

CODE SHEET

VISTA Projects Limited VENDOR DRAWING/DOCUMENT SQUAD CHECK			
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C	Not accepted. Revise as marked and resubmit drawing/document for review. Shipment will not be released, if any drawings/documents requiring approval, as per purchase order conditions, are at this code.		
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SDR CODE	EQUIPMENT TAG	REVIEWED BY	DATE
DE 99	E4050	D. Leman	2012-04-05

PROJECT NAME: Murphy Oil Cadotte /1780-002

VENDOR NAME: Calhex Industries

DOCUMENT NUMBER: 11-0707-HT

VENDOR REVISION: 0

DOCUMENT DESCRIPTION: Heat Tracing Drawing

VENDOR TRANSMITTAL NUMBER: 010-11-0707

VENDOR MUST PROVIDE THERMON EHT CALCULATION SHEET FROM THERMON'S COMPUTRACE PROGRAM. IN ADDITION, PROVIDE ACCURATE BILL OF MATERIALS WITH QUANTITIES AND CATALOGUE DATA ON THIS DWG.

SHOW PIPE EHT DATA AS SHOWN ON SAMPLE DWG. AS A MINIMUM.

RID'S SHOULD BE SHOWN & INSTALLED AT BOTTOM HALF OF PIPE/EQUIPMENT

SHOW TAG ON DWG & INSTALL NAMEPLATE ON JCS'S

MI TYPE EHT CABLES DON'T NEED AN END TERM. BOX IS THE EHT CABLE MI? PROVIDE DATA.

DWG TO HAVE SIZE OF PIPE, LENGTH OF PIPE, TYPE OF INSULATION USED, SIZE OF INSULATION, SIZE OF FLANGES, ETC

INSTALLATION OF EHT CABLE AS SHOWN IS NOT RECOMMENDED BY THERMON OR VISTA

HEAT TRACE NOZZELS AS WELL.

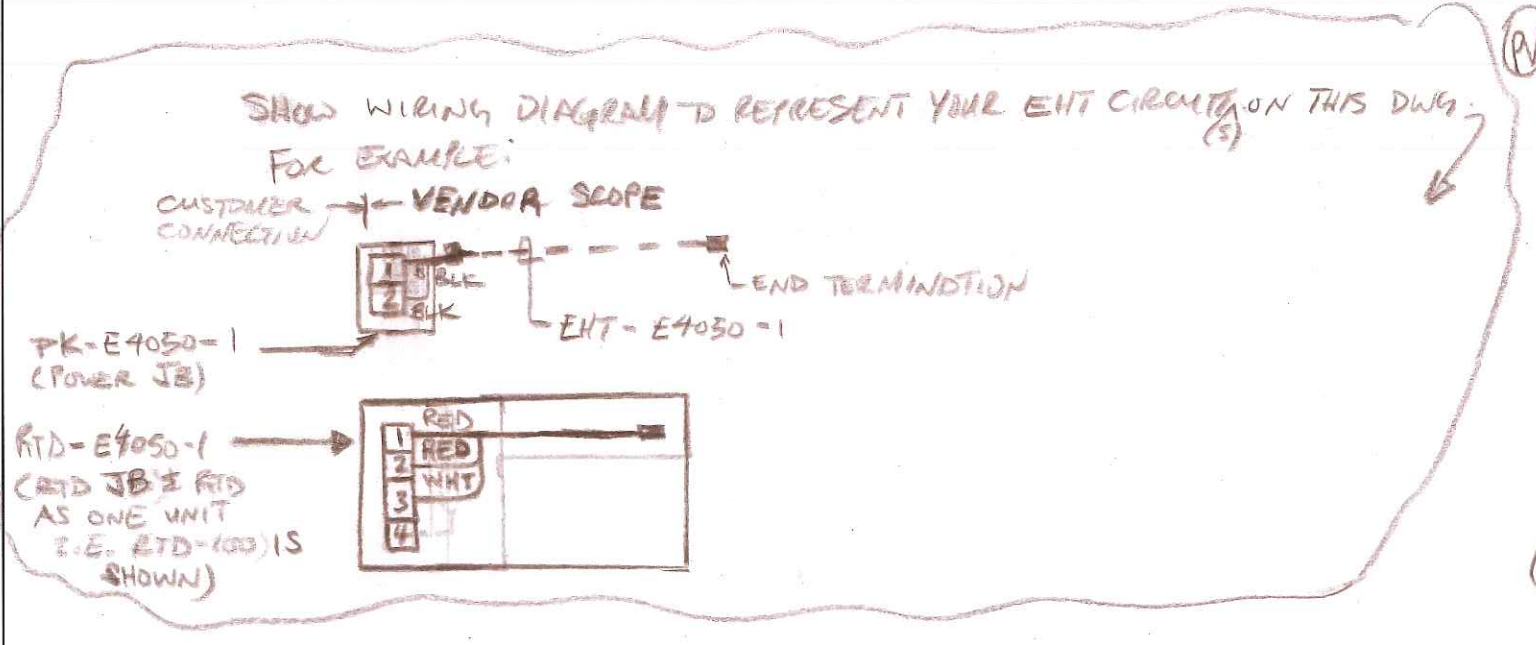
WHAT ADVANCEANCE OF EHT CABLE WAS USED FOR FLANGES DUE TO HEAT SINK LOSSES? PROVIDE DATA.

SHOW EHT AS
XX EHT PIPES ON PIPE/EQUIPMENT

IF MI EHT CABLE THEN PROVIDE MI STAINLESS STEEL EHT DATA ON ANOTHER SHEET/DWG.

MAKE SMALLER AND PUT IN A NOTE

NOTE:
HEAT TRACING:
1) ELECTRIC HEAT TRACING (EHT) SHALL BE 208 VAC MINERAL INSULATED (VENDOR - THERMON) C/W POWER JUNCTION BOX, SS BANDING & CLIPS, EHT LABELS & RTD 100 OHMS. EHT CONTROLLER TO BE SUPPLIED ON SITE BY OTHERS. A DRAWING SHOWING EHT DESIGN DATA & INSTALLATION OF HEATER CABLE ON EXCHANGER SHALL BE SUPPLIED TO VISTA PROJECTS FOR REVIEW BEFORE INSTALLATION OF EHT MATERIAL COMMENCES ON EXCHANGER.



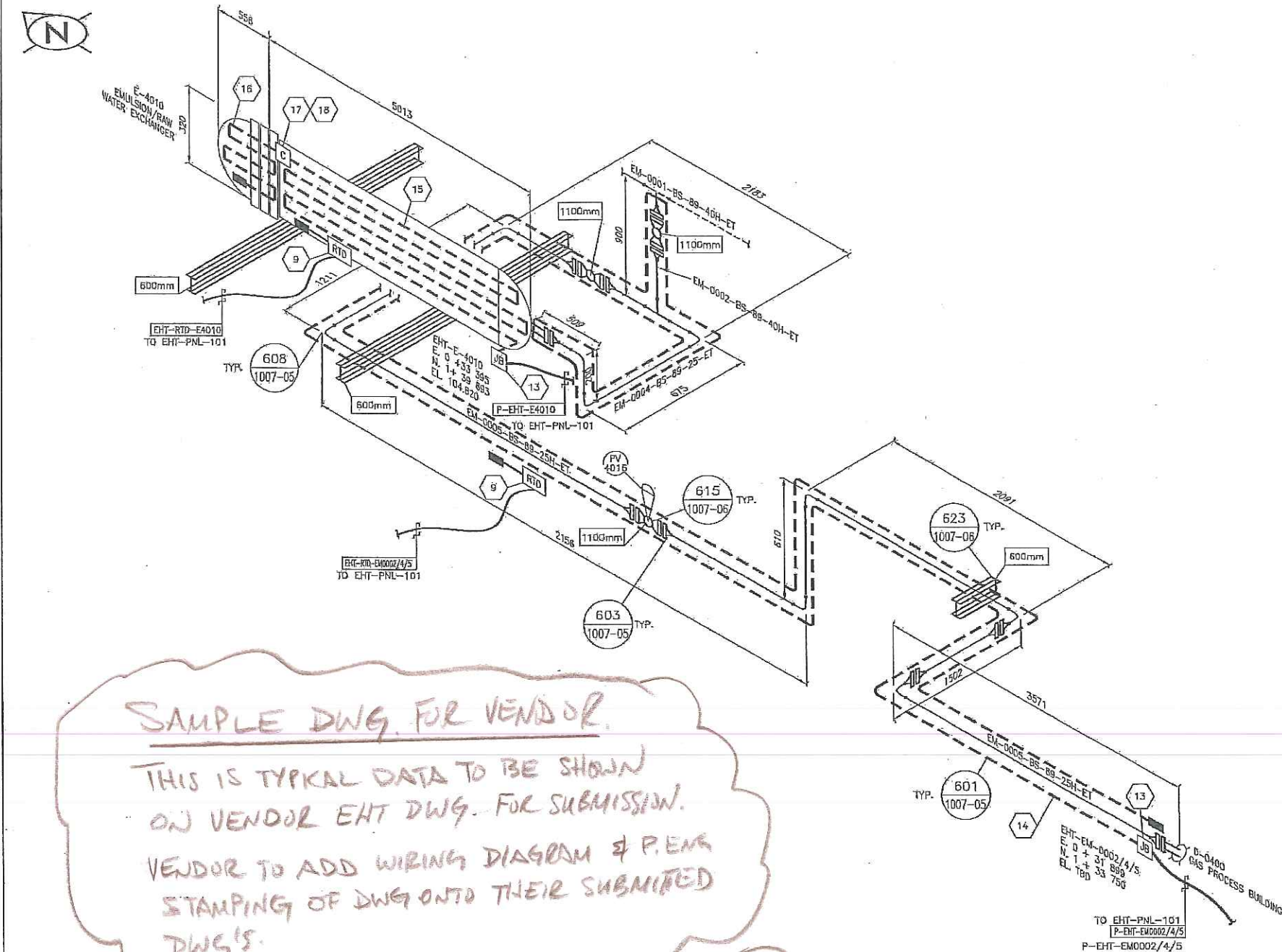
VISTA REQUESTS A VISIT TO INSPECT EHT INSTALLATION PLEASE NOTIFY VISTA.

REQUIRE MEGGER TEST VALUES AS PART OF QA/QC INSPECTION BEFORE EHT IS INSTALLED, AFTER EHT INSTALLED, AFTER INSULATION IS INSTALLED, & JUST BEFORE SHIPMENT. PROVIDE RECORDS OF ALL THE ABOVE TO VISTA.

