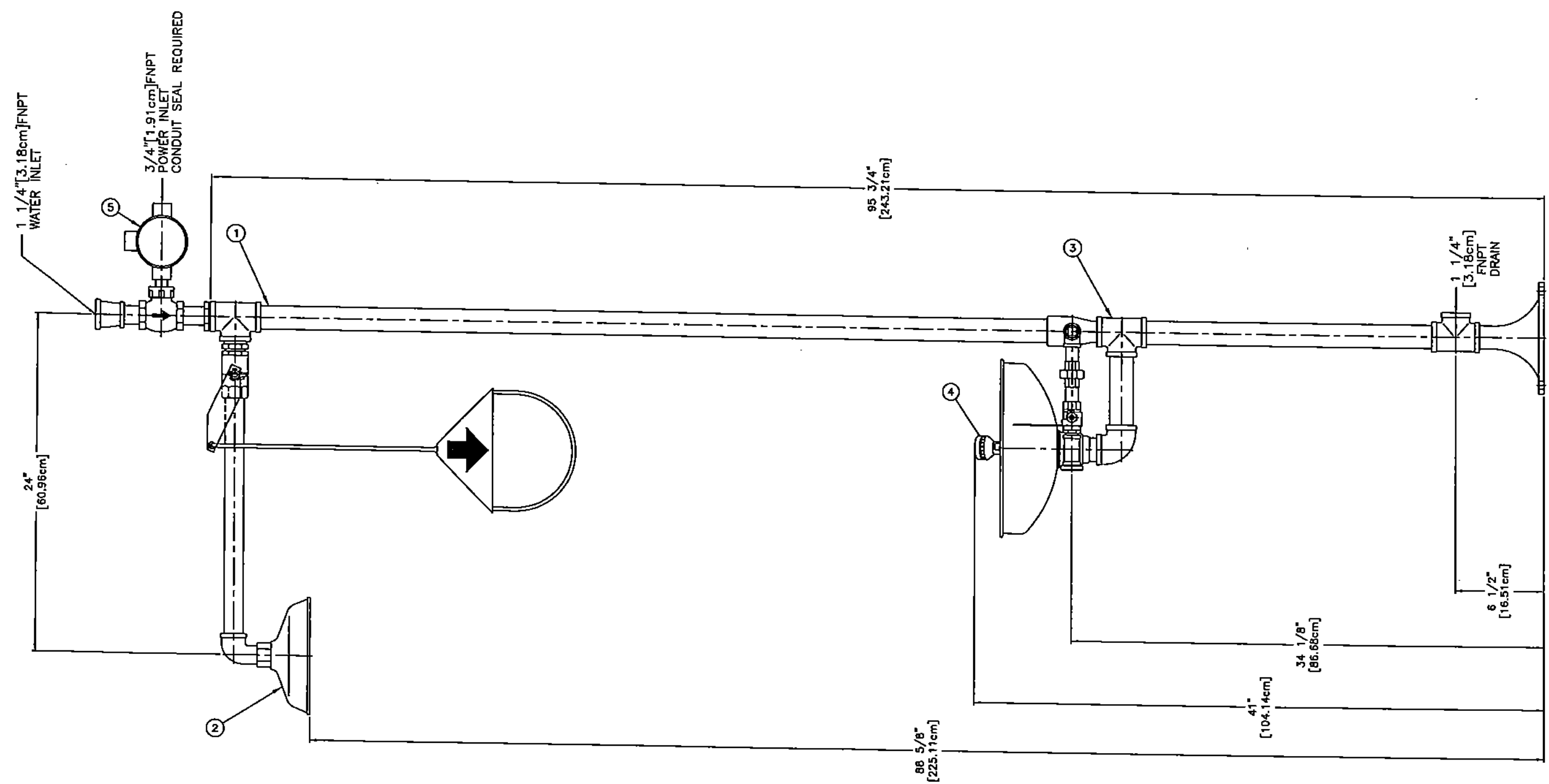
**FOR
INFORMATION
ONLY**

SHEET DIRECTORY	
DESCRIPTION	DRAWING No.
GENERAL ARRANGEMENT	D3149C
ELECTRICAL SCHEMATIC	D3150
JCT BOX LAYOUT	D3151C
P&ID	D3152
COMB GALV SH/EW	D3162
FLOW SWITCH C1D1	C0594

HUSKY OIL OPERATIONS LTD
P.O.NO. 4500124217
ITEM NO. 0040
TEMPERED WATER SYSTEM CHEMICAL BUILDING

Encon SAFETY PRODUCTS 8825 W. SAM HOUSTON PARKWAY N. HOUSTON, TEXAS 77041 PHONE: (713) 468-1449 FAX: (713) 468-1819 THIS DRAWING & ALL INFORMATION CONTAINED HEREIN IS THE SOLE & EXCLUSIVE PROPERTY OF ENCON SAFETY PRODUCTS CO.	STANDARD TOLERANCES UNLESS OTHERWISE SPECIFIED XXX DECIMALS ±.005 XX DECIMALS ±.015 X DECIMALS ±.030 RADIUS CORNERS 1/16"	SPECIAL NOTES: CL1, DIV.2, GRP.C&D CSA APPROVED	BY: GM CHK: N/A APP: VRG M.C.: N/A	DATE: 9/13/04 DATE: N/A DATE: 9/20/04 DATE: N/A	TITLE: JUNCTION BOX LAYOUT 1JB AND 2JB

ITEM	QTY.	PART NUMBER	DESCRIPTION
1	1	03-5000-10	STANDARD SHOWER
2	1	01-0540-05	HEAD YELLOW - 20 GPM
3	1	03-4000-02	SST BOWL W/STRAINER TEE
4	1	01-0521-29	EYEWASH HEAD 400 DSH W/POC
5	1	C0594	FLO SWITCH RAC 120VAC 3AMP C101



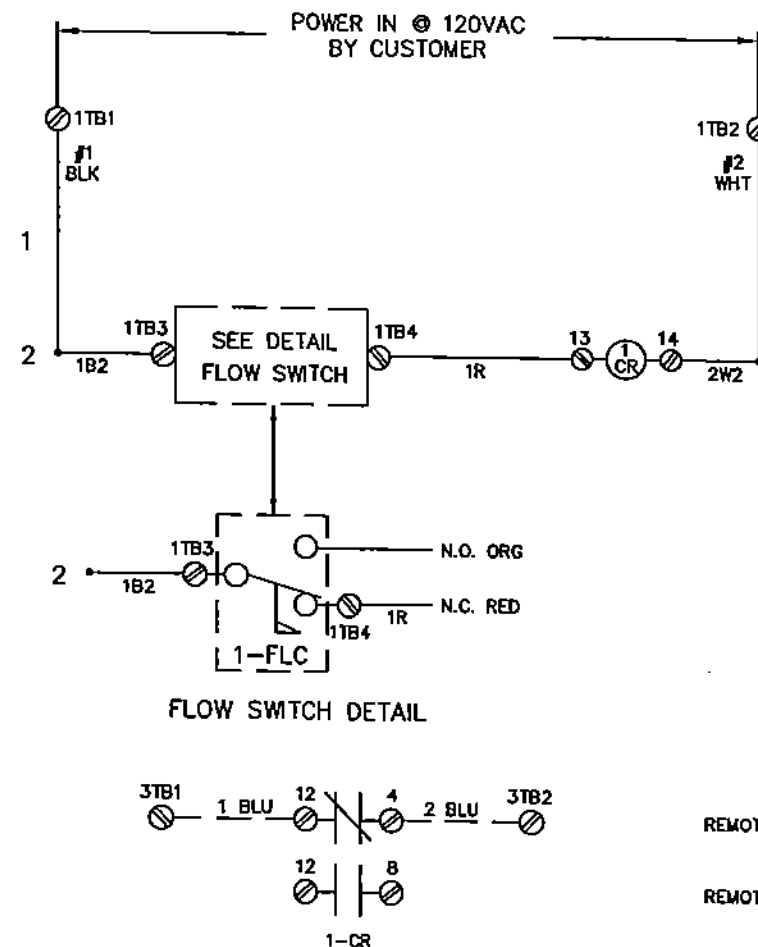
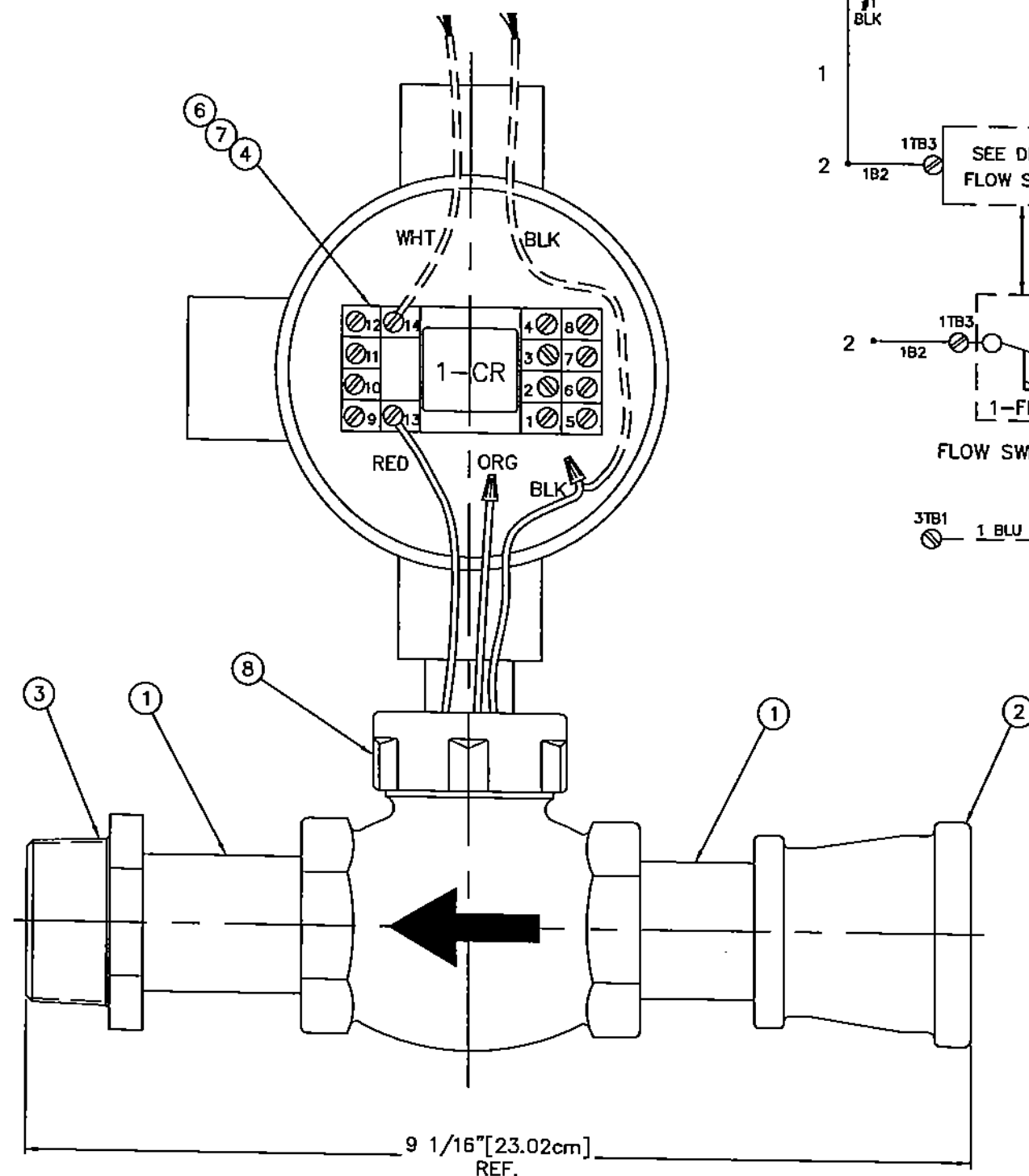
**FOR
INFORMATION
ONLY**

SHEET DIRECTORY	
DESCRIPTION	DRAWING No.
GENERAL ARRANGEMENT	D3149C
ELECTRICAL SCHEMATIC	D3150
JCT BOX LAYOUT	D3151C
P.M.D.	D3152
COMB GALV SH/EW	D3162
FLOW SWITCH C101	C0594

HUSKY OIL OPERATIONS LTD
P.O.NO. 4500124217
ITEM NO. 0040
TEMPERED WATER SYSTEM CHEMICAL BUILDING

REV	DESCRIPTION	DATE	BY	CHKD	APPD	M.C.	ECN#
-----	-------------	------	----	------	------	------	------

POWER IN
CUSTOMER TO PROVIDE
CONDUIT SEAL AT POWER ENTRY



ITEM	QTY	PART NUMBER	DESCRIPTION
1	2	00-0007-02	NIP G 1 X 2 1/2 S80
2	1	00-0019-15	REDUCER BELL G 1 1/4 X 1
3	1	00-0023-07	BSHG G 1 1/4 X 1
4	1	00-0133-93	RELAY 3 AMP 120V PB KHS17A12
5	2	00-0134-13	NUT WIRE #73B IDEAL
6	1	00-0146-15	BRACKET MTG FLOW SWITCH RELAY
7	1	00-0146-38	SOCKET IDEC #SY4S-05
8	1	00-0147-58	FLO SWITCH 2GPM FS 200 SERIES 1" C101

**FOR
INFORMATION
ONLY**

NOTES:

1. EPOXY RELAY MOUNTING BRACKET TO UNILET.
2. PERIODICALLY REMOVE BONNET AT TOP OF SWITCH & INSPECT FOR DEBRIS ON THE SHUTTLE & MAGNET.
3. DIRT & PARTICULATE METAL CHIPS CAN CAUSE THE SWITCH TO MALFUNCTION.
4. SELECT FLOW SWITCH MODE OF OPERATION N.O. OR N.C. BY CONNECTION PROPER LEAD TO TERMINAL 13 ON RELAY.
5. SELECT DESIRED REMOTE CONTACT TERMINALS FROM SCHEMATIC FOR 1-CR & CONNECT REMOTE LEADS.
6. FLOW SWITCH RATED AT 20VA WITH RELAY SYSTEM & CAN HANDLE 3A AT 120V.

Encon
SAFETY PRODUCTS
6825 W. SAM HOUSTON PARKWAY N.
HOUSTON, TEXAS 77041
PHONE: (713) 466-1449
FAX: (713) 466-1819
THIS DRAWING & ALL INFORMATION CONTAINED HEREIN IS THE
SOLE & EXCLUSIVE PROPERTY OF ENCON SAFETY PRODUCTS CO.
REPRODUCTION IN WHOLE OR IN PART WITHOUT THE EXPRESSED
WRITTEN PERMISSION IS PROHIBITED.