HEAT TRACING DRAWING					
					
CALHEX INDUSTRIES LTD.					
9515 - 48th STREET S.E. CALGARY, ALBERTA T2C 2R1					
CUSTOMER: MURPHY OIL CANADA C/O VISTA PROJECTS LTD.			PROJECT: GROUP EMULSION / BFW EXCHANGER (1) NEN 15 x 336 ITEM#: E-4050 P.O. #: MURPHY 54115097-205 / VISTA 1780-002 CADOTTE CSS PILOT - VISTA PROJECT #1780		
ENGINEERING RECORDS			SCALE	L.S.D. NO.:	13-9/16-8-85-17 WSM
DRAWING BY:	J.GREGORY	DATE	MAR.28/12	DWG. NO.:	
CHECKED BY:	D.KLADNIK		MAR.28/12	N.T.S.	
APPROVED BY:	M.SOUKA				
11-0707-HT					0

HEATING CIRCUIT NO.	P & ID NO.	LINE DATA										HEATING CABLE DATA										THERMOSTAT/CONTROLLER DATA					ELECTRICAL SUPPLY				REMARKS
		LINE NO.	SERVICE DESCRIPTION	LINE LENGTH (m) *	LINE SIZE (in)	INSULATION		MAXIMUM PROCESS TEMP(°C)	MIN. TEMP (°C)	MAINTAIN TEMP (°C)	DESIGN HEAT LOSS (w/m)	NO. OF CABLE RUNS	OUTPUT PER CABLE (w/m)	TYPE	DESIGN	TOTAL LENGTH (m)	VOLT (V)	NOMINAL AMPS	TOTAL MAXIMUM CURRENT	NOMINAL POWER (VA)	CONTROLLER/ POINT	SET POINT (°C)	HI/LO TEMP ALARM (°C)	O/C TRIP (A)	GF ALARM/TRIP (mA)	PANEL NO.	BRK NO.	BRK SIZE	VOLTS (V)		
						TYPE	THICKNESS (mm)																								
EHT-EM-0002/4/5	PID-0112	EM-0002/4/5	EMULSION	16.5	3	MW	25	245	-45	45	53.8	2	30.6	D	MIQ	42.0	120	11.8	13.6	1416	EHT-PNL-101/3-12	45	250/40	18	5/25	DP-C2	26	30	120	SPACING AT APPROXIMATELY 8.7"	
EHT-E-4010	PID-0112	E-4010	EMULSION EXCHANGER	5.5	12	MW	40	245	-45	45	105.8	—	20.6	D	MIQ	34.0	208	3.7	4.1	770	EHT-PNL-101/2-11	45	250/40	7	5/25	DP-C2	43	30	208		

* CONTRACTOR TO CONFIRM LENGTHS



BILL OF MATERIALS				
ITEM	MANUF.	CAT. NO.	QTY.	
1	THERMON	HTSX 9-2 DJ	—	SELF-REGULATING CABLE
2	THERMON	HTSX 12-2 DJ	—	SELF-REGULATING CABLE
3	THERMON	HTSX 15-2 DJ	—	SELF-REGULATING CABLE
4	THERMON	TERMINATOR DP C/W PETK-2D	—	POWER KIT C/W TERMINATION KIT
5	THERMON	TERMINATOR DP C/W SCTK-2D	—	SPLICE KIT C/W TERMINATION KIT
6	THERMON	TERMINATOR DP C/W SCTK-2D	—	TEE KIT C/W TERMINATION KIT
7	THERMON	TERMINATOR DL C/W PETK-2D	—	END KIT C/W TERMINATION KIT AND INDICATOR LIGHT
8	THERMON	RTD-500-3-HT-KIT	—	TEMPERATURE SENSOR KIT (AMBIENT)
9	THERMON	RTD-100	2	TEMPERATURE SENSOR KIT (LINE SENSING)
10	THERMON	FT-1L	—	FIXING TAPE
11	THERMON	CL	5	CAUTION LABEL
12	THERMON	AL-30L	—	ALUMINUM TAPE
13	THERMON	MIQ-PJ8FG-TB4F	2	NEMA 4X JUNCTION BOX
14	THERMON	MIQ	1	D/MIQ-70E3H-2S/42m/1416/120/2.1m/10/5
15	THERMON	MIQ	1	E/MIQ-50E2H-2S/28m/634/171/2.1m/12/6/F
16	THERMON	MIQ	1	D/MIQ-50E2H-2S/5m/135/37/2.1m/12/6/M
17	WIELAND	74.900.1228.6	1	REVOS COAX CONNECTOR (FEMALE)
18	WIELAND	74.910.1228.6	1	REVOS COAX CONNECTOR (MALE)
19	THERMON	SSTW-16	AS REQ'D	STAINLESS STEEL WIRE

NOTES:

1. PIPING LENGTHS INDICATED ON ISOMETRIC ARE IN mm.
2. HEAT SINKS HEATER CABLE ALLOWANCES ARE IN ADDITION TO LINEAR RUN OF HEATER CABLE.

LEGEND:

---	EHT - TRACER
PK	EHT - POWER KIT
SK	EHT - SPLICE KIT
JB	EHT - NEMA 4X JUNCTION BOX
C	EHT - REVOS COAX CONNECTOR
T	EHT - TEE KIT
RTD	EHT - TEMPERATURE SENSOR KIT
---	EHT - END KIT
XXXXmm	EHT - CABLE ALLOWANCE FOR HEAT SINK

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SDR CODE	EQUIPMENT TAG	REVIEWED BY	DATE
DM01/ DG02	E-4050	D. Lemor	2011/12/06

PROJECT NAME: 17801 Murphy Cadotte oil

VENDOR NAME: Calhex Industrial

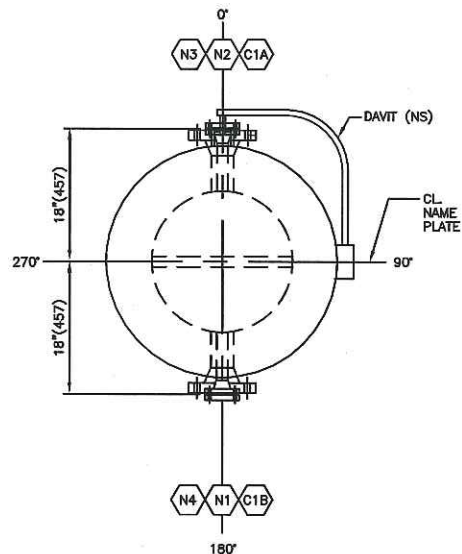
DOCUMENT NUMBER: 11-0707-0

VENDOR REVISION: 0

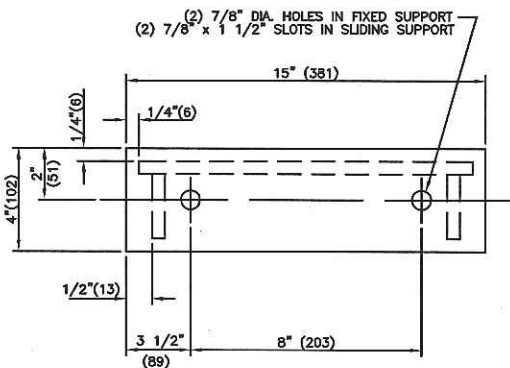
DOCUMENT DESCRIPTION: Emulsion - BFW Exchanger

VENDOR TRANSMITTAL NUMBER: 001-11-0707

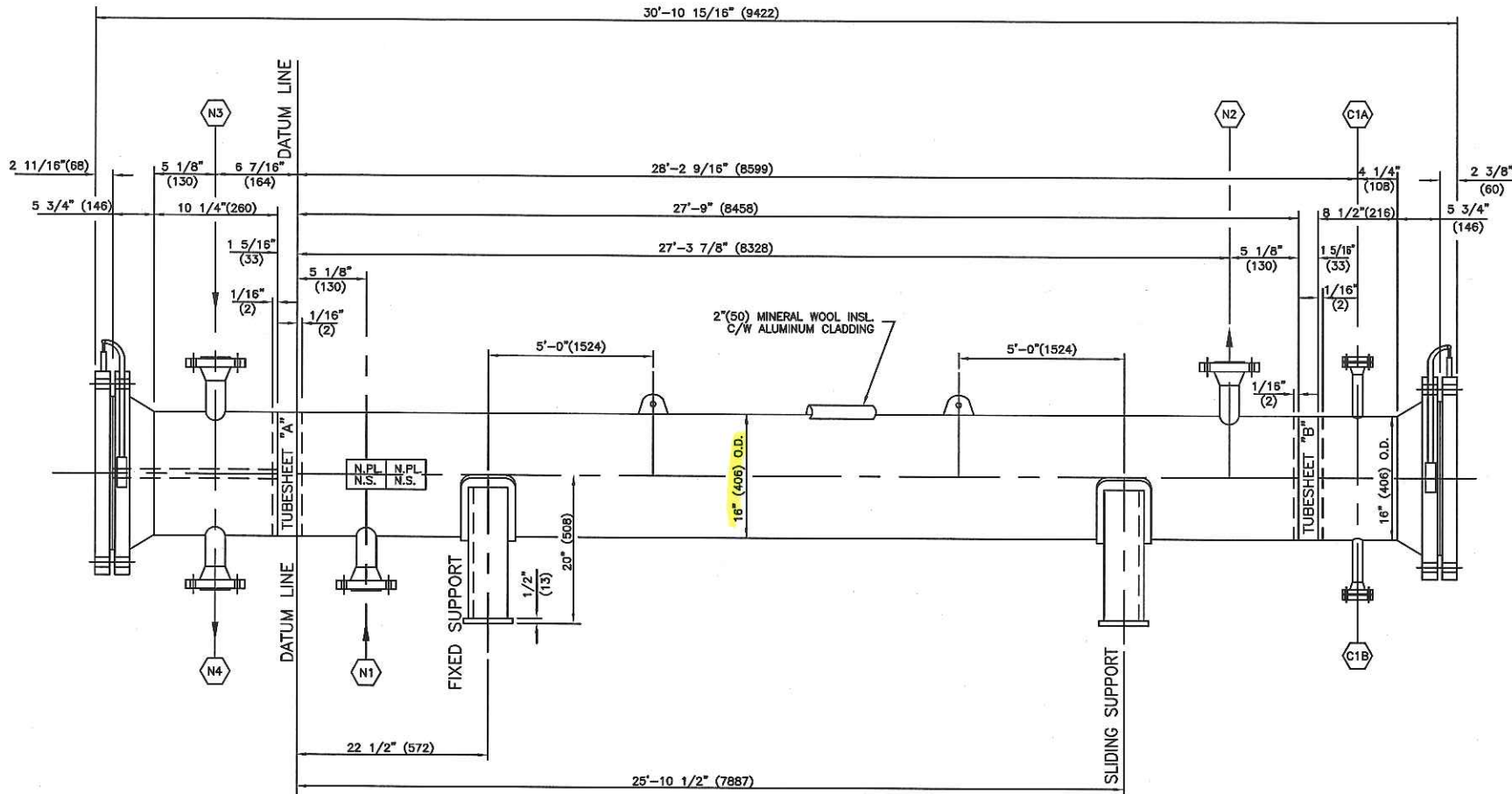
MAXIMUM NOZZLE LOAD						
NOZZLE	FORCES (LB)			MOMENTS (FT-LB)		
	Fa	Fb	Fc	Ma	Mb	Mc
N1	339	416	416	612	428	428
N2	339	416	416	612	428	428
N3	339	416	416	612	428	428
N4	339	416	416	612	428	428



END VIEW
(SUPPORT SADDLES OMITTED FOR CLARITY)



SUPPORT DETAIL



HEAT TRACING:
ELECTRIC HEAT TRACING (EHT) SHALL BE 208 VAC MINERAL INSULATED (VENDOR - THERMON) C/W POWER JUNCTION BOX, SS BANDING & CLIPS, EHT LABELS & RTD 100 OHMS. EHT CONTROLLER TO BE SUPPLIED ON SITE BY OTHERS. A DRAWING SHOWING EHT DESIGN DATA & INSTALLATION OF HEATER CABLE ON EXCHANGER SHALL BE SUPPLIED TO VISTA PROJECTS FOR REVIEW BEFORE INSTALLATION OF EHT MATERIAL COMMENCES ON EXCHANGER.

302°F
150°C

150#

Cadotte

Group Emulsion/BFW Exchanger

Provide weights

DESIGN DATA			
SHELL SIDE		TUBE SIDE	
DESIGN PRESSURE:	206 PSIG 1420 kPa	610 PSIG 4206 kPa	
DESIGN TEMPERATURE:	473 °F 245 °C	473 °F 245 °C	
MIN. DESIGN METAL TEMPERATURE:	-20 °F -29 °C	-20 °F -29 °C	
RADIOGRAPHY:	N/A PER FIG. UW-13.2(d)	100% XR/UT/MPI	
STRESS RELIEVING:	N/A	1 HR @ 1150°F 627°C	
CORROSION ALLOWANCE:	0.0625" 1.6 mm	0.125" 3.2 mm	
TEST PRESSURE:	288 PSIG 1947 kPa	793 PSIG 5467 kPa	
WELDING PROCEDURES:	CK-1 REV.3, CK-2 REV.1 (MIG'D BACK WELDS)	CK-3, CK-4 (MIG'D BACK WELDS)	
MEAN DESIGN TEMP.: SHELL: 140.43°F TUBES: 158.2°F TUBESHEET "A": 144.5°F TUBESHEET "B": 234.5°F			
IMPACT TESTING: ALL MATERIAL C.L.T. EXEMPT PER UG-20(f), UCS-66(a)(3)(g), FIG. UCS-66 NOTE (c)			
MAWP EQUAL TO DESIGN PRESSURE.			
NO CORROSION ALLOWANCE APPLICABLE TO TUBING MATERIAL.			
CODE: ASME SECTION VIII, DIV. 1, 2010 ED.	DESIGN: TEMA "R", API-680		
REGISTRATION: ALBERTA, B.C., SASK.	C.R.N. #:		
WEIGHT OF BUNDLE: TBD LBS / TBD KGS	VOLUME: TBD CU.FT. / TBD CU.M.		
SHIPPING WEIGHT (GROSS): TBD LBS / TBD KGS	TEST WEIGHT: TBD LBS / TBD KGS		
HEATING SURFACE: 948.3 SQ. FT. / 88.1 SQ.M			
REGISTERED QUALITY CONTROL PROCEDURES AQP 1386	REGISTERED WELDING PROCEDURES WP 2380.2		

CONSTRUCTION / GENERAL NOTES					
NO.	1	SURFACE PREP: SSPC-SP10 (NEAR WHITE BLAST) PAINT: ONE COAT OF INORGANIC ZINC - RICH SILICATE, INTERZING 22 (2.0-3.0 mils DFT.) FINISH: ONE COAT HIGH TEMPERATURE SILICONE ALUMINUM, INTERTHERM 50 (1.0-2.0 mils DFT.) ON EXPOSED SURFACES ONLY COLOR: ALUMINUM			
NO.	2	REGISTRATION: ALBERTA, BRITISH COLUMBIA, SASKATCHEWAN			
NO.	3	TUBE SIDE SOUR SERVICE: 100% XR/UT/MPI. SPECIAL CHECK ON PLATE MAT'L PER NACE MR-0175			
REV.	0	ISSUED FOR APPROVAL	0	INITIAL ISSUE	MS NOV/21/11
REV.	BY	DESCRIPTION	CALC. PACKAGE REV. LEVEL	REVISOR	DATE
REVISION RECORD					

NOZZLE / CONNECTION SCHEDULE					
REF.	QTY.	SIZE	RATING	TYPE	SERVICE
N1	1	3"	300	RFWN	SHELL SIDE INLET
N2	1	3"	300	RFWN	SHELL SIDE OUTLET
N3	1	3"	300	RFWN	TUBE SIDE INLET
N4	1	3"	300	RFWN	TUBE SIDE OUTLET
C1A/B	2	2"	300	RFWN	TUBE SIDE VENT / DRAIN C/W BLIND

		CALHEX INDUSTRIES LTD. 9515 - 48th STREET S.E. CALGARY, ALBERTA T2C 2R1	
		CUSTOMER: MURPHY OIL CANADA C/O VISTA PROJECTS LTD. PROJECT: EMULSION / BFW EXCHANGER (1) NEN 15 x 336 ITEM: E-4050 P.O. #: MURPHY 54115097-205 / VISTA 1780-002 SEAL: CSS PILOT - VISTA PROJECT #1780	
DRAWING BY: J.GREGORY CHECKED BY: D.KADNIK APPROVED BY:		SCALE: N.T.S. L.S.D. NO.: 13-9/16-B-85-17 WSM DWG. NO.: 11-0707-0	
		REV: 0	

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SDR CODE	EQUIPMENT TAG	REVIEWED BY	DATE
DM-02	E-4050	D. Lemon	2012-02-21

PROJECT NAME: Murphy Oil Cadotte - 1780

VENDOR NAME: Calhex Industries

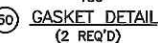
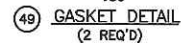
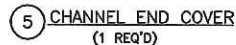
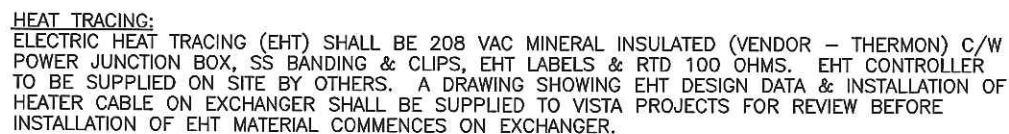
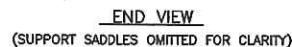
DOCUMENT
NUMBER: 11-0707-S

VENDOR
REVISION: 1

DOCUMENT
DESCRIPTION: Shell drawing / Emulsion BFW Exchanger

VENDOR
TRANSMITTAL
NUMBER: 008-11-0707

METRIC DIMENSIONS ARE IN BRACKETS



DESIGN DATA				
SHELL SIDE		TUBE SIDE		
DESIGN PRESSURE:	208 PSIG	1420 kPa	610 PSIG	4206 kPa
DESIGN TEMPERATURE:	302 °F	150 °C	473 °F	245 °C
MIN. DESIGN METAL TEMPERATURE:	-20 °F	-29 °C	-20 °F	-29 °C
RADIOGRAPHY:	N/A PER FIG. UW-13.2(d)		100% XR/UT/NPI	
STRESS RELIEVING:	N/R		1 HR @ 1150°F ^{595°C}	
CORROSION ALLOWANCE:	0.0625"	1.6 mm	0.125"	3.2 mm
TEST PRESSURE:	268 PSIG	1647 kPa	804 PSIG	5540 kPa
WELDING PROCEDURES: CX-1 REYS, CX-2 REAY (BOLD TACK WELDS) CX-3, CX-4 (BOLD TACK WELDS)				
MEAN DESIGN SHELL TEMP.: 140.43°F TUBES: 156.27° TUBESHEET "A":144.5°F TUBESHEET "B": 234.5°F				
IMPACT TESTING: ALL MATERIAL C.L. EXEMPT FOR UG-20(1), UCS-56(a)(c)(d), FIG. UCS-66 NOTE (c)				
MAWP EQUAL TO DESIGN PRESSURE.				
NO CORROSION ALLOWANCE APPLICABLE TO TUBING MATERIAL				
CODE: ASME SECTION VIII, DIV. 1, 2010 ED.			DESIGN: TEMA "R", API-860	
REGISTRATION: ALBERTA, B.C., SASK.			C.R.N. F.E.	
WEIGHT OF BUNDLES 3300 LBS / 1487 KGS			VOLUME: 31.16 CU/FT / 0.882 CU.M.	
SHIPPING WEIGHT (DRY): 7000 LBS / 3175 KGS			TEST WEIGHT: 8000 LBS/ 4082 KGS	
HEATING SURFACE: 948.3 SQ. FT. / 88.1 SQ.M				

BILL OF MATERIAL				
ITEM	QTY.	DESCRIPTION	MATERIAL	P.O.#
PLATE / STRUCTURAL				
1	2	1/2" PL. x 14 1/2" x 15 9/16" LG. - SUPPORT WEB	G-44W	
2	4	1/2" PL. x 3" x 14 7/16" - SUPPORT GUSSETS	G-44W	
3	2	1/2" PL. x 4" x 15" - BASE PLATES	G-44W	
4	2	1/4" PL. x 6" x 22" LG. ROLLED TO 18" L.D. - SUPPORT WEAR PLATE	SA-516-70N	
5	1	2 3/4" THK. PL. x 25 1/2" O.D. - CHANNEL COVER	SA-516-70N	
6	2	3/4" THK. PLATE x 5 1/2" x 6" - SHELL LIFTING LUGS	SA-516-70N	
7	1	3/8" THK. PLATE x 15" x 16" - PASS PLATE	SA-516-70N	
8				
9				
10				
11				
12				
13				
14				
15				
PIPE / FITTINGS				
16	1	16" - SCH. STD. (0.375") SEAMLESS PIPE x 27'-6 7/8" LG - SHELL	SA-106-B	
17	1	16" - SCH. XH (0.500") SEAMLESS PIPE x 10 1/4" LG - CHANNEL	SA-106-B	
18	1	10" - SCH. XH (0.500") SEAMLESS PIPE x 5 1/2" LG - CHANNEL	SA-106-B	
19	2	3 - SCH. XH (0.300") SMLS PIPE x 8 1/2" LG - N1, N2	SA-106-B	
20	2	3 - SCH. XOH (0.600") SMLS PIPE x 8 1/8" LG - N3, N4	SA-106-B	
21	2	2 - SCH. 160 (0.364") SMLS PIPE x 8 3/8" LG - C1A/B	SA-106-B	
22				
23				
24				
25				
FORGINGS				
26				
ANSI FLANGES / CPLG'S				
27	2	16" - CLASS 300 RFWN (SCH XH BORE) - CHANNEL FLANGES	SA-105N	
28	1	16" - CLASS 300 RF BLIND FLANGE - CHANNEL COVER	SA-105N	
29	2	3" - CLASS 150 RFWN (SCH XH BORE) - N1, N2	SA-105N	
30	2	3" - CLASS 300 RFWN (SCH XOH BORE) - N3, N4	SA-105N	
31	2	2" - CLASS 300 RFWN (SCH 160 BORE) - C1A/B	SA-105N	
32	2	2" - CLASS 300 RF BLIND FLANGE - C1A/B	SA-105N	
33				
34				
35				
36				
37				
STUD BOLTS & NUTS				
38	20	1 1/4" DIA. x 8" LG STUD BOLTS	SA-193-87M	
39	40	1 1/4" DIA. H. HEX NUTS	SA-194-29M	
40	20	1 1/4" DIA. x 7 1/2" LG STUD BOLTS	SA-193-87M	
41	40	1 1/4" DIA. H. HEX NUTS	SA-194-29M	
42	16	5/8" DIA. x 3 1/2" LG STUD BOLTS - C1A/B	SA-193-87M	
43	32	5/8" DIA. H. HEX NUTS - C1A/B	SA-194-29M	
44				
45				
46				
47				
48				
GASKETS				
49	3	16" - CLASS 300 RF, FLEXITALK STYLE C.G. GASKET C/W PASS RIB (SEE DETAIL)	T-318S.	
50	3	16" - CLASS 300 RF, FLEXITALK STYLE C.G. GASKET (SEE DETAIL)	T-318S.	
51	6	2" - CLASS 300 RF, FLEXITALK STYLE C.G. GASKET	T-318S.	
52				
53				
54				
NAME PLATES				
55	2	6" T-BAR STYLE NAME PLATE BRACKETS C/W S.S. NAMEPLATE PLATE	SA-516-70N	
QUANTITIES				
QUANTITIES LISTED ARE FOR ONE UNIT, ONE UNIT REQ'D				
SPECIAL CHEMISTRY				
TUBE SIDE SOUR SERVICE 100% X.R., U.T., & PWHT. SPECIAL CHEMISTRY ON PLATE MATERIAL PER NACE MR-0175 C.E. = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 C.E. < 0.45				
 CALHEX INDUSTRIES LTD. 9515 - 48th STREET S.E. CALGARY, ALBERTA T2C 2R1				
CUSTOMER: MURPHY OIL CANADA C/O VISTA PROJECTS LTD.		PROJECT: GROUP EMULSION / BFW EXCHANGER (1) NEN 15 x 336 ITEM#: E-4050 P.O. #: MURPHY 54115097-205 / VISTA 1780-002 CADOTTE CSS PILOT - VISTA PROJECT #1780		
ENGINEERING RECORDS		SCALE	L.S.D. NO.:	13-9/16-8-85-17 WSM
NAME DATE		DWG. NO.:	REV:	
DRAWING BY: J.GREGORY DEC.7/11		N.T.S.		
CHECKED BY: D.KLADNIK DEC.7/11		11-0707-S		