STANDARD TOLERANCES
UNLESS OTHERWISE SPECIFIED
XXX DECIMALS ±.005 FRACTIONS ± 1/32"
XX DECIMALS ±.015 RADIUS CORNERS 1/16"
X DECIMALS ±.030 ANGLES ± 1°

SPECIAL NOTES:

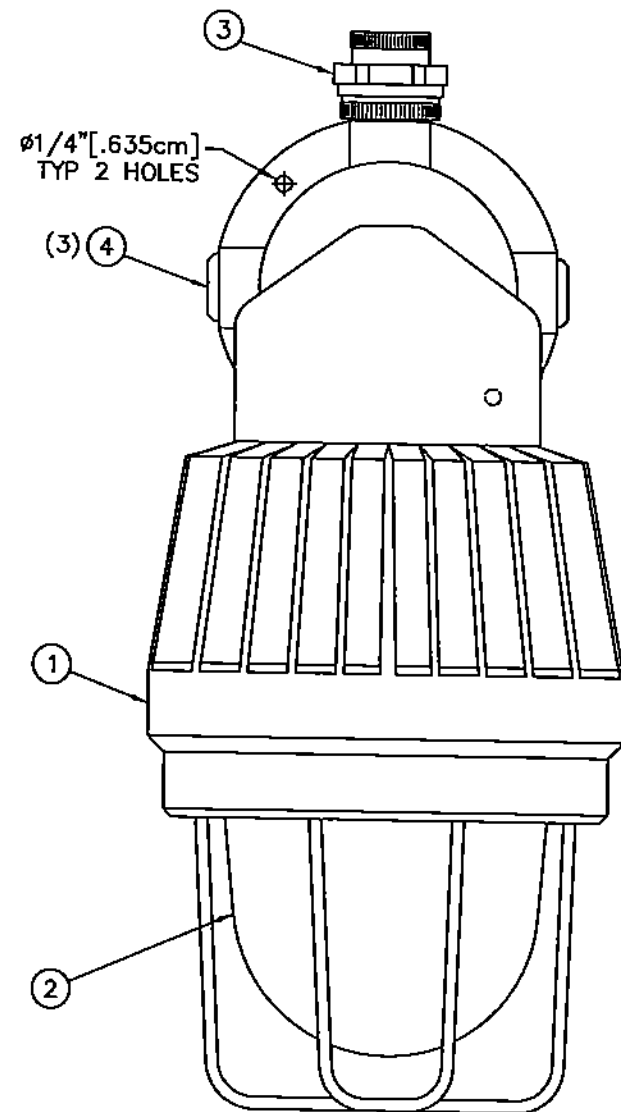
SPECIAL TOLERANCES:

BY: VRG DATE: 9/20/04
CHK: N/A DATE: N/A
APP: DATE:
M.C.: DATE:
EPF: 03-244F

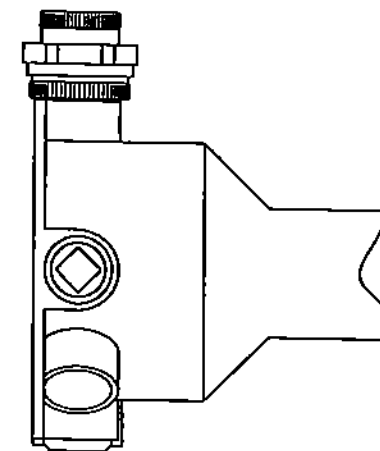
TITLE: ALARM KIT
FLOW SWITCH
CL.1, DIV.1, GRP.C&D
PDN: 50-0074-06A

REV	DESCRIPTION	DATE	BY	CHKD	APPD	M.C.	ECN#

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	00-0144-90	LIGHT FIXTURE & BRKT EM115B2G
2	1	00-0137-48	LIGHT GLOBE GRN KT100SU41G
3	1	00-0134-88	UNION C 3/4 UNY75NR EXPL PROOF
4	3	00-0135-70	PLUG C 3/4 CLOSE UP PLG75R



FRONT VIEW



PARTIAL SIDE VIEW

FOR
INFORMATION
ONLY

6825 W. SAM HOUSTON PARKWAY N.
HOUSTON, TEXAS 77041
PHONE: (713) 466-1449
FAX: (713) 466-1819

STANDARD TOLERANCES
UNLESS OTHERWISE SPECIFIED

XXX DECIMALS ±.005 FRACTIONS ± 1/32"
XX DECIMALS ±.015 RADIUS CORNERS 1/16"
X DECIMALS ±.030 ANGLES ± 1°

THIS DRAWING & ALL INFORMATION CONTAINED HEREIN IS THE
SOLE & EXCLUSIVE PROPERTY OF ENCON SAFETY PRODUCTS CO.
REPRODUCTION IN WHOLE OR IN PART WITHOUT THE EXPRESSED
WRITTEN AUTHORIZATION FROM ENCON IS PROHIBITED.

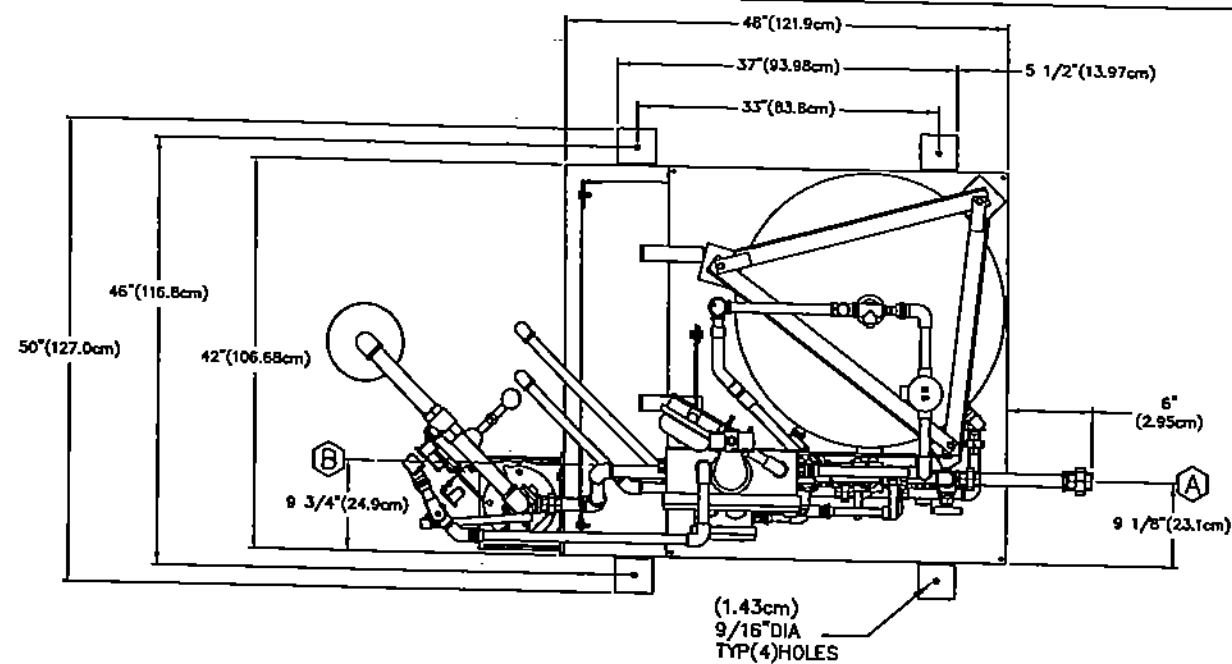
SPECIAL NOTES:

SPECIAL TOLERANCES:

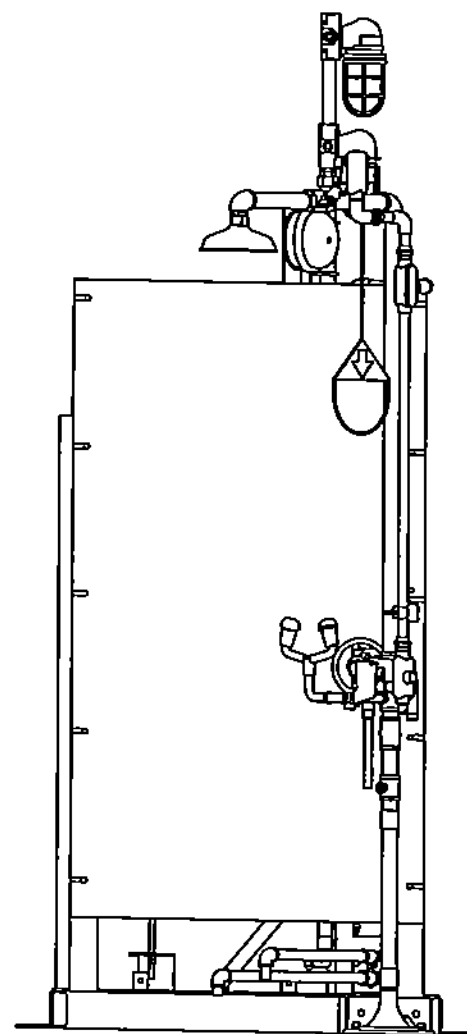
BY: VRG DATE: 9/20/04
CHK.: N/A DATE: N/A
APP.: DATE:
M.C.: DATE:
EPF# 03-244G

TITLE: AREA LIGHT ASSY
GREEN
CL.1, DIV.1, GRP.C&D

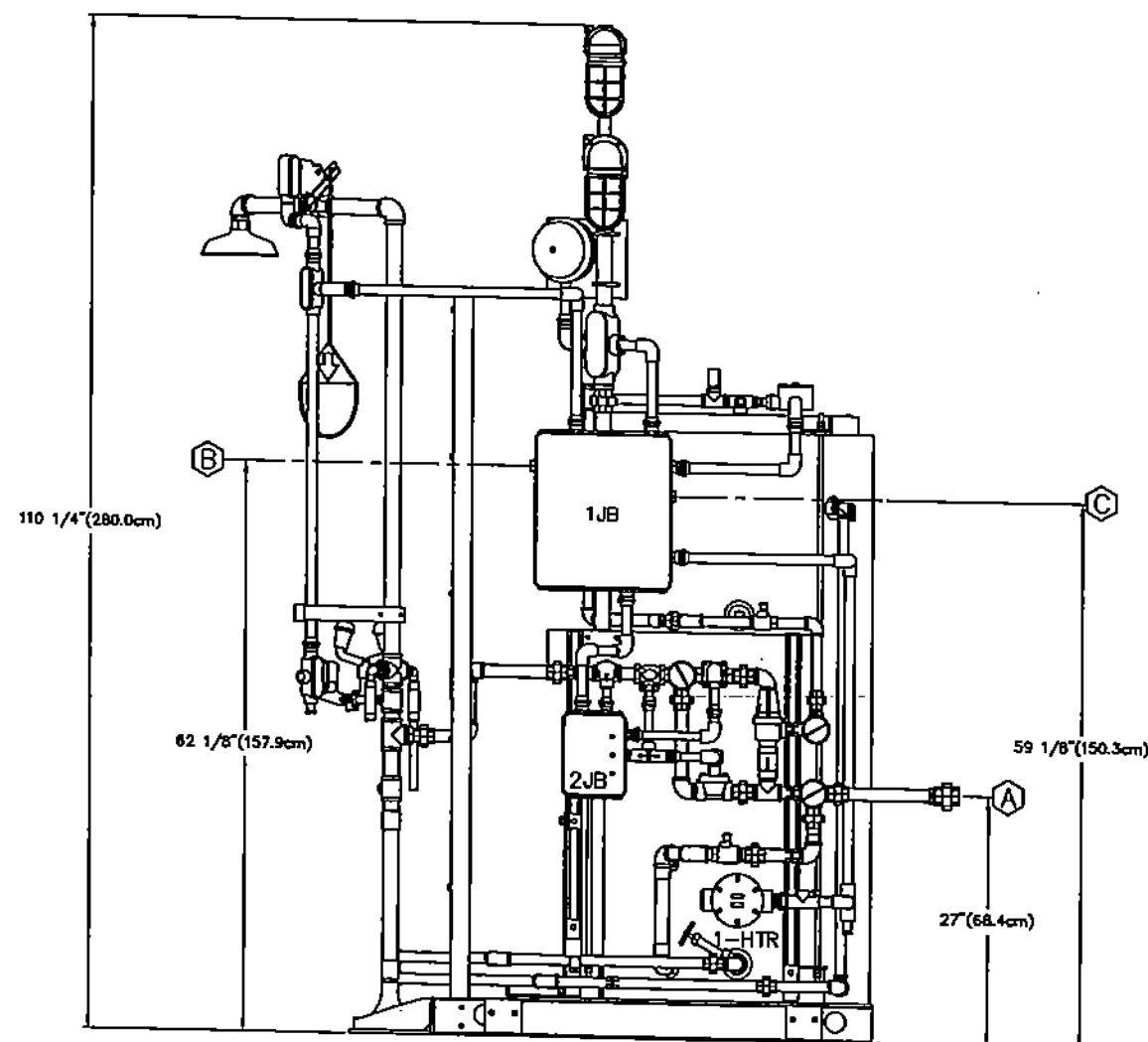
C	3/4"	ELECT. POWER IN @ 208V
B	3/4"	REMOTE ALARMS
A	1 1/2"	COLD WATER INLET
	SIZE	DESCRIPTION
CUSTOMER CONNECTIONS		
NOTE: ALL INTERFACE DIMENSIONS + 1/2"		



PLAN VIEW



LEFT VIEW



FRONT VIEW

**FOR
INFORMATION
ONLY**

SHEET DIRECTORY	
DESCRIPTION	DRAWING No.
GENERAL ARRANGEMENT	D3194C
ELECTRICAL SCHEMATIC	D3195
JCT BOX LAYOUTS	D3196C
P. & I.D.	D3197

HUSKY OIL OPERATIONS LTD
P.O. NO. 4500124217
ITEM NO. 0070
TEMPERED WATER SYSTEM COOLING WATER BUILDING

Encon SAFETY PRODUCTS
5025 W. SAN HOUSTON PARKWAY N.
HOUSTON, TEXAS 77041
PHONE: (713) 468-1449
FAX: (713) 468-1819
THIS DRAWING & ALL INFORMATION CONTAINED HEREIN IS THE
SOLE & EXCLUSIVE PROPERTY OF ENCON SAFETY PRODUCTS CO.

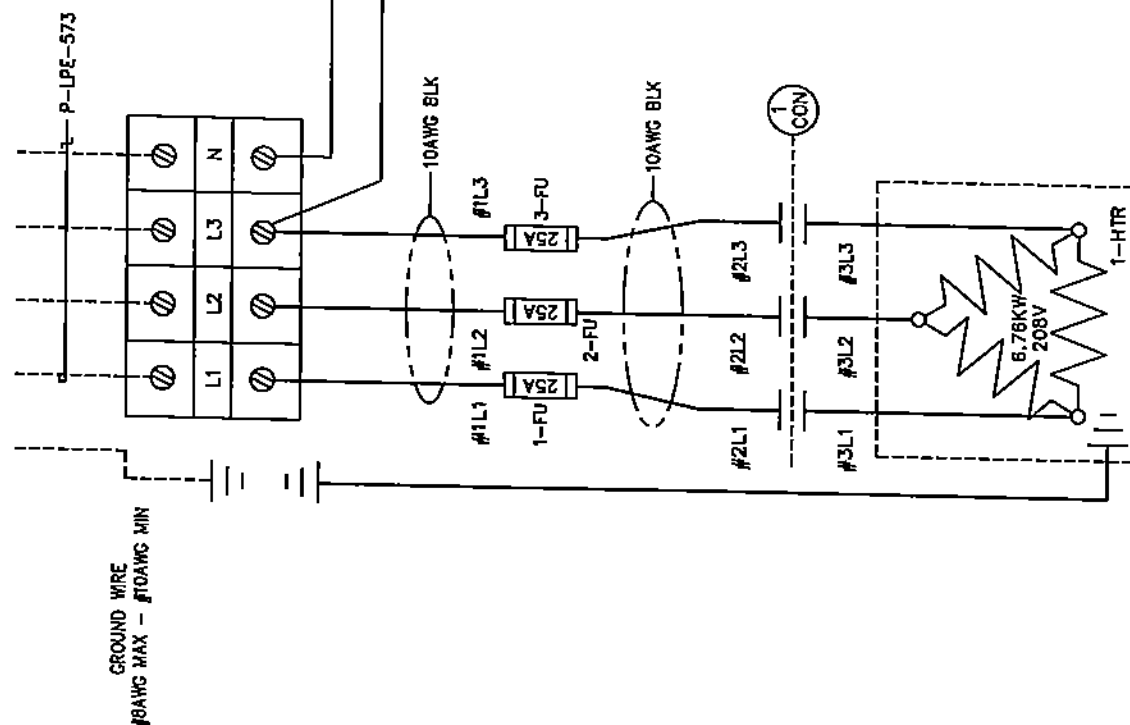
STANDARD TOLERANCES
UNLESS OTHERWISE SPECIFIED
X.XX DECIMALS ±.005 FRACTIONS ± 1/32"
X.X DECIMALS ±.015 RADIUS CORNERS 1/16"

SPECIAL NOTES:
NEMA 4X
CSA APPROVED
SPECIAL TOLERANCES:

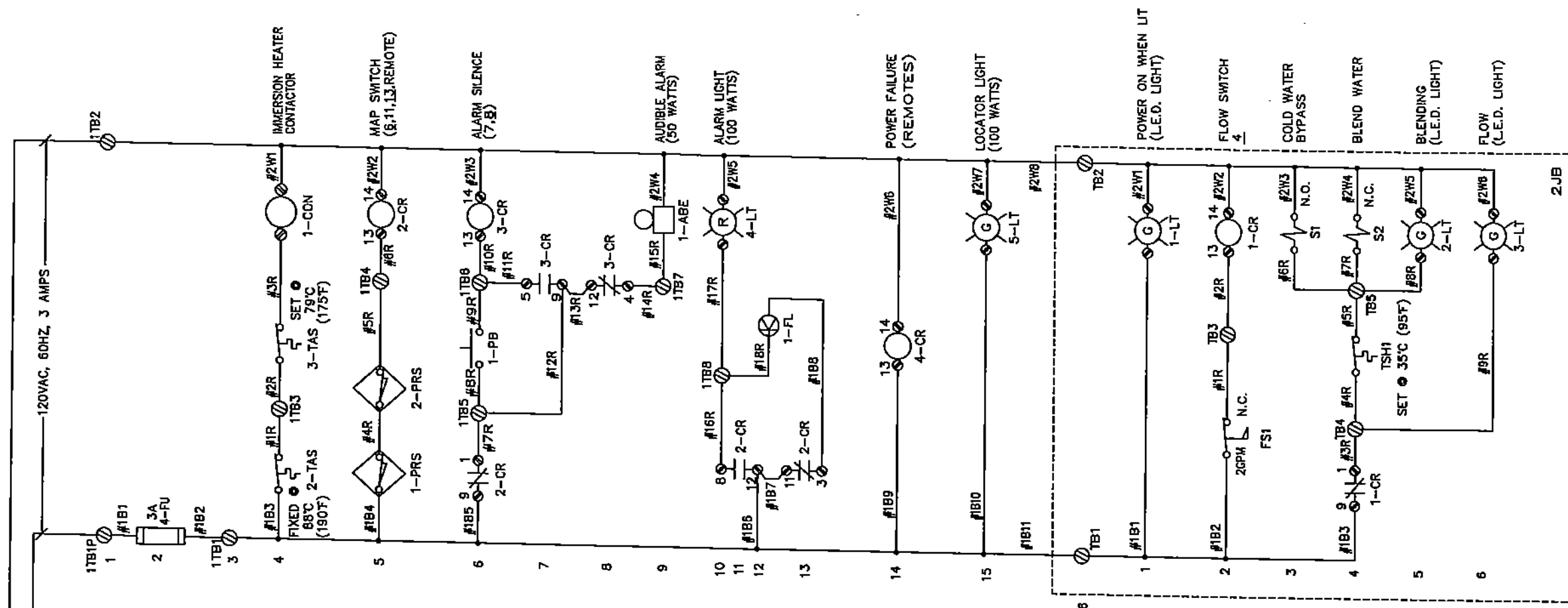
BY: CM	DATE: 9/14/02
CHK: N/A	DATE: N/A
APP: N/A	DATE: N/A
M.C: N/A	DATE: N/A

TITLE: ARCTIC EMERGENCY
SHOWER SYSTEM
GENERAL ARRANGEMENT

CUSTOMER POWER IN
3PH/60HZ/208V
CUSTOMER TO PROVIDE
OVERCURRENT PROTECTIVE DEVICE
MINIMUM 25AMPS
PBAWG MAX - 170AWG MIN
COPPER CONDUCTOR



SYSTEM SCHEMATIC
1 JB
(SEE NOTE 1)

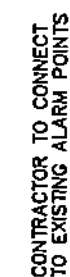


NOTE:

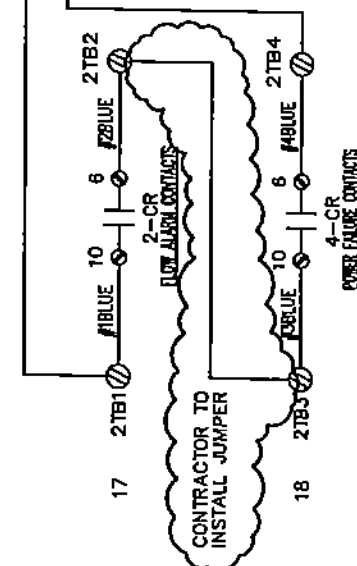
1) SYSTEM SCHEMATIC COMBINES THE SCHEMATICS OF 1JB AND 2JB. WIRE AND COMPONENT NUMBER SEQUENCE IS SPECIFIC TO INDIVIDUAL JUNCTION BOXES.