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VENDOR NAME: Calhex Industries

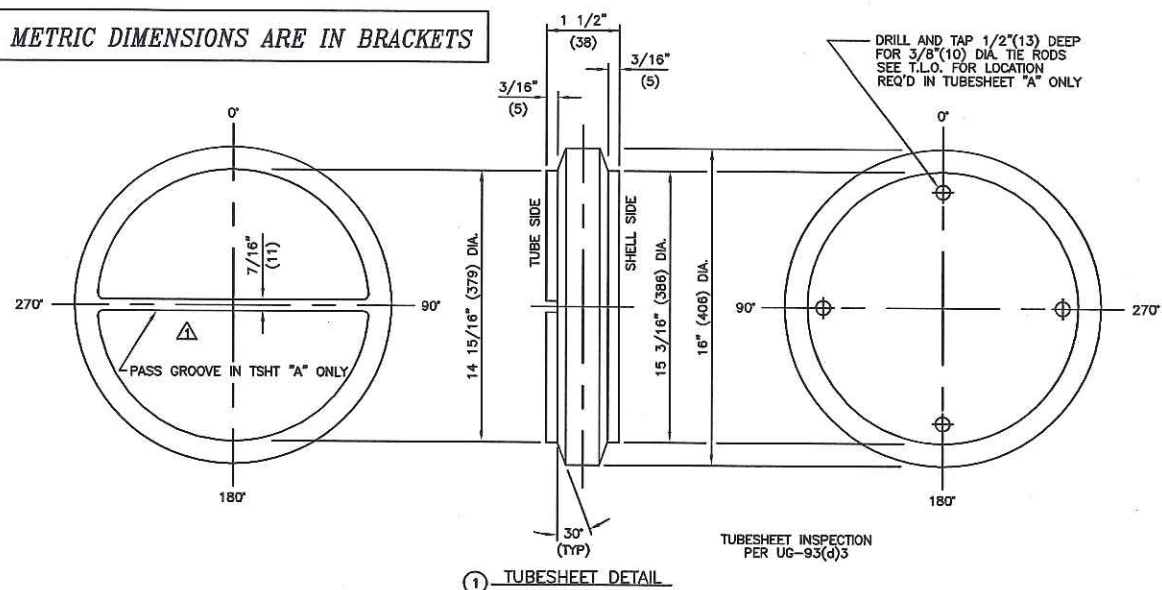
DOCUMENT
NUMBER: 11-0707-T

VENDOR
REVISION: 1

DOCUMENT
DESCRIPTION: Bundle Drawing / Emulsion BFW Exchanger

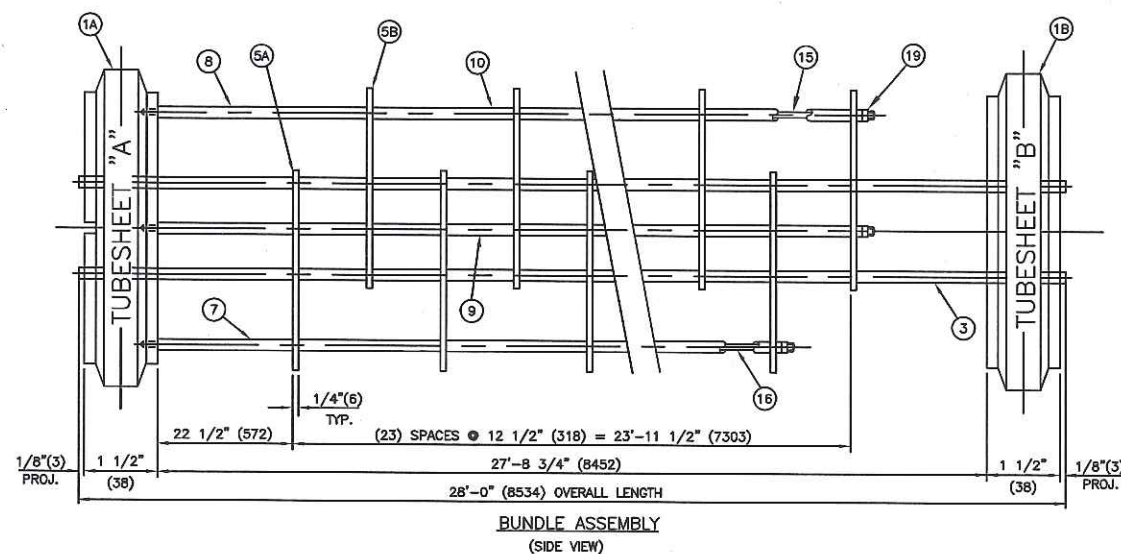
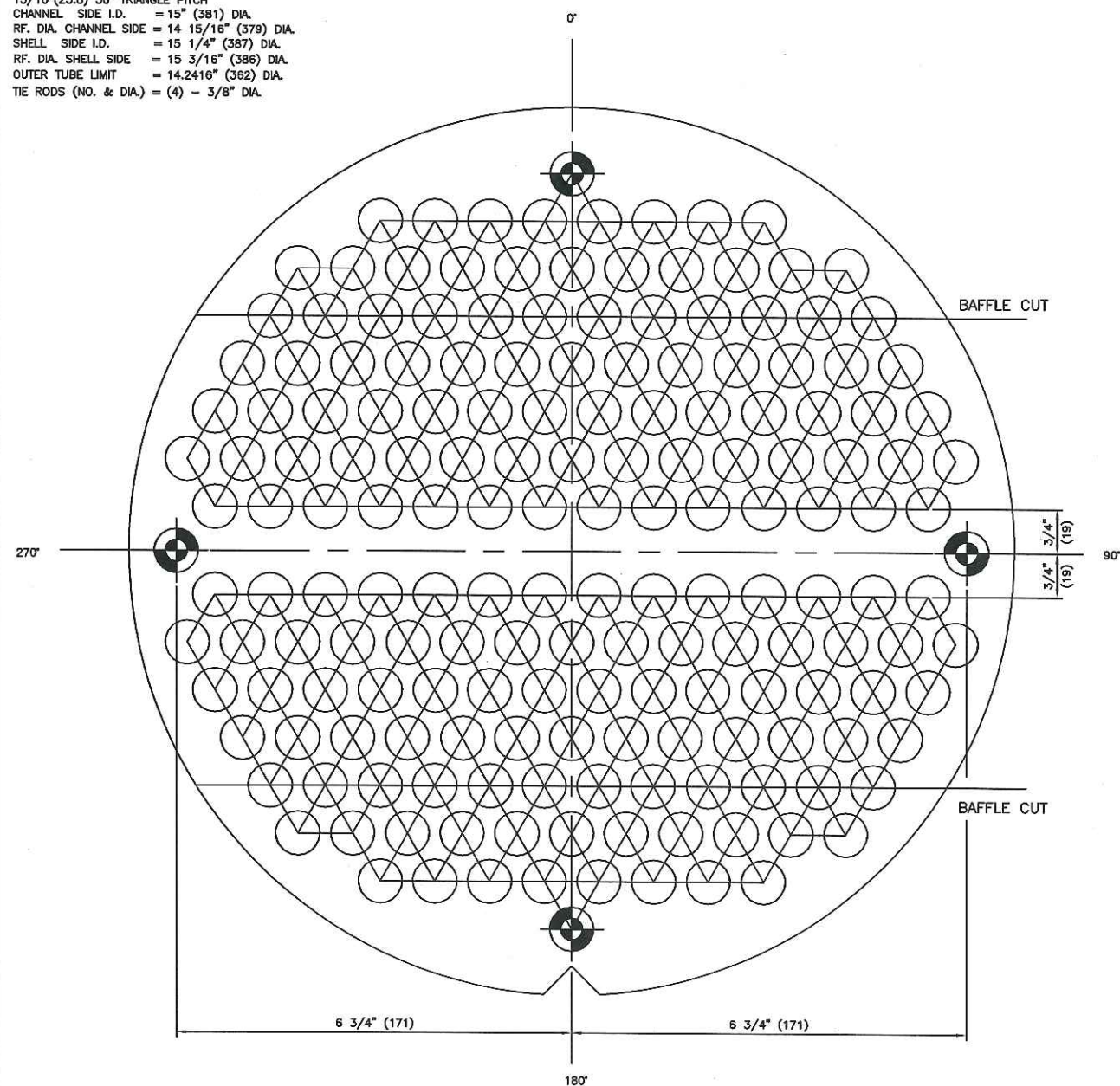
VENDOR
TRANSMITTAL
NUMBER: 008-11-0707

METRIC DIMENSIONS ARE IN BRACKETS

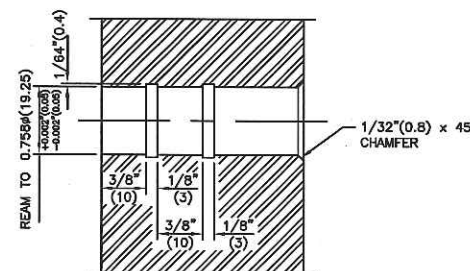


TUBE LAYOUT

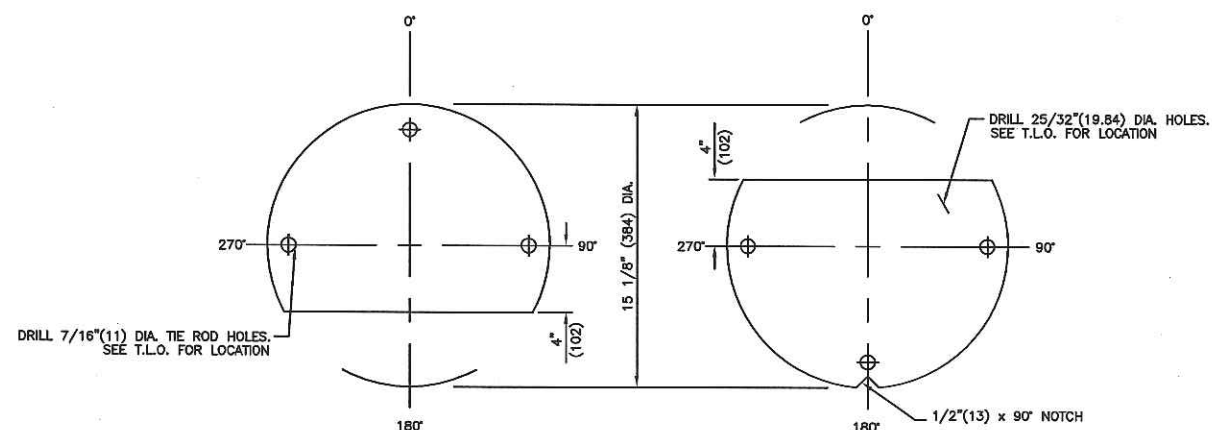
(174) 3/4"(19) O.D. x #14 BWG (M/W) x 28'-0" (8534) LG.
15/16"(23.8) 30° TRIANGLE PITCH
CHANNEL SIDE I.D. = 15" (381) DIA.
RF. DIA. CHANNEL SIDE = 14 15/16" (379) DIA.
SHELL SIDE I.D. = 15 1/4" (387) DIA.
RF. DIA. SHELL SIDE = 15 3/16" (386) DIA.
OUTER TUBE LIMIT = 14.2416" (362) DIA.
TIE RODS (NO. & DIA.) = (4) - 3/8" DIA.



TUBE EXPANSION LENGTH = 1 7/16"(37)



TUBE HOLE GROOVING DETAIL



5B BAFFLE DETAIL
(12 REQ'D)

5A BAFFLE DETAIL
(12 REQ'D)

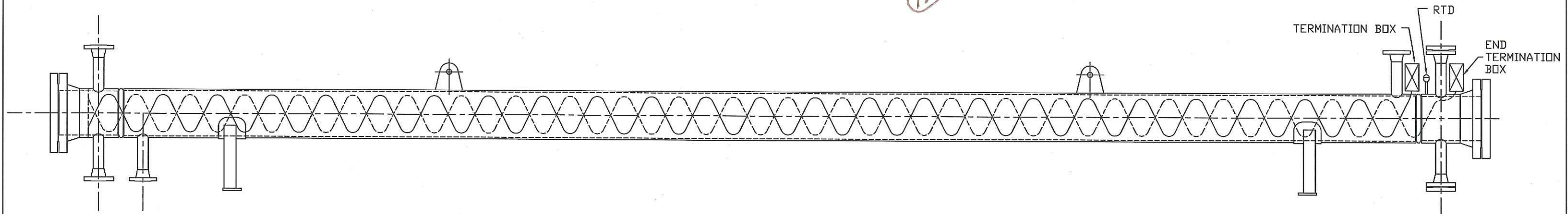
BILL OF MATERIAL				
ITEM	QTY.	DESCRIPTION	MATERIAL	P.O.#
PLATE				
1	2	1 1/2" PL. x 16" DIA. TUBESHEET	SA-516-70N	
2	-	-	-	
TUBES				
3	174	3/4" DIA. x #14 BWG (M/W) x 28'-0" SEAMLESS TUBES	SA-179	
4	-	-	-	
BAFFLES				
5	24	1/4" PL. x 15 1/8" O.D. BAFFLES	G-44W	
6	-	-	-	
SPACERS				
7	3	3/4" DIA. x #14 BWG x 22 1/2" LG. SPACER	SA-179/SA-214	
8	1	3/4" DIA. x #14 BWG x 35" LG. SPACER	SA-179/SA-214	
9	46	3/4" DIA. x #14 BWG x 12 1/4" LG. SPACER	SA-179/SA-214	
10	22	3/4" DIA. x #14 BWG x 24 3/4" LG. SPACER	SA-179/SA-214	
11	-	-	-	
12	-	-	-	
13	-	-	-	
14	-	-	-	
TIE RODS				
15	3	3/8" DIA. R.B. x 28'-1" LG. TIE ROD	H.R. STL.	
16	1	3/8" DIA. R.B. x 25'-0 1/2" LG. TIE ROD	H.R. STL.	
17	-	-	-	
18	-	-	-	
NUTS				
19	6	3/8" DIA. HEX NUTS	SA-325	
20	-	-	-	
IMPACT PLATE				
21	-	-	-	
22	-	-	-	
QUANTITIES				
MATERIAL LISTED IS FOR ONE BUNDLE, ONE BUNDLE REQ'D				
SPECIAL CHEMISTRY NOTES				
TUBE SIDE SOUR SERVICE 100% X.R., U.T., & PWHT. SPECIAL CHEMISTRY ON PLATE MATERIAL PER NACE MR-0175 C.E. = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 C.E. < 0.45				

CONSTRUCTION / GENERAL NOTES				
NO.				
1	-			
2	-			
3	-			
4	-			
5	-			
6	-			
7	-			
1	JG	PASS GROOVE	SEE "S" DWG.	SEE "S" DWG.
0	JG	ISSUED FOR APPROVAL	SEE "S" DWG.	MS
REV.	BY	DESCRIPTION	REV. LEVEL	APPROVAL
REVISION RECORD				

		CALHEX INDUSTRIES LTD.	
9515 - 48th STREET S.E.		CALGARY, ALBERTA T2C 2R1	
CUSTOMER: MURPHY OIL CANADA C/O VISTA PROJECTS LTD.		PROJECT: GROUP EMULSION / BFW EXCHANGER (1) NEN 15 x 335 ITEM: E-4050 P.O. #: MURPHY 54115097-205 / VISTA 1780-002 CADOTTE CSS PILOT - VISTA PROJECT #1780	
ENGINEERING RECORDS		SCALE	
DRAWING BY: J.GREGORY		L.S.D. NO.: 13-9/16-B-85-17 WSM	
CHECKED BY: D.KLADNIK		DWG. NO.: 11-0707-T	
APPROVED BY: M.SOLJA		REV: 1	

SEE COMMENTS ON DWG. 11-0707-HT

PV



HEAT TRACING:

ELECTRIC HEAT TRACING (EHT) SHALL BE 208 VAC MINERAL INSULATED (VENDOR – THERMON) C/W POWER JUNCTION BOX, SS BANDING & CLIPS, EHT LABELS & RTD 100 OHMS. EHT CONTROLLER TO BE SUPPLIED ON SITE BY OTHERS. A DRAWING SHOWING EHT DESIGN DATA & INSTALLATION OF HEATER CABLE ON EXCHANGER SHALL BE SUPPLIED TO VISTA PROJECTS FOR REVIEW BEFORE INSTALLATION OF EHT MATERIAL COMMENCES ON EXCHANGER.

VISTA Projects Limited VENDOR DRAWING/DOCUMENT SQUAD CHECK

- A Reviewed without exception. Proceed with fabrication. Issue final drawings/documents.
- ☒ B Reviewed except as marked and/or noted. Proceed with fabrication and resubmit drawing/document. Shipment will not be released, if any drawings/documents requiring approval, as per purchase order conditions, are at this code.
- C Not accepted. Revise as marked and resubmit drawing/document for review. Shipment will not be released, if any drawings/documents requiring approval, as per purchase order conditions, are at this code.
- D Not required for review. Received for information.

Reviewed only as to general conformity with the design concept and specifications provided. The engineer does not warrant or represent that the information contained on this drawing/document is either accurate or complete. Sole responsibility for correct design, detail and dimensions shall remain with the party submitting the drawing/document.

SDR CODE	EQUIPMENT TAG	REVIEWED BY	DATE
DE 99	E-4060	OK	2012-04-05

HEAT TRACING DRAWING



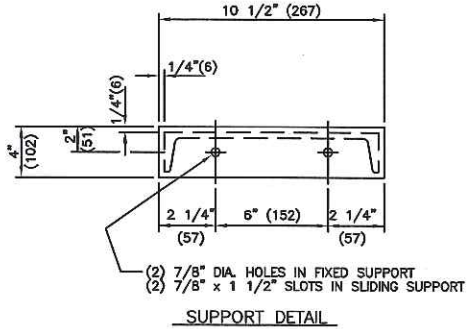
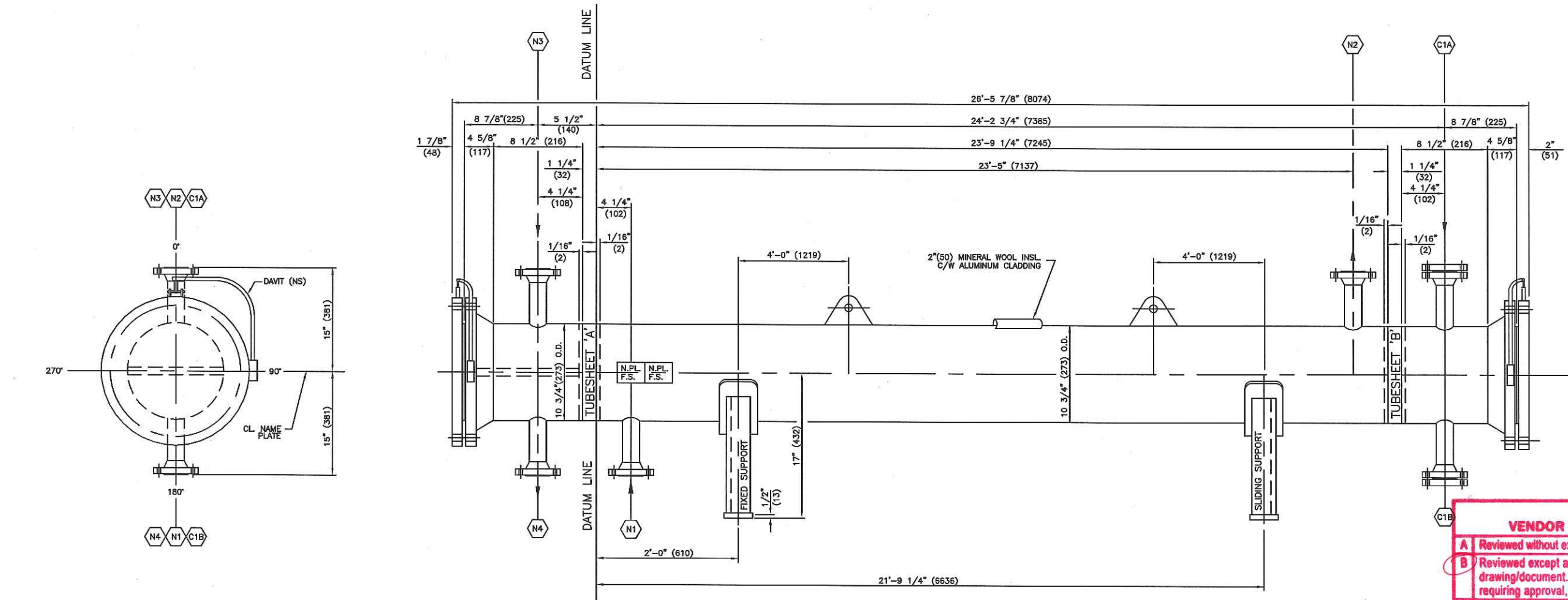
CALHEX INDUSTRIES LTD.