WIRE GAUGE LEGEND

14AWG _____
12AWG _____
10AWG _____
CUSTOM _____



BLENDING SYSTEM



ENERGIZED BY REMOTE CIRCUIT
120V-3AMP MAXIMUM

SHEET DIRECTORY	
DESCRIPTION	DRAWING NO.
GENERAL ARRANGEMENT	D3194C
ELECTRICAL SCHEMATIC	D3195
JCT. BOX LAYOUTS	D3196C
P. & I.D.	D3197

HUSKY OIL OPERATIONS LTD
P.O.NO. 4500124217
ITEM NO. 0070
TEMPERED WATER SYSTEM COOLING WATER BUILDING

BY: G.M.	DATE: 8/14/04	TITLE: SCHEMATIC MAIN JCT BOX TEMPERED WATER SYSTEM
CHECK: N/A	DATE: N/A	
APP: DATE:		
M.C.: N/A	DATE: NA	

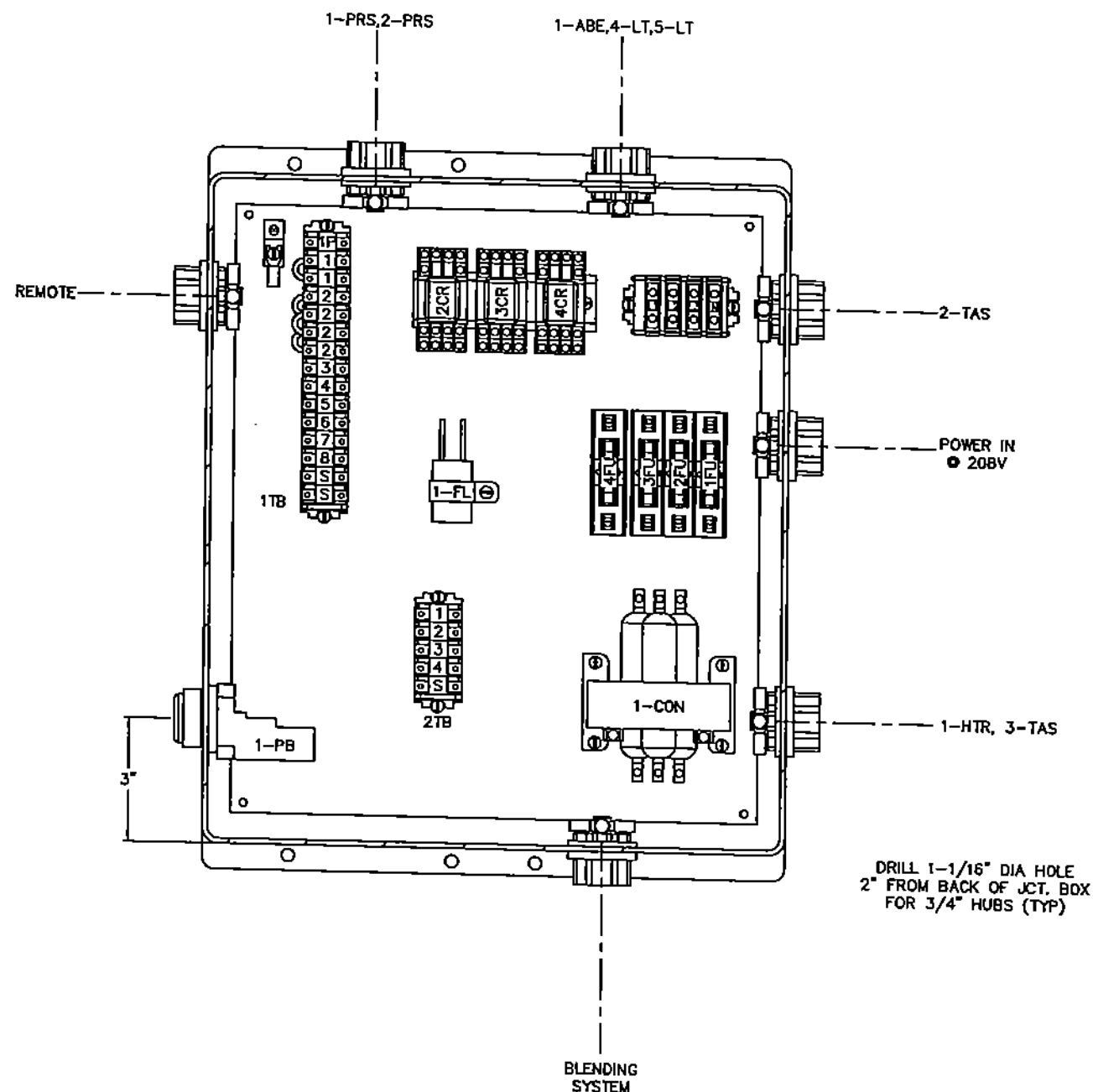
STANDARD TOLERANCES
UNLESS OTHERWISE SPECIFIED

XXX DECIMALS ±.005	FRACTIONS ± 1/32
XX DECIMALS ±.015	RADIUS CORNERS 1/16
X DECIMALS ±.030	ANCHITS ± 1/16

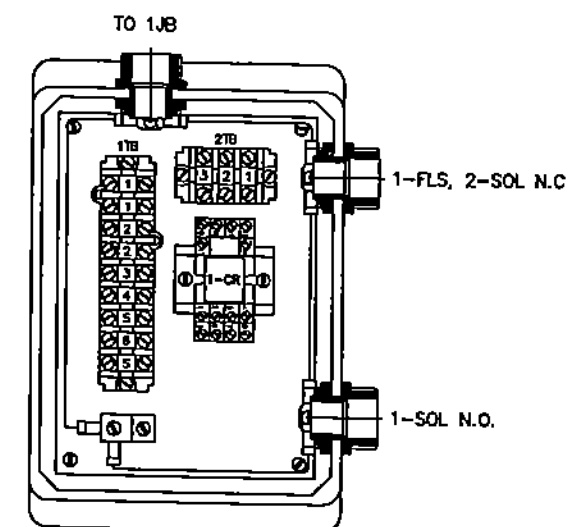
SPECIAL NOTES:	NEMA 4X CSA APPROVED
SPECIAL TOLERANCES:	

BY:	G.M.	DATE: 8/14
CHK:	N/A	DATE: N/A
APP:		DATE:
M.C.:	N/A	DATE: NA

TITLE: SCHEMATIC
 MAIN JCT BOX
 TEMPERED WATER SYSTEM



COMPONENT LAYOUT FOR 1-JB
SEE 85-6001-03 FOR STANDARD LAYOUT.



COMPONENT LAYOUT FOR 2JB
BLENDING SYSTEM

FUSE TABLE	
1FU	25AMP
2FU	25AMP
3FU	25AMP
4FU	3.0AMP

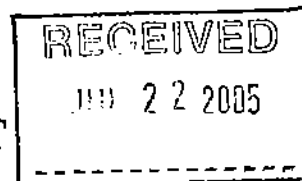
**FOR
INFORMATION
ONLY**

SHEET DIRECTORY	
DESCRIPTION	DRAWING No.
GENERAL ARRANGEMENT	D3194C
ELECTRICAL SCHEMATIC	D3195
JCT BOX LAYOUTS	D3196C
P. & I.O.	D3197

HUSKY OIL OPERATIONS LTD
P.O.NO. 4500124217
ITEM NO. 0070
TEMPERED WATER SYSTEM COOLING WATER BUILDING

13) Inspection & Consultant Reports / Miscellaneous

- ☐ Construction Supervisor Reports
- ☐ Coating & Inspection Reports
- ☐ Foundation Reports
- ☐ Process Equipment Inspections
- ☐ QA/QC Inspection Reports
- ☐ Weekly Cost Reports



ELECTRICAL CONSTRUCTION PROJECT INSPECTION REPORT

Husky Energy
Highway 16 East
Lloydminster, SK S9V 0Z8

Tech Leader: Al MacLaughlan

Date: July 11, 2005

Inspection: #1

Plant/Business Unit: Lloydminster Refinery

Project Leader: Russ Booth (Integra Energy Consulting, 4201-66 Ave. Lloydminster, Ab. T9V-2Y7)

Electrical Contractor: Flint Energy Services

Project: Polyphosphoric Acid Injection System

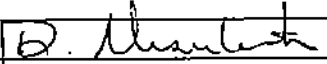
A.F.E. # RP-00398

Accompanied by Graham Blore (Husky Energy), an electrical inspection of the above noted project was conducted on July 11, 2005.

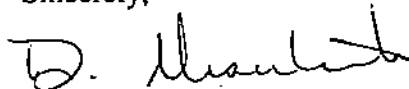
During the course of our inspection, our observations and comments are as follows:

The installation of the armoured cables and terminations, cable tray and bonding, installation of the Polyphosphoric Acid Injection building is complete and acceptable.

NOTE: Items that are identified as a (NON-COMPLIANCE) are important and must be addressed, however, those that are specifically identified with an asterisk (*) are to be addressed without delay.

The Inspections Group Inc./S.C.O.# D422		
The installation is acceptable.		
Don Ursuliak		July 11, 2005
Print Name	Signature	Date

Sincerely,



Don Ursuliak
Electrical Safety Codes Officer # D422

cc: Doug Zakaib, P. Eng. (Husky Energy - Calgary)
David E. Oliver (Husky Energy- Lloydminster)
Dwayne McConnell (Flint Energy Services- Lloydminster)

CONCRETE TEST CYLINDER REPORT

Original
amec

TO:

GLM Oilfield Construction Ltd.
PO Box 442
Lloydminster, Saskatchewan S9V 0Y4

OFFICE: Lloydminster
PROJECT NO. AX2174
CLIENT: GLM Oilfield Services
COPIES TO: GLM Oilfield Services

PROJECT: Acid Injection Building; Husky Lloydminster Refinery

SET NO. 174.03		NO. OF CYLINDERS: 6		DATE RECEIVED:		DATE CAST: 03 May 2005	
LABORATORY IDENTIFICATION NO.	FIELD OR SAMPLE NO.	DATE TESTED	AGE AT TEST (DAYS)	COMPRESSIVE STRENGTH (MPa)	TYPE OF FRACTURE**		
45785	Field Cure	10 May 2005	7	34.0			
45786		31 May 2005	28	43.4			
45787		31 May 2005	28	43.1			
45788		12 May 2005	9	30.3			
45789		FC -	Discarded				
45790		FC -	Discarded				

SPEC. STRENGTH	35	MPa	CONCRETE TEMP.	21	°C	SLUMP	AIR CONTENT
CEMENT TYPE	50		AIR TEMP.	14	°C	SPEC. - mm	- %
CEMENT CONTENT	N/S	kg/m ³	CAST TIME	11:55		ACTUAL 80 mm	4.0 %
AGGREGATE SIZE	20	mm	CAST BY	AMEC/db/ts		PLASTIC DENSITY	kg/m ³
ADMIXTURE	AEA, WRDA		MOLD TYPE	Plastic		HARDENED DENSITY	kg/m ³
SUPPLIER	Border City Concrete		INITIAL CURING TEMP.	MAXIMUM	°C	MINIMUM	°C
MIX NO.	--		LOCATION: Floor Slab - northwest corner				
TRUCK NO.	88						
TICKET NO.	11146						
BATCH TIME	11:10						
LOAD VOLUME	6	m ³	COMMENTS: Materials Testing Terms & Conditions attached. Driver added water to load after test sample taken.				
CUMULATIVE VOL.	6	m ³					

ON SITE CURING CONDITIONS:



**TY FAIL FRACTURE REQUIRED WHEN CYLINDER MEET SPECIFIED 28 DAY STRENGTH.

NOTES:

- Portions of test performed by AMEC Earth & Environmental were in accordance with CSA CAN A23.2 unless otherwise noted.
- Cylinders are nominal 100 mm (dia) x 200 mm in height unless otherwise noted.

AMEC Earth & Environmental,
a division of AMEC Americas Limited

Per

PFM Engineering Ltd.
5115 'B' 55 Avenue
Lloydminster, Ab. T9V 0Z2

Phone (780) 875 3331
Fax (780) 875 8288
e-mail pfmeng@telus.net

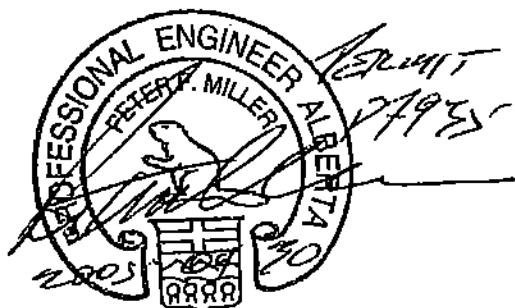
**HUSKY REFINERY, LLOYDMINSTER
ACID PAD**

SPECIFICATION

EXCAVATE:	To bottom of fill Minimum 4' 0" below top of concrete pad
GEO FABRIC	Install geo fabric to bottom of excavation
FILL	3/4" well graded granular fill Compact in 6" lifts to 98% standard proctor Confirm compaction with test on top 12"
REINFORCING	Bottom mat M15 rebar, 12" o.c. e.w. Chair 2" off base Top mat M15 rebar, 18" o.c. e.w. Chair for 3" top cover
CONCRETE	Design strength 30 mPa. 28 day type 50 sulfate resistant 1-1/4" aggregate moisten base prior to placing concrete vibrate concrete Finish as required by owner Apply curing agent or keep wet for 7 days Field cure 4 test cylinders
FOR FAST CURE	Option 1 Increase strength to 35 mPa Cover with insulated tarp for 7 days Option 2 Install glycol heating pipes Cover with insulated tarp Cure maximum temperature 100 degrees F.
SERVICE	Construction loads may be imposed at 18 mPa. strength break cylinder at 5 days Full loads may be imposed at 25 mPa strength break cylinder at 10 days.

April 29 2005

Peter Miller, P.Eng.





Husky Energy

Facsimile Cover Sheet

To: RUSSEL BOOTH From: Phil Weighill
Company: INTEGRA ENG. Company: ☐ Lloydminster Refinery
Phone: 875 8847 Phone: 780-871-6573
Fax: 875 8909 Fax: ☒ (780) 871-6698

Date: MAY 2nd/05

Pages including this
Cover Page: 2

Comments:

Please advise on what option of core
we are to use.

BAR WORK COMPLETED MAY 1st.
Final Core Tester morning of MAY 2nd/05.
We propose to start forming & placing of steel
on May 2nd and pour core on MAY 3rd.

I would suggest 35mPA Option #1. AS
a Backup, install rubber hose but only use
if strength is not adequate when Breaking 10 day
Cylinder.