9515 - 48th STREET S.E.
CALGARY, ALBERTA T2C 2R1

CUSTOMER: MURPHY OIL CANADA C/O VISTA PROJECTS LTD.		PROJECT: TEST EMULSION / BFW EXCHANGER (1) MEN 10 x 288 P.O. #: MURPHY 54115097-205 / VISTA 1780-002 CADOTTE CSS PILOT - VISTA PROJECT #1780	
ENGINEERING RECORDS		SCALE	L.S.D. NO.: 13-9/16-8-85-17 WSM
DRAWING BY: J.GREGORY	DATE: MAR.28/12	DWG. NO.:	REV:
CHECKED BY: D.KLADNIK	DATE: MAR.28/12	N.T.S.	11-0708-HT 0
APPROVED BY: M.SOKA			

MAXIMUM NOZZLE LOAD						
NOZZLE	FORCES (LB)			MOMENTS (FT-LB)		
	Fa	Fb	Fc	Ma	Mb	Mc
N1	225	274	274	258	184	184
N2	225	274	274	258	184	184
N3	225	274	274	258	184	184
N4	225	274	274	258	184	184

METRIC DIMENSIONS ARE IN BRACKETS



HEAT TRACING:
ELECTRIC HEAT TRACING (EHT) SHALL BE 208 VAC MINERAL INSULATED (VENDOR - THERMON) C/W POWER JUNCTION BOX, SS BANDING & CLIPS, EHT LABELS & RTD 100 OHMS. EHT CONTROLLER TO BE SUPPLIED ON SITE BY OTHERS. A DRAWING SHOWING EHT DESIGN DATA & INSTALLATION OF HEATER CABLE ON EXCHANGER SHALL BE SUPPLIED TO VISTA PROJECTS FOR REVIEW BEFORE INSTALLATION OF EHT MATERIAL COMMENCES ON EXCHANGER.

VISTA Projects Limited
VENDOR DRAWING/DOCUMENT SQUAD CHECK

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SDR CODE	EQUIPMENT TAG	REVIEWED BY	DATE
DM01 / DG02	E-4060	D. Lemay	2011/12/06

OUTLINE DRAWING

DESIGN DATA			
SHELL SIDE		TUBE SIDE	
DESIGN PRESSURE:	208 PSIG	1420 kPa	610 PSIG
DESIGN TEMPERATURE:	473 °F	245 °C	473 °F
MIN. DESIGN METAL TEMPERATURE:	-20 °F	-29 °C	-20 °F
RADIOGRAPHY:	N/A PER FIG. UW-13.2(d)		100% XR/UT/MPI
STRESS RELIEVING:	N/R		1 HR @ 1150°F
CORROSION ALLOWANCE:	0.0625"	1.6 mm	0.125"
TEST PRESSURE:	288 PSIG	1847 kPa	793 PSIG
WELDING PROCEDURES:	CK-1 REV.3, CK-2 REV.1 (MIG'D TACK WELDS)	CK-3, CK-4 (MIG'D TACK WELDS)	
MEAN DESIGN TEMP.: SHELL:	140.53°F	TUBES:	156.68°F
IMPACT TESTING:	ALL MATERIAL C.I.T. EXEMPT PER UG-20(f), UCS-66(a)(c)(d), FIG. UCS-66 NOTE (c)		
MAWP EQUAL TO DESIGN PRESSURE.			
NO CORROSION ALLOWANCE APPLICABLE TO TUBING MATERIAL.			
CODE: ASME SECTION VIII, DIV. 1, 2010 ED.		DESIGN: TEMA "R", API-660	
REGISTRATION: ALBERTA, B.C., SASK.		C.R.N. #:	
WEIGHT OF BUNDLE: TBD LBS / TBD KGS		VOLUME: TBD CU.FT. / TBD CU.M.	
SHIPPING WEIGHT (DRY): TBD LBS / TBD KGS		TEST WEIGHT: TBD LBS / TBD KGS	
HEATING SURFACE: 317.7 SQ. FT. / 29.52 SQ.M			
REGISTERED QUALITY CONTROL PROCEDURES AQP 1386		REGISTERED WELDING PROCEDURES WP 2380.2	

CONSTRUCTION / GENERAL NOTES				
NO.				
1	SURFACE PREP: SSFC-SP10 (NEAR WHITE BLAST) PAINT: ONE COAT OF INORGANIC ZINC - RICH SILICATE, INTERZING 22 (2.0-3.0 mils DFT.) FINISH: ONE COAT HIGH TEMPERATURE SILICONE ALUMINUM, INTERTHERM 50 (1.0-2.0 mils DFT.) ON EXPOSED SURFACES ONLY COLOR: ALUMINUM			
2	REGISTRATION: ALBERTA, BRITISH COLUMBIA, SASKATCHEWAN			
3	TUBE SIDE SOUR SERVICE. 100% XR/UT/MPI. SPECIAL CHEM. ON PLATE MAT'L PER NACE MR-0175			
0	JG	ISSUED FOR APPROVAL	-	MS
REV.	BY	DESCRIPTION	APPROVAL	DATE
REVISION RECORD				

NOZZLE / CONNECTION SCHEDULE				
REF.	QTY.	SIZE	RATING	SERVICE
N1	1	2"	300	RFWN
N2	1	2"	300	RFWN
N3	1	2"	300	RFWN
N4	1	2"	300	RFWN
C1A/B	2	2"	300	RFWN

CALHEX INDUSTRIES LTD.
9515 - 48th STREET S.E.
CALGARY, ALBERTA T2C 2R1

CUSTOMER: MURPHY OIL CANADA C/O VISTA PROJECTS LTD.		PROJECT: TEST EMULSION / BFW EXCHANGER ITEM#: E-4060 P.O. #: MURPHY 54115097-205 / VISTA 1780-002 SEAL CSS PILOT - VISTA PROJECT #1780	
ENGINEERING RECORDS		SCALE	L.S.D. NO.: 13-9/16-8-85-17 W5M
DRAWING BY: J.GREGORY	DATE: NOV.22/11	N.T.S.	DWG. NO.: 11-0708-0
CHECKED BY: D.KLADNIK	DATE: NOV.22/11		REV: 0
APPROVED BY:			

CODE SHEET

VISTA Projects Limited			
VENDOR DRAWING/DOCUMENT SQUAD CHECK			
A	Reviewed without exception. Proceed with fabrication. Issue final drawings/documents.		
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SDR CODE	EQUIPMENT TAG	REVIEWED BY	DATE
Dm-02	E-4060	D. Patil	2012-02-21

PROJECT NAME:

Murphy Oil Cadotte - 1780

VENDOR NAME:

Calhex Industries

DOCUMENT
NUMBER:

11-0708-S

VENDOR
REVISION:

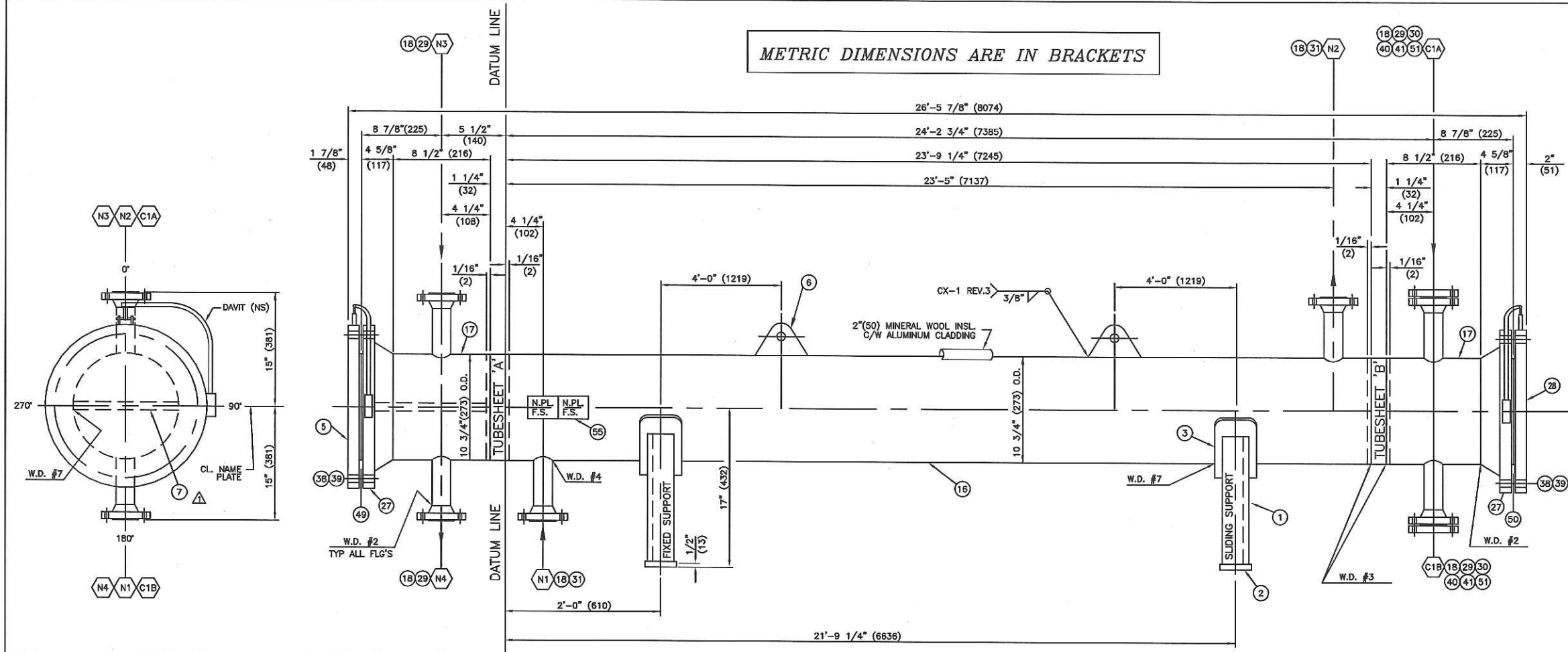
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DOCUMENT
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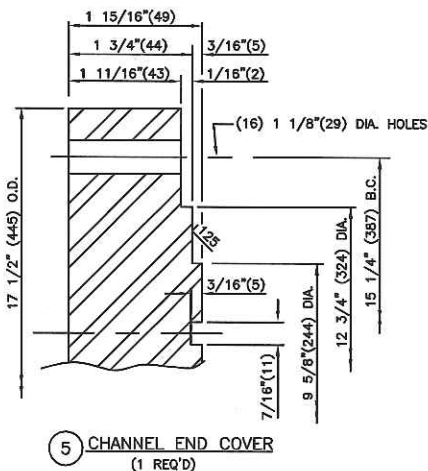
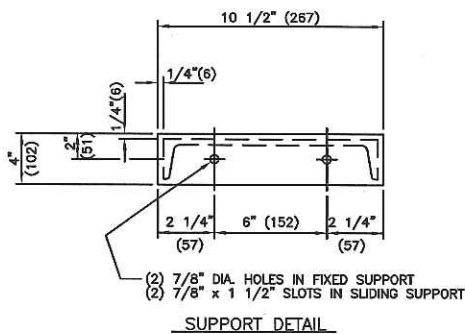
Shell Drawing / Test Emulsion BFW Exchanger