If this fax was not received in a readable form, please call the sender.

Please call me on my cell & we
will discuss. 8084014 regards

Bryan Stoff

KLINGER BUILDING SYSTEMS
5702 - 50 AVE.
Lloydminster, Alta.

BUILDING SPECIFICATIONS

QUOTE # P6485R2
DATE: APR 29/05

CUSTOMER: INTEGRA ENERGY CONSULTING
ADDRESS: LLOYD, AB

ATTENTION: RUSSEL BOOTH

DIMENSIONS: 16' WIDE x 26' 1 1/2" LONG x 12' HIGH
SELF-FRAMING CATALYST INJECTION BLDG - HUSKY REFINERY

DESIGN: NBC LATEST EDITION

ROOF SYSTEM: - GABLE STYLE 4:12 SLOPE
- 22 GAUGE GALVANIZED PANEL - 3 Inch Panel Ribs
- R20 (6 Inch) FIBERGLASS BATT INSULATION
- 24 GAUGE WHITE FLUTED ALUMINUM LINER PANEL
- 6 MIL POLY (VAPOR BARRIER)

WALL SYSTEM: - 22 GAUGE GALVANIZED PANEL
- R12 (3.5 Inch) FIBERGLASS BATT INSULATION
- 24 GAUGE WHITE FLUTED ALUMINUM LINER PANEL
- 6 MIL POLY (VAPOR BARRIER)

ACCESSORIES:

DOORS (c/w 16 gauge steel frame, 20 gauge steel leaf, metal threshold, weatherstrip, sweep & check chain)
2 - 3'0 x 7'0 INSULATED
2 - 2'0 x 2'0 INDUSTRIAL WIRE GLASS WINDOW IN DOOR
2 - 44 TP VON DUPRIN PANIC HARDWARE

WINDOWS: N/A

LOUVERS: 1 - 24 x 24 ADJUSTABLE LOUVER c/w BIRD SCREEN AND WING NUT LOCK

VENTILATORS: 1 - CANARM S12-E1 WALL MOUNT EXHAUST FAN c/w 120V X.P. MOTOR AND STORM HOOD

PIPE CUTOUTS: SEE ACCESSORIES

EAVE/ACCESSORIES:

52 ft - VENDOR'S STANDARD GALVANIZED EAVESTROUGH
30 ft - VENDOR'S STANDARD GALVANIZED DOWNSPOUT
52 ft - VENDOR'S STANDARD ICERAKES

Terr:

Please record as
work ticket in P.O. 510
Thanks Russ

18,590.00

Husky P.O.

4500136304

A/C 82248

can't use
code
81001

ENTERED MAY - 3 2005

Page2

QUOTE # P6485R2

OTHER ACCESSORIES:

- TWO(2) 7' x 11'6" REMOVABLE ENDWALL PANELS
- TWO(2) 10" x 10" WALL OPENINGS FOR FUTURE PIPING
- PATCHING OF THE ABOVE OPENINGS ONCE PIPES ARE INSTALLED
- 20' LONG x 6" THROAT RIDGE VENT c/w CHAIN OPERATED DAMPERS
- CONCRETE WEDGE ANCHORS
- ** - TWO(2) 4' x 8' REMOVABLE WALL PANELS

QUOTATION:

1. Klinger Building Systems will supply and erect the described building
AT THE HUSKY LLOYD REFINERY for the amount of;

EIGHTEEN THOUSAND FIVE HUNDRED NINETY DOLLARS (\$18,590.00)

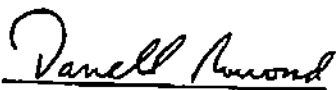
- All taxes are extra.

NOTES:

- THE LOUVER SIZE MATCHES THE CFM CAPACITY OF THE FAN
- ** - INTERIOR CEILING HEIGHT AT PEAK IS 14' - CONFIRM EQUIPMENT REQUIREMENTS
- ** - MINIMUM OF 24" REQUIRED AROUND PERIMETER OF BLDG

2. Please note our standard Terms and Conditions (attached) for all construction projects undertaken at Klinger Building Systems.

Submitted by:



Darrell Nowosad
(780) 875-9811

TERMS & CONDITIONS

Delivery is 1 - 2 weeks after approved drawings and is subject to confirmation at time of purchase. This quotation is valid for a period of thirty days unless noted otherwise.

2. Drawings stamped by Professional Engineer are available on request at an Additional cost. No permits have been allowed for in this proposal.
3. The proposal assumes that workmen have free and easy access to the work. There is no cost allowance in the proposal for constructing work platforms, bridging trenches, ect.
4. Wall and roof penetrations, when encountered unexpectedly, may be subject to additional charge.
5. Work will be performed using standard electrical tools unless noted otherwise in the quotation.
6. Building adjustments or excavation necessary because site is not reasonable square or level may result in additional charges. Unless otherwise noted, no foundation is included in our proposal.
7. Removal of electrical and mechanical fixtures is to be performed by others unless noted otherwise. No electrical or mechanical work is included in this proposal.
8. Saskatchewan Education & Health Tax is not Included unless noted otherwise.
9. Invoices are due and payable within 30 days of the date of the invoice.
10. Building shall be designed to withstand the loadings established by the National Building Code of Canada, Latest Edition unless noted otherwise in the quotation.
11. The Code of Standard Practices of the Canadian Sheet Metal Building Institute, 1982 Edition, for pre-engineered metal buildings shall cover the design, fabrication and erection of the buildings.
12. All shop and field labor shall be performed by NON-UNION LABOR.
13. Product sale may be subject to credit approval.

HUSKY OIL
PURCHASE REQUISITION

2005.04.29

Requisition Number: 10249696
Purchasing Group: 035 Amber Corps

Plant: RF01

Item	Material	Delivery Date	Order Quantity	UOM	Price Per Unit	Net Value
------	----------	---------------	----------------	-----	----------------	-----------

0010		2005.05.09	1.000	EA	17,760.00 / 1	17,760.00
------	--	------------	-------	----	---------------	-----------

16' x 26' x 12' Self-framing Building
Unloading Point: Refinery Capital Warehouse Recipient: P. Weighill

Item Text
16' x 26' 1 1/2" x 12' high Self-framing catalyst injection skid building for refinery poly acid skid project.
As per quote # P6485R1 from Klingers Building Systems dated April 28, 2005. Copy of quote forwarded to M<(>&<)>SM.
\$17,760 + tax FOB Refinery includes erection of building on site.

Vendor: 323906 KLINGER BUILDING SYSTEMS (Desired)
Requisitioner: None identified on requisition
Release Strategy: 04 Requisition has not been released yet
Purchase Order: 4500136304 / 00010

0020		2005.05.09	1.000	EA	830.00 / 1	830.00
------	--	------------	-------	----	------------	--------

Price Adder for Removeable Panels
Unloading Point: Refinery Capital Warehouse Recipient: P. Weighill

Item Text
Price adder to original quote for 2 extra removeable 4' x 8' wall panels required for installation of the poly acid skid.
As per revised Klinger's quote P6485R2 dated 29 April 2005, the price adder comes to \$830 (e.g., revised \$18,590 minus original \$17,760)

Vendor: None identified on requisition
Requisitioner: None identified on requisition
Release Strategy: 01 Requisition has not been released yet
Purchase Order: No purchase order has been created for this requisition

Total Cost of Requisition (less taxes):

18,590.00

APPROVAL:

Terri

Please add \$830 to Klinger work order.

Project # P0510

Thanks Russ.

Project # 0510 Cost Tracker



SPARTAN CONTROLS LTD.
and its divisions :
Sterling Valve Automation
Farris Pressure Management

8403 - 51 Ave
Edmonton, AB, T6E 5L9
Phone: 780 440-8335
Fax: 780 466-4624

To:	Company:	Phone:
Russell Booth	Integra Energy Consulting Ltd	780-875-8847
<u>rbooth@integraenergy.net</u>		Fax:
cc: MMW, WON		cc Fax:

From:	Michael Perron	Date:	April 1, 2005
Phone:	780 440-8335	Number of pages:	2
EMail:	perron.michael@spartancontrols.com	Quote:	383287 SQ
Reference:	Husky Refinery Flow Meters	Revision #	1

Spartan Controls is pleased to submit this revised proposal for the following Emerson Process Management Micro Motion Division flow and density meter. We deleted item two from our proposal and changed the flange rating of item one to 300 ANSI.

Item	Qty	Description	Price Each
1	1	Micro Motion 2-Inch Flow and Density Meter CMF200M419NBBCEZZZ CMF200M: Micro Motion Coriolis ELITE sensor; 2-inch; 316L stainless steel 419: 2-inch ANSI 300 lb weld neck raised face flange N: Standard pressure containment B: 4-wire extended mount stainless steel integral core processor for remote transmitter B: 1/2-inch NPT - no gland C: CSA E: English Quick Reference Guide and English Manual Z: Reserved for future use Z: No measurement application software Z: Standard product 2700R11ABCEZZZ 2700: Micro Motion Coriolis MVD multivariable flow and density transmitter R: 4-wire remote mount transmitter 1: 18 to 30 VDC and 85 to 265 VAC; self switching 1: Dual line display for process variables and totalizer reset A: One mA; one frequency; RS485 B: 1/2-inch NPT - no gland C: CSA E: English quick reference guide and English manual Z: Flow and density variables (standard) Z: No software options 2 Z: Standard product CMVDSZZ015 -4-wire shielded cable -Overall copper shield with drain wire for grounding -Length of cable - 15 feet PIPEMTKT MICRO MOTION TRANSMITTER PIPE MOUNTING KIT	\$17,283.00

ENTERED APR 28 2005
AS WT

GENERAL NOTES:

1. Shipment is 3 weeks, after receipt of order.
2. Shipment is based on quantities quoted and subject to prior sale.
3. If the standard delivery quoted above is not acceptable, please advise, as we may be able to expedite the order quicker than indicated.
4. Ex Works Spartan Controls, Edmonton.
5. Terms are net 30 days. G.S.T. is extra at 7%. P.S.T. is extra if applicable.
6. Quotation is valid for 30 days.
7. The equipment quoted is offered on the information provided. Ultimately, it is the responsibility of the system designer and the end user to determine whether this equipment is suitable for the intended application. Product data sheets can be found at www.spartancontrols.com to confirm any technical issues.
8. No inspection, testing or layout drawings are included in the pricing, unless otherwise indicated on the quotation.
9. One copy of the Operating and Installation manual will be supplied with the equipment at no charge. All additional copies can be supplied at additional cost.
10. Per Spartan Controls' Terms and Conditions.
Please see www.spartancontrols.com/terms.

Thank you for the opportunity to submit our proposal. If you have any questions or concerns, please do not hesitate to call myself at 780-440-8335, or Bill Noelck at 780-440-5664.

Yours truly,
SPARTAN CONTROLS

Mike Perron
Application Engineering

Any transactions resulting from this quotation will be Invoiced directly from Spartan Controls Ltd with payment being remitted to Spartan Controls Ltd.

Husky Oil

**HUSKY OIL
LLOYDMINSTER REFINERY
DESIGN BASIS MEMORANDUM
FOR
CATALYST INJECTION SYSTEM**

HAWK PROJECT NUMBER: 100116

REV.	DESCRIPTION	DATE	ORIGINATOR	CHECKED	APPROVAL
A	Issued for Client Review	2003.10.10	C. Crawford	D. Burchill	
0	Final Issue	2003.10.15	C. Crawford	D. Burchill	

PREPARED BY



**HAWK ENGINEERING
EDMONTON, ALBERTA**

TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY.....	1
2.0 BACKGROUND INFORMATION.....	2
3.0 JUSTIFICATION	2
4.0 RISK ASSESSMENT	2
5.0 DESIGN BASIS.....	2
6.0 WORK SCOPE AND EQUIPMENT DESCRIPTION	4
7.0 COST ESTIMATE SUMMARY.....	7

ATTACHMENTS

SK1 and SK2 PFD Sketches

SK3 Layout Drawing Sketch

Cost Estimate

Pictures of Skid Unit

This Design Basis Memorandum represents work done by Hawk Engineering ("Hawk") performed to recognized engineering principles and practices. The work is based upon the project scope and design information as described herein and as provided by the client. The contents of this document are confidential and prepared solely for use by the customer with whom Hawk has entered into a contract. Any representations in this document are furnished for general information only and are not in any way guaranteed or warranted by Hawk or its sub consultants or their respective employees. None of the above named parties or individuals shall be liable, in negligence or otherwise, for any reliance that may be placed by any other party upon any representations contained herein.

EXECUTIVE SUMMARY

1.1 Problem Definition

Husky Energy currently injects a powdered catalyst into two of its five asphalt blow drums at the Lloydminster Refinery to improve the quality of the asphalt. Husky believes that this catalyst does not mix homogeneously with the asphalt, remaining in clumps and thus reducing its effectiveness. This clumping is also thought to lead to amounts of the powder getting into the stream being fed to the incinerator in sufficient quantities to cause minor explosions in the system. Husky intends to decommission this powder system and to install a system that will inject liquid polyphosphoric acid into each of the five blow drums.

1.2 Justification

This project is expected to improve the saleability of the blown asphalt by improving its performance under extreme temperatures and heavy load through the addition of polyphosphoric acid as a catalyst. Further, the liquid catalyst handling system will be operationally safer than the current powdered catalyst system.

1.3 Process Description

The process will include: bulk storage of polyphosphoric acid, pumping of metered quantities from the storage vessel to the blow drums, and injection of the acid via nozzles into the middle of the blow drum. The system will be heat traced to maintain a flowing temperature. There will be safety interlocks to ensure that the acid cannot be injected into the drums in the absence of the asphalt.

1.4 Project/Work Scope

This DBM encompasses the installation of a polyphosphoric acid storage and injection system that will inject controlled amounts of the catalyst into the asphalt blow drums. The vendor-supplied skid-mounted system will include a storage vessel, pump, meter and secondary containment. The delivery pipe and injection nozzles will be fabricated of 316SS.

1.5 Estimated Costs

The capital cost estimate +/- 40% is \$410,000, including a 10% contingency.

2.0 BACKGROUND INFORMATION

2.1 Current Situation

Husky currently utilizes five blow drums in its asphalt refining process. Currently, two of the blow drums are outfitted with injection nozzles for a powdered catalyst system.

2.2 Problem Definition

Husky believes that this catalyst does not mix homogeneously with the asphalt, remaining in clumps and thus reducing its effectiveness. This clumping is also thought to lead to amounts of the powder getting into the stream being fed to the incinerator in sufficient quantities to cause minor explosions in the system. Husky wishes to change to a liquid catalyst injection system to inject polyphosphoric acid into any of the five blow drums.

The catalyst must be injected in metered amounts and is corrosive to mild steel, thereby necessitating safety interlocks to make sure the blow drums are never exposed directly to the acid.

3.0 JUSTIFICATION

Polyphosphoric acid is used to improve the performance of asphalt. The addition of polyphosphoric acid increases the high and low temperature properties of asphalt, improving its ability to perform under conditions of extreme temperatures and heavy traffic loads. This project is expected to improve the saleability of the blown asphalt.

There are inherent safety risks associated with the powdered catalyst handling system currently in use. Manual filling of the catalyst pot exposes personnel to risk of contact with hazardous chemicals. There have been instances of flashbacks from the incinerator that are thought to be a result of powder in the stream. Liquid catalyst will more readily mix with the asphalt than the powdered catalyst.

4.0 RISK ASSESSMENT

Phosphoric acid is a corrosive agent that will burn exposed tissue. It is not flammable but emits toxic fumes when heated. It will react with certain metals (i.e. mild steel, aluminum) and may produce flammable hydrogen-air mixtures. Rubber gloves, apron and chemical safety goggles should be worn when handling this product.

5.0 DESIGN BASIS

5.1 General Concept

The process will include: bulk storage of polyphosphoric acid, pumping of metered quantities from the storage vessel to the blow drums, and injection of the acid via nozzles into the middle of the blow drum. The system will be heat traced to maintain a flowing temperature. There will be safety interlocks to ensure that the acid cannot be injected into the drums in the absence of the asphalt.

5.2 Design Conditions:

- Catalyst to be used is Rhodia "115% Polysphoric Acid" or equivalent.
- The concentration of polyphosphoric acid in the asphalt will be between 0.5% and 1.0%. At a 0.75% concentration on a 40-drum batch, approximately 300 kg of acid (38.6 US gallons at 7.77 kg/USgal) will be required.
- Climatic data per National Building Code, latest edition.

5.3 Standards, Specifications and Codes

The following specifications and codes will be considered during this project:

NBC	National Building Code of Canada
ASME B31.3	Process Piping
ASME B16.5	Steel Pipe Flanges and Fittings
CAN/CSA-S16.1	Limit States Design of Steel Structures
CAN/CSA-A23.3	Design of Concrete Structures
APIRP 500	API Recommended Practice 500
APIRP 540	Electrical Installations in Petroleum Processing Plants
C22.1	Canadian Electrical Code, Part 1
OSHA	Alberta Occupational Health and Safety,
NFPA	National Fire Protection Association

Husky Expansion Design Specifications:

EDS-04-01	Paint and Protective Coatings
EDS-11-01	Design Loads for Structures
EDS-11-02	Steel Design Criteria
EDS-11-03	Concrete Design Criteria
EDS-11-04	Miscellaneous Structures
EDS-12-01	Foundation Design Criteria
EDS-12-02	Equipment Foundations
EDS-19-01	Site Preparation and Earthwork
EDS-31-12	Steam Tracing
EDS-31-23	Mechanical Cleaning of Pipe
EDS-31-32	Pipe Supports
EDS-31-40	Piping Inspection and Testing Requirements Summary
EDS-33-01	Fired Heaters
EDS-34-01	Atmospheric and Low Pressure Storage Tanks
EDS-37-01	Hot service Thermal Insulation Design Materials and Application
EDS-41-01	Centrifugal Pumps – API
EDS-71-04	Motor Control
EDS-71-07	MCC Starters and Breakers
EDS-72-03	Grounding Requirements
EDS-73-01	Wire Raceway and Conduit Systems
EDS-77-02	Lighting Systems
EDS-79-01	Area Classification

EDS-79-12	Standard Motor Control Schemes
EDS-81-03	Instrument P&ID Standards
EDS-81-09	Instrument Index
EDS-81-14	Piping & Tubing for Instruments and Control Valves
EDS-84-03	Flow Instruments
EDS-84-06	Level Instruments
EDS-84-07	Pressure Instruments
EDS-84-08	Temperature Instruments
EDS-86-01	Control Valves and Regulators
EDS-86-02	Safety and Relief Valves
EDS-86-04	Control Valve Testing and Inspection Requirements

Husky Pipe Specifications:

Piping Specification "A", ANSI 150 LB
 Piping Specification "G", ANSI 150 LB
 Piping Specification "T", ANSI 150 LB
 Piping Specification "M", ANSI 150 LB
 Piping Specification "K"
 Specification for Valves

5.4 Operating and Control Guidelines

The temperature of the acid in the storage tank and the delivery piping must be maintained to ensure that it flows when pumping is initiated. Phosphoric acid is highly viscous and does not transfer heat well. If allowed to cool down, "slugs" of thick liquid can impede pumping. The vendor recommends maintaining fluid temperature of at least 120°F and preferably above 140°F (60°C).

The amount of acid to be injected into the drums will be proportional to the volume of asphalt to be treated. The level of asphalt must be gauged and a suitable volume of acid selected using the PLC so that the correct amount is injected.

Safety interlocks will prevent injection of asphalt into an empty drum.

The handling system and the delivery piping must be inspected regularly for leaks.

6.0 Work Scope and Equipment Description

6.1 General Scope Summary

This section describes the general scope requirement. It includes a description of all mechanical equipment, piping, instrumentation, and electrical work.

6.2 Mechanical Equipment

Storage and handling system

Phosphoric acid is corrosive to mild steel, cast iron, copper, brass and bronze. Type 316 ELC stainless steel is the most widely used material for storage and piping of polyphosphoric acid.

The storage tank should be made inert with nitrogen or dry instrument air to avoid moisture pickup from outside air. At 40 USgal per batch, a 4,000 gallon tank will accommodate 100 batches.

A positive displacement pump should be used to pump the acid from the tank. Dual lobe and other gear pumps offer good turndown ratios, and predictable pumping characteristics over the wide range of viscosity encountered with phosphoric acid.

The general specifications of the storage and handling system are:

- Skid mounted/self supported and portable by tractor and lowboy without escorts.
- Overall dimensions of the 4000 gallon unit are approximately 8'Wx9'Hx22'L.
- Total spill containment for storage tank, pump and lines and unloading operation.
- Tank and lines all 316L SS.
- All lines are heat traced with self-contained, adjustable temperature control and readout.
- 316L SS ViKing internal gear pump; standard pump capacity is 4 to 14 USgpm at 150 psi head.
- Pump controlled with a variable frequency drive.
- Pump discharge is 1 inch; suction is 1½ inch.
- All parts totally insulated. Tank has a steel sheet cover over calcium chloride insulation.
- Ultrasonic level measurement with readout and second hi-level alarm sensor.
- Dry-pac vent system to eliminate influx of moist air.
- Combination hi-pressure relief and vacuum break.
- 18 inch hinged manway for internal cleaning and inspection.
- All exposed areas sealed for outdoor weather location.
- Standard metering options are a mechanical, set point w/shutoff Badger Meter, or electronic milliamp.
- Readout/output for electronic control of pumping frequency, safety limits, shutoff and recording input.
- Unit not equipped with a PLC, but a small limited I/O unit can be provided.

Safety Shower

A stand alone safety shower will be installed near the storage and handling system to be utilized in case of accidental exposure of personnel to the acid.

6.3 Piping

All piping will be 316 stainless steel and of welded and flanged construction. Plug and ball valves of 316 stainless steel construction with Teflon sleeves or seats will be used. Gaskets will be 1/8" thick Viton or Teflon.

Delivery piping from the pump to the drums will be 1½" diameter. The piping will connect to existing vessel nozzles. Injection nozzles will be designed to deliver the acid to a point well inside the blow drum to avoid direct contact with the metal of the drum.

Special materials are not required downstream of the blow drum (i.e. after the acid is mixed with the asphalt).

6.4 Insulation and Heat Tracing

Tanks and piping shall be heated and insulated. Electric tracing is recommended rather than steam because temperature is self-regulated. It is more difficult to control uniform temperature with steam tracing, and there is risk of temperature control failure. High equipment or line temperature can result in premature corrosion failure due to localized hot spots.

Husky has steam readily and inexpensively available throughout the refinery and prefers to use steam rather than electrical tracing. The cost estimate accompanying this DBM is based on steam tracing.

? °C

The vendor recommends a minimum fluid temperature of 120°F for the Lloydminster climate because any weak spot in the system (relative to insulation effectiveness) could result in crystallization or high viscosity sufficient to cause system or line plugging. The preferable fluid temperature is 140°F. ?

6.5 Civil/Structural

6.5.1 Containment Berms

The skid unit has secondary containment integral to its design. No further containment is required.

6.5.2 Foundations

The skid will be supported on a concrete foundation underpinned by four concrete piles drilled to below the frost line.

6.5.3 Structures

The storage and handling system will be sheltered with a three-sided steel shelter with removable roof panels. The shelter will provide a windbreak and snow shed. The removable roof panels will facilitate access to the manway. Clearances will

be designed so as not to impede normal operation, including filling of the storage tank.

The delivery pipe will be supported on the existing pipe rack with additional steel added as required.

6.6 Electrical

Power for the new pump motors and tank heaters will be supplied from MCC-7. The need for a new motor starter or breaker in MCC-7 will be confirmed during detailed engineering. It is anticipated that MCC-7 has the physical and electrical capacity to accommodate the new loads.

Cable trays, ladders, barrier strips and fittings shall be aluminium.

Cable trays shall have fittings (i.e. 90° elbows) suitable for the largest size of cable.

Electrical and instrumentation cables shall run in parallel with the pipeline routings where possible. Structural supports will be provided for new cable trays on the existing pipe rack. Spacing of the support shall not exceed Vendor's recommendations for the type and loading of the tray.

Additional outdoor lighting fixtures will be determined during detailed design. Lighting levels, unless otherwise specified, shall be in accordance with API RP540 guidelines.

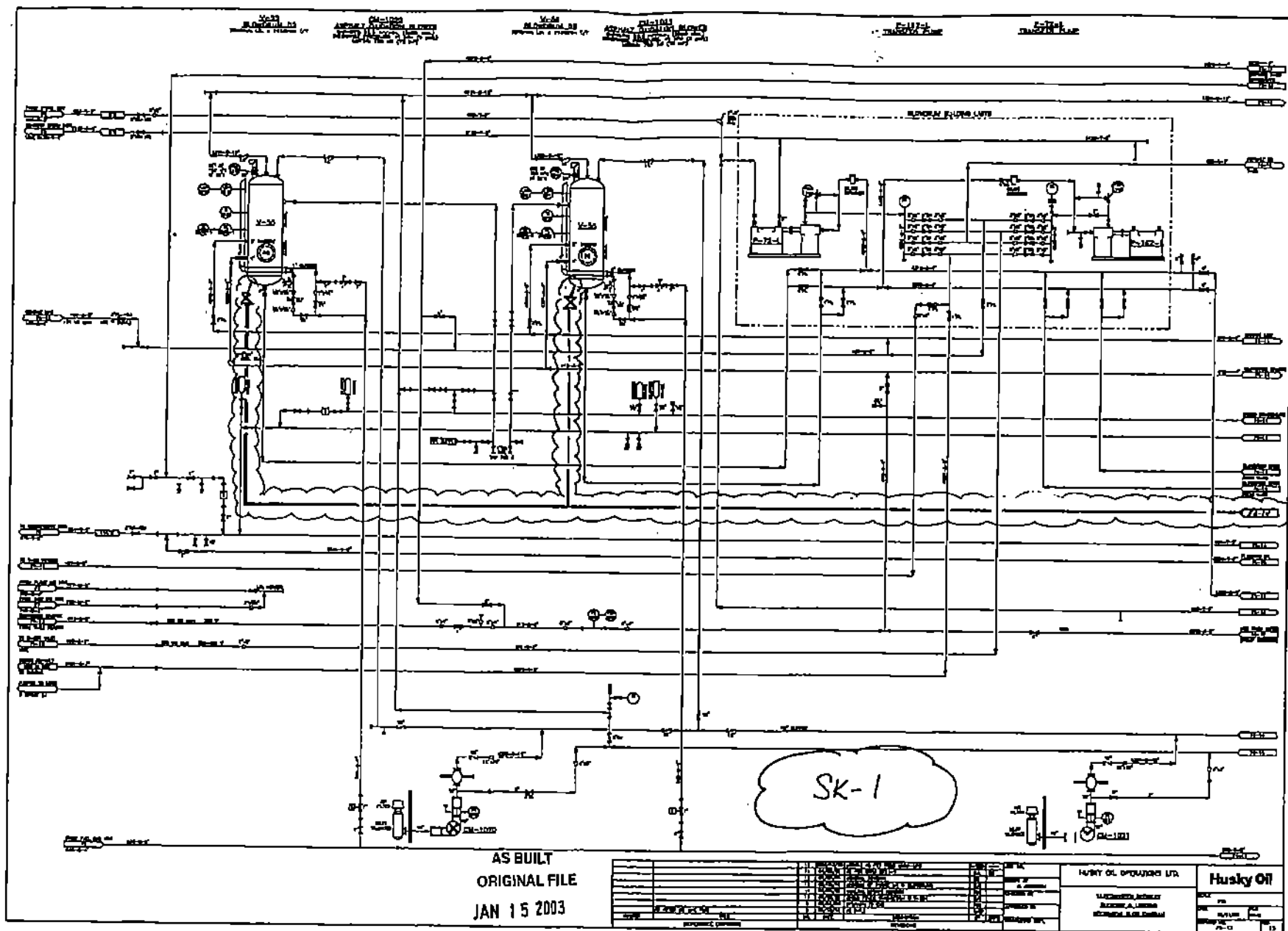
6.7 Instrumentation & Controls

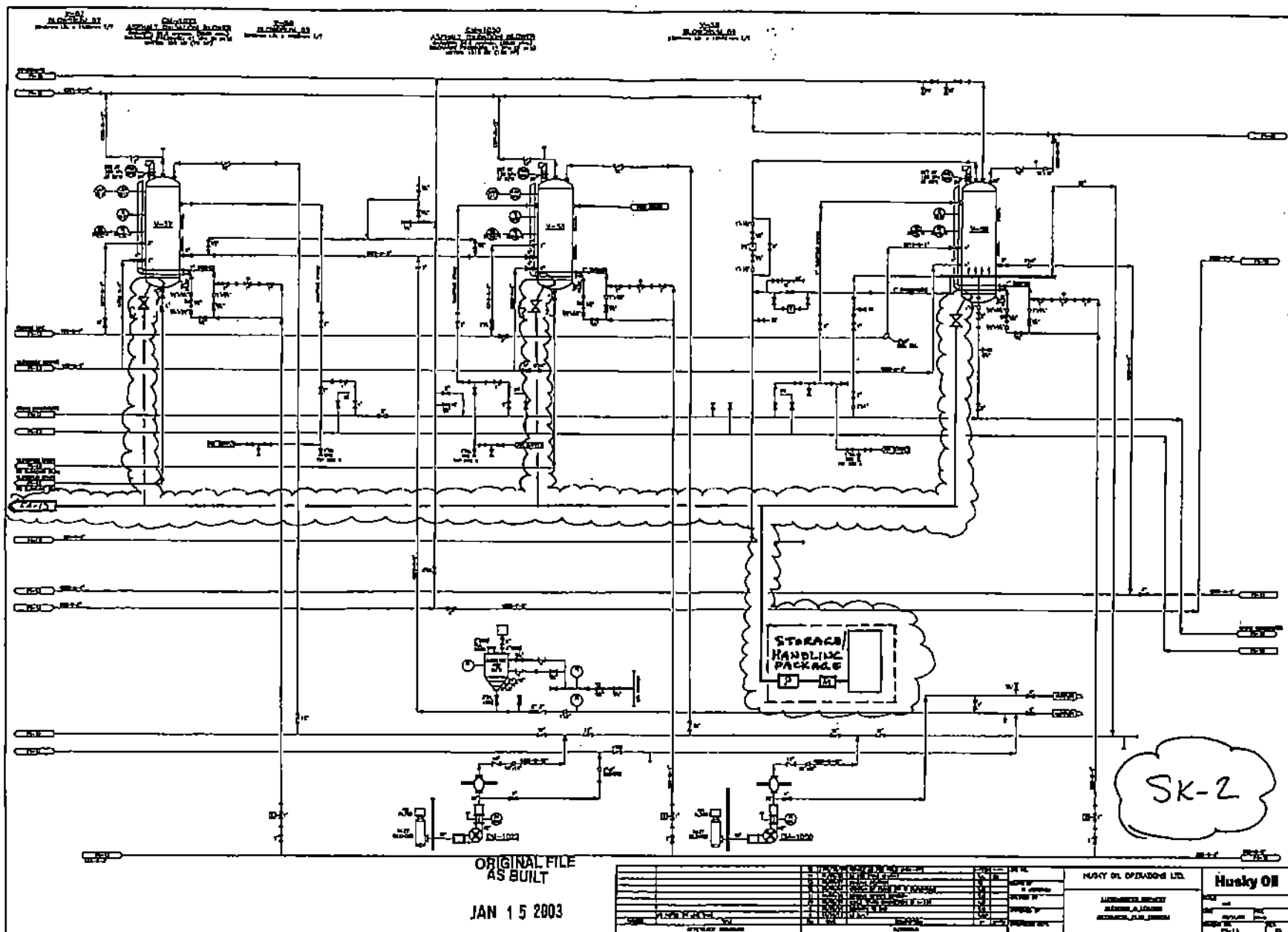
Blowdrums V-55, V-56, V-57, V-58 and V-59 will be fitted with strain gages to determine Blowdrum Asphalt level. The Catalyst Injection lines to each Blowdrum will be fitted with automated switching valves complete with open and closed limit switches. All the above noted signals will be to be wired to the DCS in MCC 7 assuming I/O is available. Husky will create DCS screens and configure DCS for expansion.

Catalyst pump control will be determined in detailed design.

7.0 Cost Estimate Summary

The capital cost estimate +/- 40% is \$410,000, including a 10% contingency. See attachment for details.





SK-3
SCALE 1:500

SV

SHOP & WAREHOUSE

RCC
BLDG.