VENDOR
TRANSMITTAL
NUMBER:

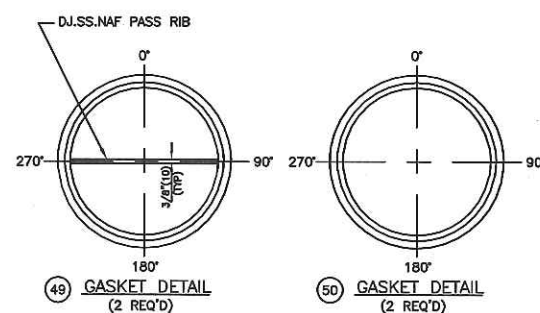
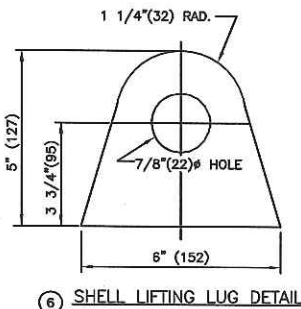
008-11-0708



MAXIMUM NOZZLE LOAD						
NOZZLE	FORCES (LB)			MOMENTS (FT-LB)		
	Fa	Fb	Fc	Ma	Mb	Mc
N1	225	274	274	258	184	184
N2	225	274	274	258	184	184
N3	225	274	274	258	184	184
N4	225	274	274	258	184	184

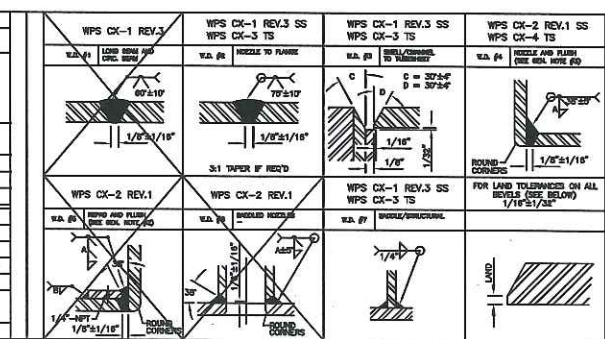


HEAT TRACING:
ELECTRIC HEAT TRACING (EHT) SHALL BE 208 VAC MINERAL INSULATED (VENDOR - THERMON) C/W POWER JUNCTION BOX, SS BANDING & CLIPS, EHT LABELS & RTD 100 OHMS. EHT CONTROLLER TO BE SUPPLIED ON SITE BY OTHERS. A DRAWING SHOWING EHT DESIGN DATA & INSTALLATION OF HEATER CABLE ON EXCHANGER SHALL BE SUPPLIED TO VISTA PROJECTS FOR REVIEW BEFORE INSTALLATION OF EHT MATERIAL COMMENCES ON EXCHANGER.



BILL OF MATERIAL				
ITEM	QTY.	DESCRIPTION	MATERIAL	P.O.#
PLATE / STRUCTURAL				
1	2	10" CHANNEL @ 15.3#/FT. x 13 15/16" LG. - SUPPORTS	C-44W	
2	2	1/2" PL. x 4" x 10 1/2" - BASE PLATES	C-44W	
3	2	1/4" PL. x 6" x 16" LG. ROLLED TO 10 3/4" LG. - SUPPORT WEAR PLATE	SA-516-70N	
4				
5	1	1 15/16" THK. PL. x 17 1/2" O.D. - CHANNEL COVER	SA-516-70N	
6	2	1/2" THK. PLATE x 5" x 6" - SHELL LIFTING LUGS	SA-516-70N	
7	2	3/8" THK. PLATE x 6 3/4" x 13 1/8" - PASS PLATE	SA-516-70N	
8				
9				
10				
11				
12				
13				
14				
15				
PIPE / FITTINGS				
16	1	10" - SCH. STD. (0.365") SEAMLESS PIPE x 23'-8 1/4" LG - SHELL	SA-106-B	
17	2	10" - SCH. XH (0.500") SEAMLESS PIPE x 6 1/2" LG - CHANNELS	SA-106-B	
18	6	2" - SCH. 160 (0.344") SMLS PIPE x 6 1/4" LG - N1, N2, N3, N4, C1A/B	SA-106-B	
19				
20				
21				
22				
23				
24				
25				
FORGINGS				
26				
ANSI FLANGES / CPLG'S				
27	2	10" - CLASS 300 RFWN (SCH XH BORE) - CHANNEL FLANGES	SA-105N	
28	1	10" - CLASS 300 RF BLIND FLANGE - CHANNEL COVER	SA-105N	
29	4	2" - CLASS 300 RFWN (SCH 160 BORE) - N3, N4, C1A/B	SA-105N	
30	2	2" - CLASS 300 RF BLIND FLANGE - C1A/B	SA-105N	
31	2	2" - CLASS 150 RFWN (SCH 160 BORE) - N1, N2	SA-105N	
32				
33				
34				
35				
36				
37				
STUD BOLTS & NUTS				
38	32	1" DIA. x 6 1/2" LG STUD BOLTS	SA-193-B7M	
39	64	1" DIA. H. HEX NUTS	SA-194-2HM	
40	16	5/8" DIA. x 3 1/2" LG STUD BOLTS - C1A/B	SA-193-B7M	
41	32	5/8" DIA. H. HEX NUTS - C1A/B	SA-194-2HM	
42				
43				
44				
45				
46				
47				
48				
GASKETS				
49	3	10" - CLASS 300 RF, FLEXITALC STYLE C.G. GASKET C/W PASS RIB (SEE DETAIL)	T-318S.S.	
50	3	10" - CLASS 300 RF, FLEXITALC STYLE C.G. GASKET (SEE DETAIL)	T-318S.S.	
51	6	2" - CLASS 300 RF, FLEXITALC STYLE C.G. GASKET	T-318S.S.	
52				
53				
54				
NAME PLATES				
55	2	6" T-BAR STYLE NAME PLATE BRACKETS C/W S.S. NAMEPLATE PLATE	SA-516-70N	
QUANTITIES				
QUANTITIES LISTED ARE FOR ONE UNIT, ONE UNIT REQ'D				
SPECIAL CHEMISTRY				
TUBE SIDE SOUR SERVICE 100% X.R., U.T., & PWHT.				
SPECIAL CHEMISTRY ON PLATE MATERIAL PER NACE MR-0175				
C.E. = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15				
C.E. < 0.45				

CONSTRUCTION / GENERAL NOTES				
1	SURFACE PREP: SSPC-SP10 (NEAR WHITE BLAST) PAINT: ONE COAT OF INORGANIC ZINC - RICH SILICATE, INTERZING 22 (2.0-3.0 mils DFT.) FINISH: ONE COAT OF HIGH TEMPERATURE SILICONE ALUMINUM, INTERTHERM 50 (1.0-2.0 mils DFT.) ON EXPOSED SURFACES ONLY COLOR: ALUMINUM			
2	EXTERNAL DIMENSIONS, NOZZLE, SUPPORT LOCATIONS AND FABRICATION TOLERANCES SEE TEMA 2007 EDITION, SECTION 2, FIGURES F-1 AND F-2			
3	TUBE SIDE SOUR SERVICE, 100% XRT/UT/MP. SPECIAL CHM. ON PLATE MAT'L PER NACE MR-0175			
4	HARDNESS TESTING OF ALL WELDS TUBESIDE (REFER TO BID CLARIFICATION #2)			
5	TUBESIDE HYDROTEST PRESSURE GOVERNED BY ANSI FLANGE OPERATING STRESS RATIO.			
REV.	BY	DESCRIPTION	CALC. PACKAGE REV. LEVEL REQUIRED	APPROVAL DATE
1	JQ	PASS PLATE	0	INITIAL ISSUE FEB.16/12
0	JQ	ISSUED FOR APPROVAL	0	INITIAL ISSUE DEC.7/11



NOZZLE / CONNECTION SCHEDULE									
REF.	QTY.	SIZE	RATING	TYPE	SERVICE	WELD SIZE A	WELD SIZE B	WELD DETAIL #	EXTERNAL PROJECT.
N1	1	2"	150	RFWN	SHELL SIDE INLET	3/8"	---	2,4	9 5/8"
N2	1	2"	150	RFWN	SHELL SIDE OUTLET	3/8"	---	2,4	9 5/8"
N3	1	2"	300	RFWN	TUBE SIDE INLET	3/8"	---	2,4	9 5/8"
N4	1	2"	300	RFWN	TUBE SIDE OUTLET	3/8"	---	2,4	9 5/8"
C1A/B	2	2"	300	RFWN	VENT / DRAIN C/W BLIND	3/8"	---	2,4	9 5/8"

DESIGN DATA			
SHELL SIDE		TUBE SIDE	
DESIGN PRESSURE:	208 PSIG	1420 kPa	610 PSIG
DESIGN TEMPERATURE:	302 °F	150 °C	473 °F
MIN. DESIGN METAL TEMPERATURE:	-20 °F	-29 °C	-20 °F
RADIOGRAPHY:	N/A PER FIG. UW-13.3(d)		
STRESS RELIEVING:	N/A		
CORROSION ALLOWANCE:	0.0625"	1.6 mm	0.125"
TEST PRESSURE:	288 PSIG	1847 kPa	804 PSIG
WELDING PROCEDURES:	CX-1 REV.3, CX-2 REV.1 (INCL'D TACK WELDS)		
MEAN DESIGN TEMP.: SHELL:	140.53°F	TUBES: 156.69°F	TUBESHEET "A": 144°F
IMPACT TESTING:	ALL MATERIAL C.L.T. EXEMPT PER UW-20(c), UCS-66(a)(c)(d), FIG. UCS-68 NOTE (c)		
MAWP EQUAL TO DESIGN PRESSURE.			
NO CORROSION ALLOWANCE APPLICABLE TO TUBING MATERIAL.			
CODE: ASME SECTION VIII, DIV. 1, 2010 ED.	DESIGN: TEMA "H", API-660		
REGISTRATION: ALBERTA, B.C., SASK.	C.R.N. #:		
WEIGHT OF BUNDLE: 1200 LBS / 544 KGS	VOLUME: 11.76 CU.FT. / 0.333 CU.M.		
SHIPPING WEIGHT (DRY): 3200 LBS / 1452 KGS	TEST WEIGHT: 4000 LBS / 1814 KGS		
HEATING SURFACE: 317.7 SQ. FT. / 29.52 SQ.M.			
REGISTERED QUALITY CONTROL PROCEDURES ASQ 1368	REGISTERED WELDING PROCEDURES WP 2380.2		