TRACK
MOBIL
BLDG

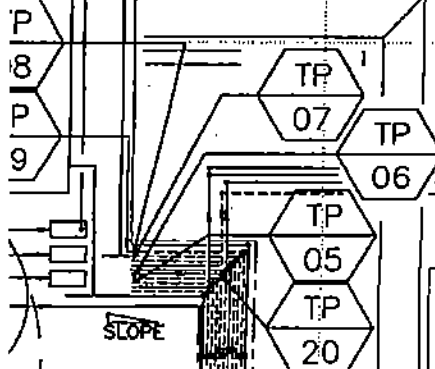
NEW SHUTTER

INCINERATOR

BLOWER
HOUSE

1.5" SS PIPE

431



022-K-4"
(1% SLOPE)
034-A-6"
033-A-4"
017-A-2"
487-A-4"
030-A-4"
T201-G-2"
250-A-6"
662-T-4"
663-T-4"
T008-T-4"
761-M-2"
T119-K-6"
760-M-2"
204-A-8"
658-T-2"

T-50

MCC 5

TP
22

PMA
UNIT

V101

487-A-4"
412-A-6"
T029-A-4"

T006-A-6"
T009-A-6"

H-221

LS-1004

TP
21
TP
04

T-22

T-24

272-A-6"
233-A-6"

T-02

AUTO
BLENDER

LS-1003

T-54

T-53 T-52

STEAM
PLANT &
CONTROL
ROOM



COST ESTIMATE SUMMARY

Client:	Husky Energy	Issue Date:	October 15, 2003
Project:	Asphalt Catalyst Injection System	Rev. No.:	1
Location:	Lloydminster, Alberta	Hawk Project No.:	100116
Currency:	Canadian Dollars		
Estimate Type:	+/- 40% for DBM		
Escalation To:	1st Quarter, 2004		

DESCRIPTION	LABOR (WH)	LABOR (\$)	MATERIAL (\$)	SUBCONT (\$)	TOTAL (\$)
CIVIL, SITEWORK	40	2,000	100	11,400	13,500
BUILDINGS				22,500	22,500
STEELWORK				10,000	10,000
PROCESS EQUIPMENT	80	4,200	155,300		159,500
PIPING & VALVES	283	16,200	10,300	5,000	31,500
INSTRUMENTATION	60	3,200	35,000		38,200
ELECTRICAL	239	12,500	10,400		22,900
PAINTING					
INSULATION	37	1,900	1,700		3,600
TOTAL DIRECT COST	738	40,000	212,800	48,900	301,700
CONSTRUCTION INDIRECTS					8,600
ENGINEERING (factored at 15% of project total)					62,000
SPARES					
BASE COST ESTIMATE					372,300
ESCALATION @ 1st Quarter, 2004					
CONTINGENCY @ 10%					37,300
TOTAL COST ESTIMATE					409,600

COST ESTIMATE DETAILS

Project: Asphalt Catalyst Injection System

Issue Date: October 15, 2003

Hawk Project No.: 100116

Location: Lloydminster, Alberta

Rev. No.: 1

ITEM NO.	ITEM DESCRIPTION	QTY	UNIT	UNIT MATL COST \$	UNIT LAB WH	SUB-CONTRACT UNIT RATE \$/UNIT	MATERIAL COST \$	LABOR			SUB-CONTRACT COST \$	TOTAL COST \$
								LABOR WH	RATE \$/WH	COST \$		
10	CIVIL, SITEWORK											
11	Rhodia Skld Foundation											
12	24" dia x 20' long Pile, drilled & poured	4.0	Ea			1,350.00					5,400	5,400
13	Grouting	4.0	Ea	10.00	4.00		40	16.0	47.72	764		804
14												
15	15'x30'x15' high Shelter Foundation											
16	18" dia x 20' long Pile, drilled & poured	6.0	Ea			820.00					4,920	4,920
17	Grouting	6.0	Ea	10.00	4.00		60	24.0	47.72	1,145		1,205
18												
19	Site Grading / Graveling allowance	1.0	Lot			1,000.00					1,000	1,000
20												
21	TOTAL CIVIL, SITEWORK						100	40.0		1,909	11,320	13,329
22	STEELWORK											
23	Allowance for access to skld	1.0	Lot			10,000.00					10,000	10,000
24												
25												
26	TOTAL STEELWORK										10,000	10,000
27	BUILDINGS											
28	15'x30'x15' high Shelter - uninsulated Building (no floor & no heating), Feb, Supply and Erect	450.0	SF			50.00					22,500	22,500
29												
30												
31	TOTAL BUILDINGS										22,500	22,500
32	PROCESS EQUIPMENT											
33	4000 Gallons Skid, Size 8' w x 9' h x 22' long. Cost \$67600 US as per quote @ 1.35 Can	1.0	Ea	91,260.00	40.00		91,260	40.0	51.62	2,065		93,325
34	- Extra for Metering Option	1.0	Ea	4,000.00			4,000					4,000
35	- Freight to site	1.0	Ea	5,000.00			5,000					5,000
36	Safety Shower	1.0	Ea	55,000.00	40.00		55,000	40.0	51.62	2,065		57,065
37	TOTAL PROCESS EQUIPMENT						155,260	80.0		4,130		159,390
38	PIPING & VALVES											
39	Injection Pump Outlet to Blowdrums Piping 1 1/2" SS											
40	1.5" Pipe Smls Sch 40S 316 SS	150.0	Ft	9.96	0.41		1,494	61.5	57.18	3,517		5,011
41	1.5" Conc Red Sch 40S 316 SS	1.0	Ea	30.71	2.85		31	2.9	57.18	163		194
42	1.5" Elbow Sch 40S 316 SS	12.0	Ea	28.52	2.85		342	34.2	57.18	1,956		2,298

COST ESTIMATE DETAILS

Project: Asphalt Catalyst Injection System

Issue Date: October 15, 2003

Hawk Project No.: 100116

Location: Lloydminster, Alberta

Rev. No.: 1

ITEM NO.	ITEM DESCRIPTION	QTY	UNIT	UNIT MATL COST \$	UNIT LAB WH	SUB-CONTRACT UNIT RATE \$/UNIT	MATERIAL COST \$	LABOR			SUB-CONTRACT COST \$	TOTAL COST \$
								LABOR WH	RATE \$/WH	COST \$		
43	1" Flange 150# 316 SS	1.0	Ea	29.38	1.11		29	1.1	57.18	63		93
44	1.5" Flange 150# 316 SS	15.0	Ea	43.90	1.42		658	21.3	57.18	1,218		1,876
45	1.5" Plug Valve 150# 316 SS	6.0	Ea	280.00	2.85		1,680	17.1	57.18	978		2,658
46	1.5" Check Valve 150# 316 SS	1.0	Ea	370.00	2.85		370	2.9	57.18	163		533
47	1.5" Tee Sch 40S 316 SS	4.0	Ea	41.35	4.28		165	17.1	57.18	978		1,143
48												
49	Injection Piping for Blowdrums	5.0	Set			1,000.00					5,000	5,000
50	Nuts, bolts, gaskets etc.	1.0	Lot	700.00			700					700
51	For Piping:											
52	1/2" SS Tube Steam Tracer c/w fittings	230.0	FT	14.41	0.35		3,314	80.5	57.18	4,603		7,917
53	1/2" SS Insulated Supply & Return Tubing	100.0	FT	7.15	0.22		715	22.0	57.18	1,258		1,973
54												
55	For Skid Storage Tank:											
56	1/2" SS Insulated Supply & Return Tubing	100.0	FT	7.15	0.22		715	22.0	57.18	1,258		1,973
57												
58												
59	TOTAL PIPING & VALVES						10,214	282.5		16,154	5,000	31,368
60	INSTRUMENTATION											
61	Strain Gauges wired to Electronic Controller c/w Analog Output, 4 per Blowdrum	5.0	Set	6,000.00	8.00		30,000	40.0	52.35	2,094		32,094
62	1 1/2" SS Switching Valve c/w Open & Closed Limit Switch	5.0	Set	1,000.00	4.00		5,000	20.0	52.35	1,047		6,047
63												
64												
65	TOTAL INSTRUMENTATION						35,000	60.0		3,141		38,141
66	ELECTRICAL											
67	12 inch wide Ladder Tray Aluminum	30.0	Ft	16.57	0.24		497	7.2	52.18	376		873
68	- 12" Tray Fittings	2.0	Lot	120.00	2.00		240	4.0	52.18	209		449
69	- 4/0 Grounding Cable for Tray	50.0	FT	1.40	0.10		70	5.0	52.18	261		331
70												
71	Size 1 Starter600V In MCC-7	1.0	Ea	1,500.00	2.00		1,500	2.0	52.18	104		1,604
72	3C #12 AWG 1 kv Armored Cu Cable from MCC-7 to Catalyst Pump	230.0	Ft	1.23	0.02		283	4.6	52.18	240		523
73												
74	Local Electrical Junction Box	1.0	Ea	500.00	4.00		500	4.0	52.18	209		709
75	40 C #12 AWG Armored Cable	800.0	Ft	4.20	0.12		3,360	96.0	52.18	5,009		8,369
76												

COST ESTIMATE DETAILS

Project: Asphalt Catalyst Injection System

Issue Date: October 15, 2003

Hawk Project No.: 100116

Location: Lloydminster, Alberta

Rev. No.: 1

ITEM NO.	ITEM DESCRIPTION	QTY	UNIT	UNIT MATL COST \$	UNIT LAB WH	SUB-CONTRACT UNIT RATE \$/UNIT	MATERIAL COST \$	LABOR			SUB-CONTRACT COST \$	TOTAL COST \$
								LABOR WH	RATE \$/WH	COST \$		
77	1 Pr #16 AWG Armored Control Cable for Strain Gauges to Controller	400.0	Ft	0.60	0.02		241	8.0	52.18	417		658
78	1 Pr #16 AWG Armored Control Cable from Controller to local JB	100.0	Ft	0.60	0.02		60	2.0	52.18	104		165
79	1 Pr #16 AWG Armored Control Cable from Limit Switches on Switching Valves to local JB	300.0	Ft	0.60	0.02		181	6.0	52.18	313		494
80	Local Instrument Junction Box	1.0	Ea	500.00	4.00		500	4.0	52.18	209		709
81	20 Pr #16 AWG Armored Control Cable from local JB to DCS in MCC-2 on existing Cable Trays	800.0	Ft	3.46	0.09		2,765	72.0	52.18	3,757		6,522
82												
83	Terminations	1.0	Lot	200.00	24.00		200	24.0	52.18	1,252		1,452
84												
85												
86												
87	TOTAL ELECTRICAL						10,397	238.8		12,461		22,857
94	INSULATION											
95	1 1/2" Piping Insulation 1 1/2" thick Calcium Silicate	230.0	LF	7.34	0.18		1,689	36.8	50.79	1,869		3,558
96												
97												
98	TOTAL INSULATION						1,689	36.8		1,869		3,558
99	CONSTRUCTION INDIRECTS											
100	Scaffolding - Rental	1.0	Lot			500.00					500	500
101	Scaffolding - Labour	1.0	Lot		100.00			100.0	50.79	5,079		5,079
102	50 Ton Hydraulic Truck Crane to Install Skid	8.0	Hr			185.00					1,480	1,480
103	- Mob & Demob	1.0	Time			530.00					530	530
104	Construction / Field Co-ordination by Owner Company	1.0	Lot	Not Included								
105	Construction Management by External Engineering Company	1.0	Lot	Not Included								
106	Excavation Permits	1.0	Lot			500.00					500	500
109	Concrete Testing	1.0	Lot			500.00					500	500
113												
114												
115	TOTAL CONSTRUCTION INDIRECTS							100.0		5,079	3,510	8,589

COST ESTIMATE DETAILS

Project: Asphalt Catalyst Injection System

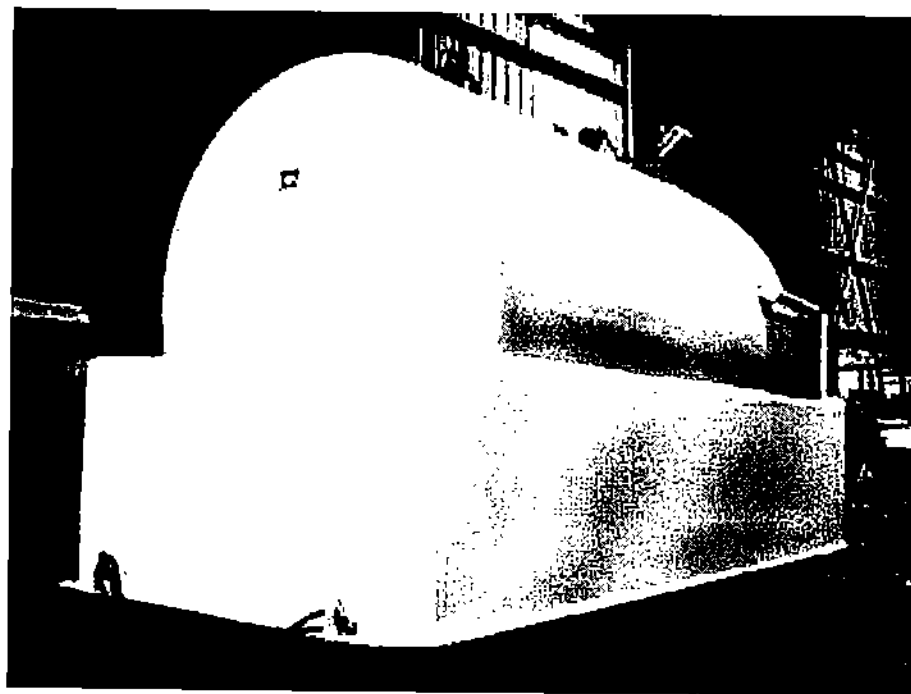
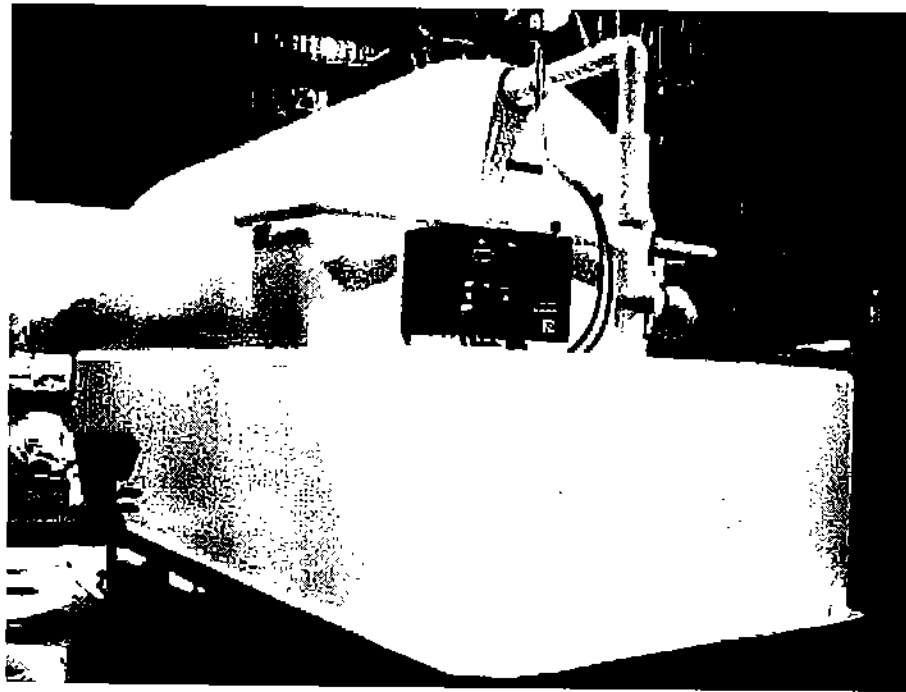
Location: Lloydminster, Alberta

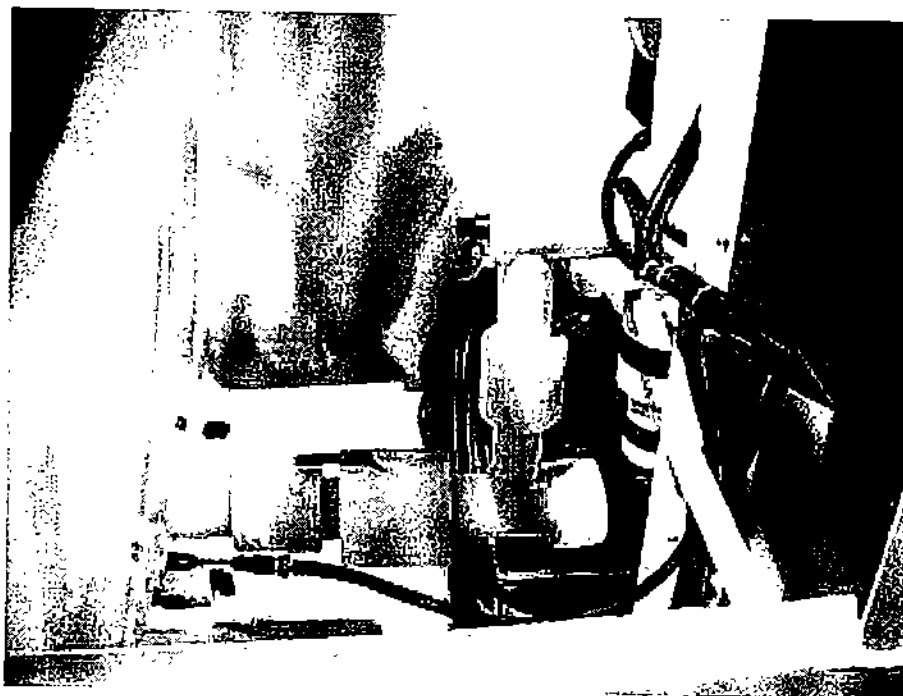
Issue Date: October 15, 2003

Hawk Project No.: 100116

Rev. No.: 1

ITEM NO.	ITEM DESCRIPTION	QTY	UNIT	UNIT MATL COST \$	UNIT LAB WH	SUB-CONTRACT UNIT RATE \$/UNIT	MATERIAL COST \$	LABOR			SUB-CONTRACT COST \$	TOTAL COST \$
								LABOR WH	RATE \$/WH	COST \$		
116	ENGINEERING											
117	Project Management & Execution by Owner Company	1.0	Lot	Not Included								
118	Project Management & Execution by External Engineering Company	1.0	Lot	Not Included								
119	Engineering	1.0	Lot	62,000.00			62,000					62,000
120	Commissioning & Startup assistance by Owner Company People	1.0	Lot	Not Included								
121	Commissioning & Startup Assistance by External Engineering Company	1.0	Lot	Not Included								
122	Owner's Travel Cost - Vendors Shop Visits	1.0	Lot	Not Included								
123	Expediting & Inspection by Others	1.0	Lot	Not Included								
124												
125												
126	TOTAL ENGINEERING						62,000					62,000





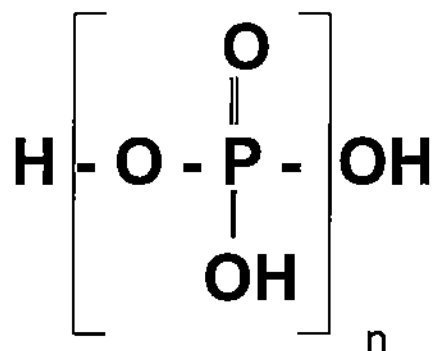
Rhodia Specialty Phosphates

INNOVALT™ Safety and Handling

INNOVALT™ Nomenclature

- **Orthophosphoric Acid - Ranges from 1% to 95% by weight of H_3PO_4 . Grades include Technical, FCC, NF, ACS, and High Purity.**
- **INNOVALT™ - 105% to 118+% by weight of H_3PO_4 . Technical grade only.**

INNOVALT™ Chemistry



1 to 95% Orthophosphoric Acid - $n = 1$

105 to 118% INNOVALT™ - n ranges from 4 to 15
ortho, pyro, tri, tetra, high poly constituents

INNOVALT™ Chemistry, continued

Physical State : Colorless to amber, viscous, hygroscopic liquid

Specific Gravity: 2.05 @ 20 Deg C

Density: 17.1 lbs./gallon @ 20 Deg C

Viscosity: 2600 @ 60 Deg C

(centipoise) 380 @ 100 Deg C

Flash point: None

**Freeze point: Very viscous at ambient temperature, freezing is
difficult to attain; glassy consistency @ 52Deg C**

Solubility: Completely miscible in asphalt

Hazards

- **Can Burn Eyes and Skin (Thermal Burns)**
- **Corrosive and Irritating**
- **Mist may Damage Throat and Lungs**
- **Can React with Some Metals / Corrosive to Mild Steel, Cast Iron, Copper, Brass, Bronze**
- **Keep away from Sulfides / Sulfites, Strong Oxidizing / Reducing Agents**

Recommended Personal Protective Equipment

- **Chemical Safety Glasses / Goggles**
- **Face Shield**
- **Chemical Resistant Gloves / Boots and Apron**
- **Good Work Practices/ Personal Hygiene**
- **Safety Shower and Eye Wash Station**

First Aid

- **Eye Contact**
 - **Flush Eyes with Water for 15 minutes**
 - **Do not neutralize**
 - **Seek Medical Attention**
- **Skin Contact**
 - **Flush with Water**
 - **Remove Contaminated Clothing**
 - **Do Not Neutralize**
 - **Seek Medical Attention**

First Aid, continued

- **Ingestion**
 - **Dilute with Large Quantities of Water**
 - **Do Not Induce Vomiting**
 - **Seek Medical Attention**
- **Inhalation**
 - **Remove to Fresh Air**
 - **If Breathing Stops-- Administer Artificial Respiration / CPR**

INNOVALT™ Spills

- **Dike or Contain Material**
- **Reclaim Material to Suitable Container(s)**
- **Neutralize Spill with Soda Ash or Sodium Bicarbonate**
- **Exercise Caution during Neutralization**
- **Emergency Response Numbers**
 - **Chemtrec - (800) 424-9300**
 - **Rhodia CAERs - (800) 916-3232**

Additional Product Information

- **More information on INNOVALT™ can be found at our website at: <http://rhodia-innovalt.com>**
- **More information on orthophosphoric acid and polyphosphoric acid can be found at our website at: <http://rhodia-phosphates.com>**

Thanks for your time.

REMEMBER: SAFETY IS FIRST

See conclusions on pg 6.

Corrosion is not a consideration once product is mixed with asphalt and stored in controlled conditions.



Technology Support and Development

November 30th, 2001

From: N. Fradette TSD/Cranbury

Reference: MOC21074

Enclosures: **Appendix 1 -** Pictures Of 1020 Carbon Steel Samples After 12 Days Of Total Immersion In [REDACTED] Asphalt Containing 0%, 1% And 2% (105% And 115%) Polyphosphoric Acid.
Appendix 2 - Pictures Of 1020 Carbon Steel Samples After 12 Days Of Total Immersion In [REDACTED] Asphalt Containing 0%, 1% And 2% (105% And 115%) Polyphosphoric Acid.
Appendix 3 Immersion Data Sheets

**105% AND 115% POLYPHOSPHORIC ACID CORROSIVENESS:
PART 1 - 1020 CARBON STEEL CORROSION RESISTANCE IN
ASPHALT CONTAINING 1% AND 2% POLYPHOSPHORIC ACID**

SUMMARY

Immersion test results suggest that the use of 105% polyphosphoric acid as an additive at a 1 to 2% concentration and the use of 115% polyphosphoric acid as an additive at a 1% concentration in petroleum asphalt mixtures decreases the corrosiveness of the two types of asphalt tested towards 1020 carbon steel (PPA-containing mixtures have corrosion rates <0.8 MPY in [REDACTED] and <1.3 MPY in [REDACTED]). Therefore, after acid is incorporated into the asphalt, the mixture can be handled and/or stored in equipment made of carbon steel provided that environmental conditions are similar to the testing conditions outlined in this report.

A

B

Rhodia, Inc.
TSD - Materials Engineering and Corrosion
259 Prospect Plains Road
Cranbury, NJ 08512-7500
Phone: (609) 860-3248 Fax: (309) 273-2124

1. BACKGROUND

Polyphosphoric acid (or PPA) is frequently used as a reactive additive in order to improve high temperature characteristics of asphalt pavements. After acid is incorporated into the asphalt, the mixture is handled and/or stored in carbon steel-made equipment. The objective of this study is to assess the corrosivity of petroleum asphalt containing 0 to 2% of 105% and 115% polyphosphoric acid.

2. METHODS

Two petroleum asphalt samples (CAS # 8052-42-4) were tested:

- 1- ~~_____~~ 64-22
- 2- ~~_____~~ 67-22

The petroleum asphalt samples were received from ~~_____~~. 105% or 115% polyphosphoric acid (Rhodla, Inc., Nashville, TN) was added (0%, 1% and 2%) to the molten asphalt and tested to ASTM G 31-72 ¹ "Standard Practice for Laboratory Immersion Corrosion Testing of Metals". Mixing procedure procedure:

- 1- Asphalt is warmed-up to 175 deg. C;
- 2- Polyphosphoric acid is warmed-up to 60 deg. C;
- 3- Hot asphalt is added to a 304 stainless reactor and its weight content is determined;
- 4- Appropriate quantity of warm polyphosphoric acid is added to the hot asphalt;
- 5- The mixture is then homogenized using a mechanical mixer (5 minutes at ~160 deg.C);
- 6- The coupons are immersed and the reactor put into a thermostatically controlled sand bath maintained at 175 deg. C. The reactors were non-hermetically closed and the content exposed to air for the duration of the test. No agitation was used.

120 grit surface finish 1020 carbon steel (C1020) test coupons (part # CO2193780304100) were obtained from Alabama Specialty Products, Inc. (Munford, AL) and were ultrasonically cleaned in Stoddard solvent for 15 minutes and then rinsed in ethanol. Test coupons were not subjected to any other pretreatment. After immersion, the asphalt was cleaned off the surface using Stoddard solvent (1 hour in solvent and sonicated for 1 hour in fresh solvent at room temperature) followed by a final ethanol rinse. Coupons were examined under light microscope and the weight difference was evaluated.

Since most samples were covered with a dark scale, an additional cleaning step was performed in order to reveal the carbon steel surface and determine the net corrosion rates. The acidic cleaning solution C.3.5 described in ASTM G 1-90 ² was used for that purpose.

3. RESULTS AND DISCUSSION

3.1 Results After 12 Days: Cleaned and Non-Descaled Steel Coupons

After 280 hours (~12 days), all the 1020 carbon steel samples immersed in either the asphalt-PPA or the asphalt-PPA mixtures showed some discoloration and/or presence of a dark scale (see Appendix 1 and 2 for pictures of the carbon steel sample after immersion in the asphalt or asphalt-PPA, respectively). This scale and/or discoloration is presumably the result of the oxidation/corrosion of the steel sample with subsequent formation of a phosphate, oxide or other type of deposit depending on the nature of the asphalt mixture tested.

In some cases, the black and brown scale showed poor adhesion to the steel surface as it is the case for sample # 1 and #2 and it is not presumed to be a phosphate-type scale but mainly an organic-based scale since these two asphalt samples did not contain any PPA. Samples #2 and #3 (1% [105%] PPA and 1% [115%] PPA in asphalt, respectively) were covered with a very adherent gray powdery scale as it is the case for sample #8 (-Low) and #8 (1% [105%] PPA and 1% [115%] PPA in asphalt, respectively). Samples #4 and #9 (2% [105%] PPA in asphalt and 2% [115%] PPA in asphalt, respectively) were found to be only slightly darkened after immersion. Sample #5 was severely scaled with a non-homogeneous coating (2% [115%] PPA in asphalt) while sample #10 showed a light scale.

The fact that samples #3 and #10 showed a heavily corroded band on the bottom of the samples is noteworthy. This corroded band is covered with brownish iron oxides and not iron phosphate. Both samples were immersed in mixtures containing 115% PPA (1% in asphalt for #3 and 2% in asphalt for #10) and is indicative of a phase separation or product segregation rich in polyphosphoric acid. It is possibly due to the high temperature, the generation of a high viscosity phase following the reaction of petroleum asphalt with PPA or incomplete mixing.

Observed corrosion rates (see Figure 1) and comments are reported in Table I for asphalt and in Table II for asphalt-PPA. When coupons are cleaned but not descaled the total weight change or the observed corrosion rate has two components:

$$\text{Corrosion Rate}_{(\text{Observed})} = \text{Net Corrosion}_{(\text{Material Loss Rate})} + \text{Scale Growth}_{(\text{Material Gain Rate})} \quad [1]$$

Figure 1 shows that all PPA-containing mixtures experienced significant net scale growth whereas the 2% PPA115- mixture experienced stock loss or more corrosion than scale growth. For the pure asphalt, the net scale growth was less than for the PPA-containing mixtures. In general, adherent, dense and uniform scale formation can slow down corrosion if the scale has some protective characteristics towards the aggressive species involved in the corrosion mechanism. Results discussed in section 3.2 will suggest that the net scale growth and adhesion/uniformity characteristics that were described in this section will tend to give lower corrosion rates, albeit not necessarily directly proportional to the scale growth.

3.2 Results After 12 Days: Cleaned and Descaled Steel Coupons

All samples were free from dark gray scale or black scale after cleaning. Net corrosion rates are reported in Table 1 for ^A asphalt and in Table II for ^B asphalt (see also Figure 2). The ^B asphalt seems more corrosive than the ^A asphalt product with a corrosion rate of 1.3 MPY compared to 0.6 MPY for the ^A asphalt. All PPA-containing mixtures were found to be less corrosive than the pure asphalt excepted for the 2% PPA115-^A Mixture with a rate >2 MPY. In general, mixtures containing PPA105 were found to be less corrosive than their PPA115 counterpart however, the reported PPA115 corrosion rates may be erroneous since these figures may have been obtained from non-homogeneous mixtures as evidenced for two of these mixtures with coupons having more pronounced corrosion near the bottom edge. In all cases, PPA was found to be equally or less corrosive at 1% than at 2%.

^A TABLE I: Immersion Results for ^A Asphalt.

Asphalt	Comments*	Corrosion Rate (MPY)**	
		Before Descaling	After Descaling***
0% PPA	Slight Discoloration/Non-Adh. Blk Scale	-0.1	0.6
1% PPA 105	Gray adh. & Uniform Scale	-0.4	0.3
1% PPA 115	Gray adh. Scale/Heavy corrosion Bottom	-0.9	0.6
2% PPA 105	Very Slight Discoloration	-0.5	0.3
2% PPA 115	Heavy Brown/Gray non uniform Scale	0.8	2.1

* Observed prior to descaling

** C1020, 12 days immersion @ 175 deg. C. Negative Figures Indicate Weight Gain

*** Net corrosion rate

^B TABLE II: Immersion Results for ^B Asphalt.

Asphalt	Comments*	Corrosion Rate (MPY)**	
		Before Descaling	After Descaling***
0% PPA	Heavy non-Adh non-Uniform Blk Scale	-0.1	1.3
1% PPA 105	Very Dark Gray Adh. & Uniform Scale	-0.8	0.2
1% PPA 115	Very Dark Gray Adh. & Uniform Scale	-0.7	0.5
2% PPA 105	Slight Discoloration and Uniform Scale	-0.3	0.3
2% PPA 115	Light Gray non-Unif. Scale/Corr. Bottom	-0.8	0.4

* Observed prior to descaling

** C1020, 12 days immersion @ 175 deg. C. Negative Figures Indicate Weight Gain

*** Net corrosion rate

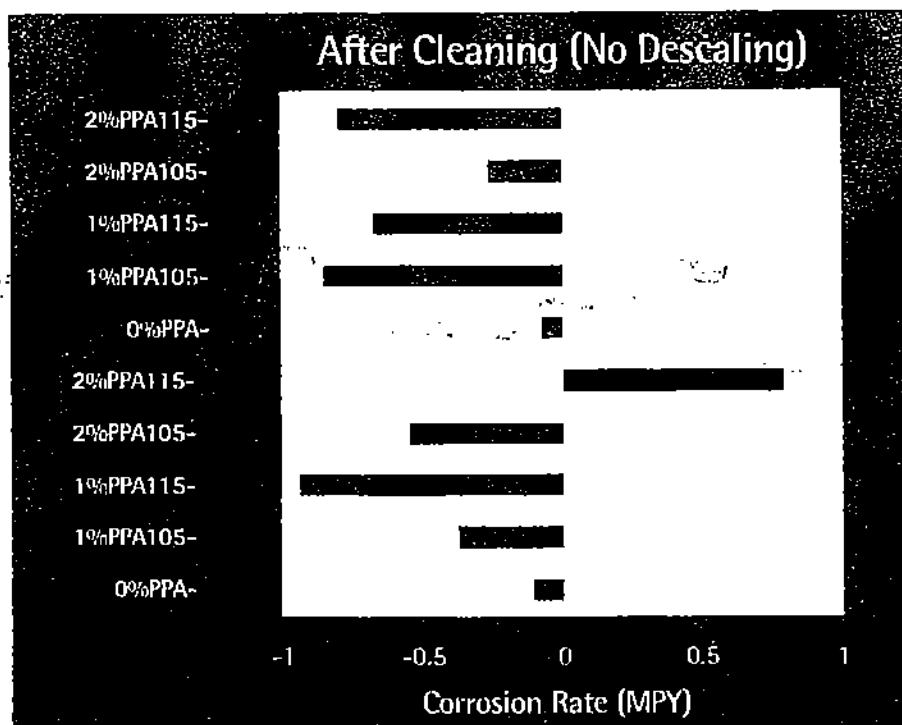


FIGURE 1: Corrosion Rates of C1020 Immersed in PPA-Containing Asphalt for 12 Days at 175 Deg. C. After Cleaning the Samples but Without Descaling. Negative Corrosion Rates Indicate a Weight Gain due to Deposit/Scale Formation.

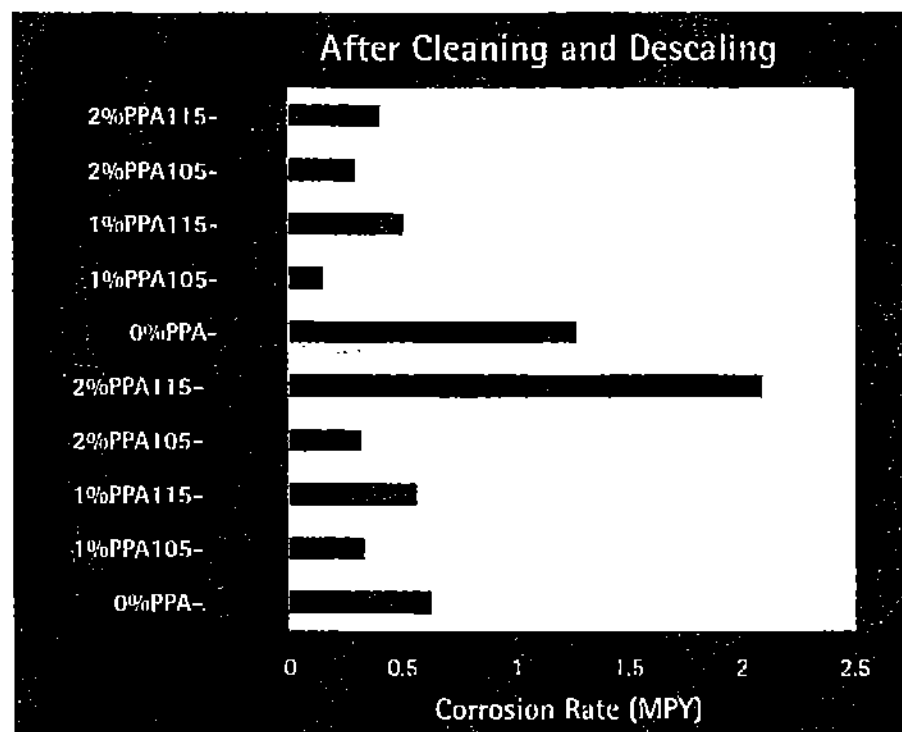


FIGURE 2: Corrosion Rates of C1020 Immersed in PPA-Containing Asphalt for 12 Days at 175 Deg. C. After Cleaning and Descaling.