CALHEX INDUSTRIES LTD.
9515 - 48th STREET S.E.
CALGARY, ALBERTA T2C 2R1

CUSTOMER: MURPHY OIL CANADA C/O VISTA PROJECTS LTD.	PROJECT: TEST EMULSION / BFW EXCHANGER (1) NEN 10 x 288 P.O. #: MURPHY 54115097-205 / VISTA 1780-002 CADOTTE CSS PILOT - VISTA PROJECT #1780
ENGINEERING RECORDS	SCALE
DRAWING BY: J.GREGORY CHECKED BY: D.KLADNIK APPROVED BY: M.SOUKA	DATE: DEC.7/11 DATE: DEC.7/11
N.T.S.	DWG. NO.: 11-0708-S

CODE SHEET

VISTA Projects Limited VENDOR DRAWING/DOCUMENT SQUAD CHECK			
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C	Not accepted. Revise as marked and resubmit drawing/document for review. Shipment will not be released, if any drawings/documents requiring approval, as per purchase order conditions, are at this code.		
D	Not required for review. Received for information.		
Reviewed only as to general conformity with the design concept and specifications provided. The engineer does not warrant or represent that the information contained on this drawing/document is either accurate or complete. Sole responsibility for correct design, detail and dimensions shall remain with the party submitting the drawing/document.			
SDR CODE	EQUIPMENT TAG	REVIEWED BY	DATE
DM-02	E-4060	D. Lemon	2012-01-11

PROJECT NAME: 1780 Murphy Cadotte

VENDOR NAME: Calhex Industries Ltd

DOCUMENT NUMBER: 11-0708-T

VENDOR REVISION: 0

DOCUMENT DESCRIPTION: Test Emulsion/BFW Exchangers

VENDOR TRANSMITTAL NUMBER: 002-11-0708

METRIC DIMENSIONS ARE IN BRACKETS

Technical drawing of a tube sheet detail showing front, side, and end views with dimensions in inches and millimeters.

Front View (Left):

- Overall diameter: 9 11/16" (246) DIA.
- Inner diameter: 7/16" (11)
- Pass groove in TSHT "A" ONLY (indicated by a leader line).
- Angular dimensions: 0°, 90°, 180°, 270°.

Side View (Center):

- Tube side thickness: 1 3/8" (35)
- Shell side thickness: 3/16" (5)
- Tube side diameter: 9 15/16" (252) DIA.
- Shell side diameter: 10 3/4" (273) DIA.
- Angular dimension: 30° (TYP)

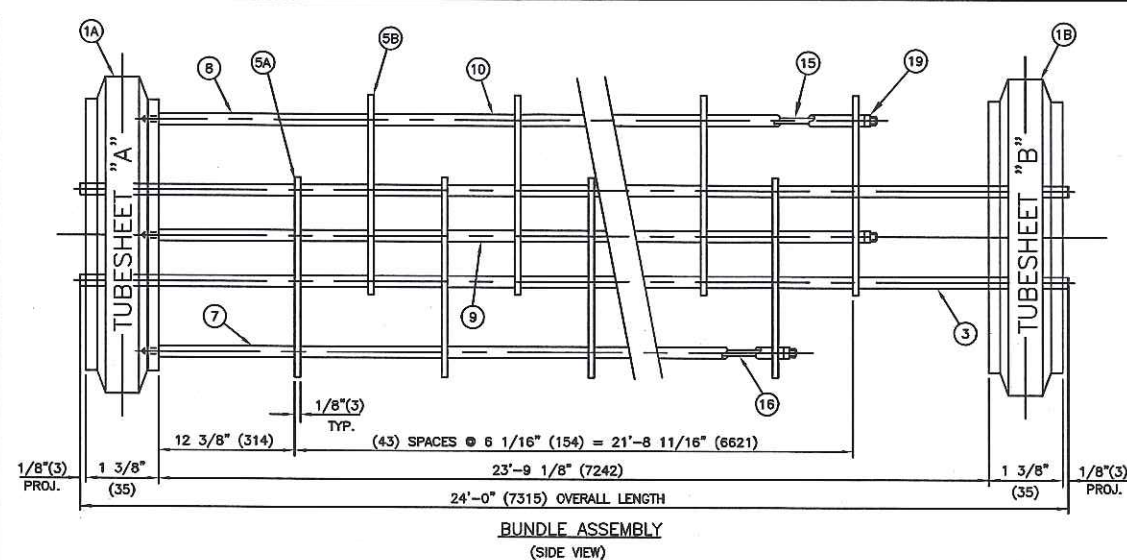
End View (Right):

- Overall diameter: 9 11/16" (246) DIA.
- Inner diameter: 7/16" (11)
- Drill and tap 1/2" (13) DEEP FOR 3/8" (10) DIA. TIE RODS (indicated by a leader line).
- SEE I.L.O. FOR LOCATION REQ'D IN TUBESHEET "A" ONLY (indicated by a leader line).
- Angular dimensions: 0°, 90°, 180°, 270°.

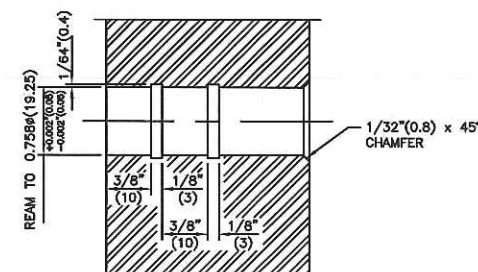
Notes:

- TUBESHEET INSPECTION PER UG-93(d)3
- ① TUBESHEET DETAIL

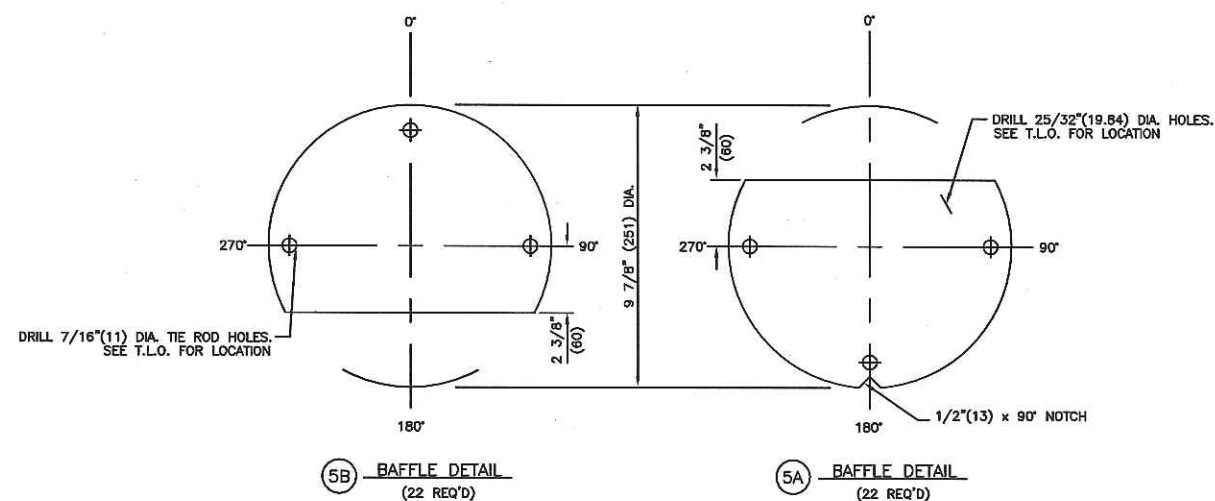
(68) 3/4"(19) O.D. x #14 BWG (M/W) x 24'-0" (73151) LG.
15/16"(23.8) 30° TRIANGLE PITCH
CHANNEL SIDE = 9 3/4" (248) DIA.
RF. DIA. CHANNEL SIDE = 9 11/16" (246) DIA.
SHELL SIDE ID = 10.02" (255) DIA.
RF. DIA. SHELL SIDE = 9 15/16" (252) DIA.
OUTER TUBE LIMIT = 9.3198" (237) DIA.
TIE RODS (NO. & DIA.) = 4 - 3/8" DIA.



TUBE EXPANSION LENGTH = 1 3/8"(35)



TUBE HOLE GROOVING DETAIL



BILL OF MATERIAL				
ITEM	QTY.	DESCRIPTION	MATERIAL	P.O.#
PLATE				
1	2	1 3/8" PL. x 10 3/4" DIA. TUBESHEET	SA-516-70N	
2	-	-	-	
TUBES				
3	88	3/4" DIA. x #14 BWG (14/10) x 24'-0" SEAMLESS TUBES	SA-179	
4	-	-	-	
BAFFLES				
5	44	1/8" PL. x 9 7/8" O.D. BAFFLES	Q-44#	
8	-	-	-	
SPACERS				
7	3	3/4" DIA. x #14 BWG x 12 3/8" LG. SPACER	SA-179/SA-214	
8	1	3/4" DIA. x #14 BWG x 18 7/16" LG. SPACER	SA-179/SA-214	
9	86	3/4" DIA. x #14 BWG x 5 15/16" LG. SPACER	SA-179/SA-214	
10	42	3/4" DIA. x #14 BWG x 12" LG. SPACER	SA-179/SA-214	
11	-	-	-	
12	-	-	-	
13	-	-	-	
14	-	-	-	
TIE RODS				
15	3	3/8" DIA. R.B. x 23'-0" LG. TIE ROD	H.R. STL.	
16	1	3/8" DIA. R.B. x 22'-6" LG. TIE ROD	H.R. STL.	
17	-	-	-	
18	-	-	-	
NUTS				
19	8	3/8" DIA. HEX NUTS	SA-325	
20	-	-	-	
IMPACT PLATE				
21	-	-	-	
22	-	-	-	
QUANTITIES				
MATERIAL LISTED IS FOR ONE BUNDLE, ONE BUNDLE REQ'D				
SPECIAL CHEMISTRY NOTES				
TUBE SIDE SOUR SERVICE 100% X.R., U.T., & PWHT. SPECIAL CHEMISTRY ON PLATE MATERIAL PER NACE MR-0175 C.E. = C + Mn/6 + (Cr + Mo + V)/5 + (Ni + Cu)/15 C.E. < 0.45				

[illegible]