4. CONCLUSION

All 1020 carbon steel samples that were immersed in asphalt (PPA-free or PPA-containing) for ~12 days at 175 deg. C showed:

- Scale growth;
- Net Corrosion;

We also noted that steel samples immersed in 105% and 115% PPA-containing asphalt containing 1 to 2% acids were characterized by:

- A more adherent and more uniform scale than with PPA-free asphalt (with the exception of 2%PPA115 in [REDACTED] mixture);
- Lower corrosion rates than with PPA-free asphalt (with the exception of 1% and 2%PPA115 [REDACTED] mixtures);

Additionally, the appearance of steel samples immersed in 2% PPA105 asphalt was very close to the appearance of unexposed stock steel samples, and this for both asphalt types.

It appears that the lower corrosivity of asphalt containing PPA is related to the formation of a protective iron phosphate scale on carbon steel. Pursuing the immersion test for 3 months will help us to monitor the degree of protection of this scale.

Immersion test results suggest that the use of 105% polyphosphoric acid as an additive at a 1 to 2% concentration and the use of 115% polyphosphoric acid as an additive at a 1% concentration in petroleum asphalt mixtures decreases the corrosiveness of asphalt towards 1020 carbon steel (PPA-containing mixtures have corrosion rates <0.6 MPY in [REDACTED] and <1.3 MPY in [REDACTED]). Therefore, after acid is incorporated into the asphalt, the mixture can be handled and/or stored in equipment made of carbon steel provided that environmental conditions are similar to the testing conditions outlined in this report

5. REFERENCES

- [1] Practice G31-72(1999) Standard Practice for Laboratory Immersion Corrosion Testing of Metals, ASTM Book of Standards Volume:03.02, AMERICAN SOCIETY FOR TESTING AND MATERIALS, West Conshohocken, PA. (2001)
- [2] Practice G1-90(1999) Standard Practice for Preparing, Cleaning, and Evaluating Corrosion Test Specimens, ASTM Book of Standards Volume:03.02, AMERICAN SOCIETY FOR TESTING AND MATERIALS, West Conshohocken, PA. (2001)

64-22 7/10/2001

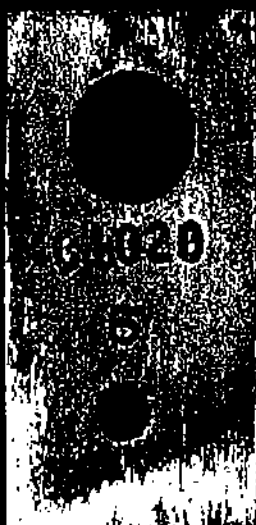
0.25"



B

67-22 6/21/2001

0.25"



0% PPA



1% PPA 105



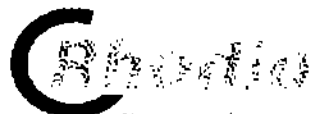
1% PPA 115



2% PPA 105



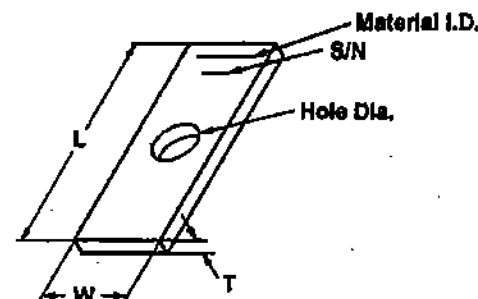
2% PPA 115



Advanced Polymer Solutions

IMMERSION TEST DATA

PROJECT: MOC21074
 PLANT: NA
 UNIT: NA
 TEST: ASTM G31-72
 TEST FLUID: Petroleum Asphalt + 0-1% Polyphosphoric Acid
 AERATION: NA
 AGITATION: NA
 VELOCITY: NA
 TEMPERATURE: 176 °C
 SAMPLE PREP.: NA
 DATE IN: 11/16/01 15:00
 DATE OUT: 11/28/01 7:00
 TOTAL TIME (hour): 280.0



NOTE: AFTER CLEANING (NOT DESCALED)

S/N	Material	Fluid	L (in.)	W (in.)	T (in.)	Hole Dia. (in.)	Area (sq. in.)	Area (sq. cm)	WI (g)	WT (g)	Wloss (g)	T (hour)	Density (g/cm3)	Corrosion Rate*		Comments
														(mm/y)	(MPY)	
1	1020 Csteel	0%PPA	1.000	0.500	0.125	0.25	1.375	8.871	7.0036	7.0042	-0.0006	280	7.87	-0.0027	-0.106	Slight Discoloration/Non-Adh. Blk Scale
2	1020 Csteel	1%PPA105	1.000	0.500	0.125	0.25	1.375	8.871	6.7668	6.7679	-0.0021	280	7.87	-0.0094	-0.37	Gray adh. & Uniform Scale
3	1020 Csteel	1%PPA116	1.000	0.500	0.125	0.25	1.375	8.871	7.1527	7.1660	-0.0053	280	7.87	-0.0238	-0.937	Gray adh. Scale/Heavy corrosion Bottom
4	1020 Csteel	2%PPA105	1.000	0.500	0.125	0.25	1.375	8.871	7.0486	7.0617	-0.0031	280	7.87	-0.0139	-0.547	Very Slight Discoloration
5	1020 Csteel	2%PPA116	1.000	0.500	0.125	0.25	1.375	8.871	7.1652	7.1607	0.0045	280	7.87	0.0202	0.796	Heavy Brown/Gray non uniform Scale
6High	1020 Csteel	0%PPA	1.000	0.500	0.125	0.25	1.375	8.871	7.1986	7.1689	-0.0004	280	7.87	-0.0016	-0.071	Heavy non-Adh non-Uniform Blk Scale
6Low	1020 Csteel	1%PPA105	1.000	0.500	0.125	0.25	1.375	8.871	7.1444	7.1492	-0.0048	280	7.87	-0.0216	-0.846	Very Dark Gray Adh. & Uniform Scale
8	1020 Csteel	1%PPA116	1.000	0.500	0.125	0.25	1.375	8.871	7.2168	7.2208	-0.0038	280	7.87	-0.017	-0.669	Very Dark Gray Adh. & Uniform Scale
9	1020 Csteel	2%PPA105	1.000	0.500	0.125	0.25	1.375	8.871	7.2848	7.2863	-0.0015	280	7.87	-0.0067	-0.264	Slight Discoloration and Uniform Scale
10	1020 Csteel	2%PPA116	1.000	0.500	0.125	0.25	1.375	8.871	7.2079	7.2124	-0.0045	280	7.87	-0.0202	-0.796	Light Gray non-Unif. Scale/Corr. Bottom

* Negative corrosion rate denotes a stock gain or weight gain. Density of the stock gained assumed to be similar to base metal's density in calculation.



Materials Engineering and Corrosion

IMMERSION TEST DATA

PROJECT: MOC21074
 PLANT: NA
 UNIT: NA
 TEST: ASTM G31-72
 TEST FLUID: Petroleum Asphalt + 0-1% Polyphosphoric Acid
 AERATION: NA
 AGITATION: NA
 VELOCITY: NA
 TEMPERATURE: 175 °C
 SAMPLE PREP.: NA
 DATE IN: 11/18/01 16:00
 DATE OUT: 11/28/01 7:00
 TOTAL TIME (hour): 280.0

NOTE: AFTER CLEANING AND DESCALING

S/N	Material	Field	L (in.)	W (in.)	T (in.)	Hole Dia. (in.)	Area (sq. in.)	Area (sq. cm)	W1 (g)	W2 (g)	Wloss (g)	T (hour)	Density (g/cm3)	Corrosion Rate*		Comments
														(mm/y)	(MPY)	
2	1020 Carbon	1%PPA105	1.000	0.500	0.125	0.25	1.375	8.871	6.7558	6.7639	0.0019	280	7.87	0.0085	0.335	
4	1020 Carbon	2%PPA105	1.000	0.500	0.125	0.25	1.375	8.871	7.0486	7.0488	0.0016	280	7.87	0.0081	0.318	
6-high	1020 Carbon	0%PPA	1.000	0.500	0.125	0.25	1.375	8.871	7.1865	7.1893	0.0072	280	7.87	0.0323	1.272	
8	1020 Carbon	1%PPA115	1.000	0.500	0.125	0.25	1.375	8.871	7.2168	7.2139	0.0029	280	7.87	0.013	0.512	
10	1020 Carbon	2%PPA115	1.000	0.500	0.125	0.25	1.375	8.871	7.2079	7.2058	0.0023	280	7.87	0.0103	0.406	Uniform Corrosion/Corr. Residue Bottom

* Negative corrosion rate denotes a stock gain or weight gain. Density of the stock gained assumed to be similar to base metal's density in calculation.

Study to assess corrosion rates on aluminum tank trailer used
to delivery product.







MORRISVILLE PLANT

June 25, 2002

Subject: CORROSION RATE STUDY OF 1.2% POLYACID-ASPHALT BLEND ON ALUMINUM

A corrosion study has been performed to determine the effect of a hot asphalt-polyacid mix on contacting aluminum and subsequent are the findings. Asphalt is transported in aluminum trailers and the addition of 115% polyphosphoric acid to the material has raised some questions regarding its corrosive effect on the aluminum container. Hence, this experiment was initiated to determine the corrosive wear rate of the hot 320 deg F asphalt-polyacid mix on the transporting tank. This corrosion wear rate experiment was performed over a 5-day period (120-HR period) at the Morrisville Plant and, the experiment showed that the agitated 1.2% polyacid asphalt blend when maintained at a constant temperature of 320 F produced a corrosive wear rate of approximately 1 mill (0.001") per year on an aluminum coupon.

A 2-5/8" long x 3/4" wide x 1/8" thick aluminum 5052 alloy corrosion coupon was prepared for this purpose. The experiment consisted of maintaining a stirred 1.2% blend of polyacid and asphalt at the temperature of 320 F for a period of 5 days with the suspended coupon in it and hence calculating the corrosion rate over this period. The corrosion coupon was suspended in the flask with a titanium alloy wire hanger. The coupon thickness was measured with a machinists' micrometer both before and after the experiment. The coupon was also weighted before and after. Following are pictures of the corrosion coupon front and back, both before and after the test period. The temperature over the 5 day period was monitored with a thermocouple wire immersed into the agitated hot asphalt liquid.

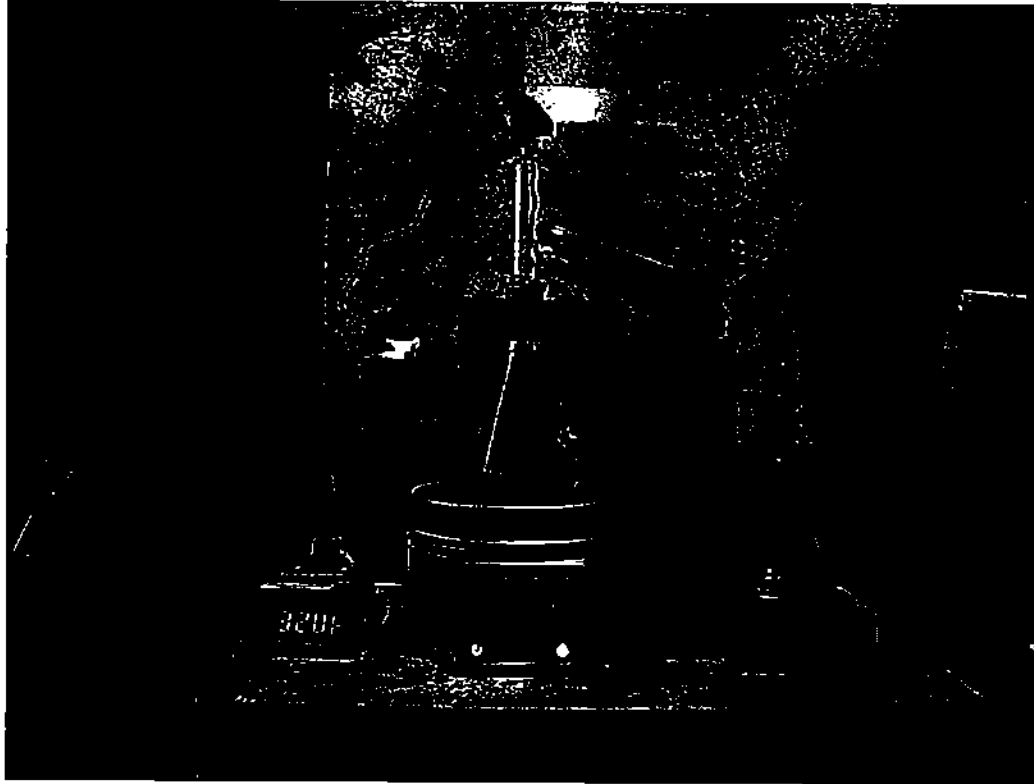
BEFORE TEST*		AFTER 5-DAY TEST*	
	Coupon Front		Coupon Front
	Coupon Back		Coupon Back

* Note: Color effect produced by difference in indoor Vs outdoor lighting during photography. Otherwise, there was absolutely no visual difference between before and after test coupon appearance.

The micrometer measurement after the five day period failed to detect a coupon thickness difference. Both before and after measurements were 0.1232". There was also no detectable changes in the physical appearance, as seen in above photos. However, there was a small detectable weight loss, with weight prior to test being 10.3615g and the weight after being 10.3580g. The small 0.0035g difference translates into a 1.234 MPY (0.001234") corrosion rate which means this would be the loss if the agitated hot 320F asphalt-1.2% polyacid solution contacted an aluminum surface for a continuous period of one year.

It was also noted throughout this 5 day heating period that the liquid level in the heated flask remained constant, with no visible evidence of any boil-over condensate into the adjacent flask.

Photograph of the experiment set up to measure asphalt corrosion wear on aluminum.



Summary: Little or no corrosion was detected with aluminum handling the 1.2% poly-asphalt mix agitated at 320F. Expected corrosion rate, if any, would be as low as 1 to 2 mills (0.001 - 0.002") per year.

Calculation basis:

5052 Aluminum coupon.

2-5/8" x 3/4" x 1/8" with 1/8" drilled hole fully submersed during study with titanium wire.

Initial thickness of alloy strip: 0.1232". Final thickness: 0.1232" (No detectable wear).

Initial weigh : 10.3615g. Final weight 10.3580g (0.0035g weight loss).

Calculated density of aluminum coupon (weight/volume): 2.623g/cm³ (10.3615g/3.94991 cm³)

Calculated Surface area of coupon: 31.080cm².

Calculated volume loss of aluminum over 5 day period (0.0035g): 0.001334 cm³.

P. Vorona

June 25 Corrosion Report on hot Asphalt against Aluminum.

magnesium alloy 5052 2.5% mag + 0.25% cr
sg = 2.7(Data from books)
0.1 lbs/in³ iron is .28 lbs/in³
2.6989g/cm³
0.0975 lb/in³ at 68F

P. Vorona Calculations

Corrosion Coupon: Aluminum 5052 alloy, 2-5/8" x 3/4" x 1/8" with 1/8" hole.

Initial Condition :measured 0.1232" thickness and 10.3615 net weight after washing in trichloroethane and oven drying

Final Condition after

5 days (120 Hrs) corrosion

test exposure in agitated 320F : measured 0.1232" thickness and 10.3580g net weight after washing in trichloroethane and oven drying.

1.2% Polyacid conditioned

asphalt

16.38706

Approx. volume of aluminum coupon:

Volume of rectangular piece - volume of 1/8" hole :

0.241038 cubic inch 3.949907 cubic cm

Approx. density of aluminum coupon:

weight of piece/volume of piece:

2.623226 grams/cm³

Approx. surface area of coupon:

4.817481 inch sq = 31.08046 cm sq

5-day corrosion loss: 0.0035 grams = 0.001334 cm³

5-day corrosion loss: 0.016900951 mils

365-day corrosion loss: 1.233769414 mils

Summary: 1 mill corrosion per year.