As Built Data Sheets

- Specifications Sheet

AXH air-coolers
air-x-limited

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					Proposal / Job No.	118455		
					Date	10/14/2011		
					Page	1 OF 1		
1	*Purchaser*	VISTA PROJECTS / MURPHY OIL CORP.			*Ultimate User*	MURPHY OIL CORP.		
2	*Inquiry / PO#*	PO: 1780-009 (VISTA) / 54115097-207 (MURPHY)			*Destination*	CADOTTE PILOT CSS		
3	*# Units*	1	*Model*	96BZF	*Reference*	BOILER FEED WATER COOLER		
4	*Assembly*	PACKAGED	*Draft*	FORCED	*Overall Size , Ft*	9'W x 17'L	*Est Wt*	8,800 LBS

THERMAL & MECHANICAL DESIGN

5	***Service***	BOILER FEED WATER
6	*Flow*	41580#/HR
7	*Fluid*	WATER
8	*Temp. In / Out, °F*	167.0 / 104.0
9	*Pressure, PSI*	73PSIG
10	*Pressure Drop, PSI*	8.4
11	*Heat Load, BTU/HR*	2711224
12	*True LMTD*	30.5
13	*Overall Rate, U*	162.7
14	*Fouling Factor*	.0010
15	*Surface, Tube / Total, Sq Ft*	546 / 8687
16	***Sections, #***	(1)
17	*Design Temp, °F Max / Min*	212 / -49
18	*MWP / Test Press, PSIG*	256 / 333
19	*Pass Arrangement*	CROSSFLOW
20	*# Tube Rows*	3
21	*# Tube Passes*	6
22	***Tubes, OD x BWG***	5/8X16
23	*Material*	SA179 STEEL
24	*# Per Section / Length, Ft*	212 / 16
25	*Turbulators*	
26	*Accelerators*	
27	***Fins, Type***	HI-EFF
28	*Material*	AL
29	***Nozzles, Rating / Type***	150RF
30	*Material*	SA350LF2
31	*#-Inlets / Size In*	(1) 3
32	*#-Oulets / Size In*	(1) 3
33	***Headers, Type***	BOX
34	*Material*	SA516-70
35	*Corrosion Allow, In*	.0625
36	*Grooved Tubesheet*	DBL
37	*Plugs, Type*	SHOULDER
38	*Plugs Material*	SA350LF2
39	*PWHT*	YES
40	*ASME Code & Nat'l Board*	YES
41	*CRN*	AB / BC / SK
42	***Add'l Specs & Options***	
43	*API*	661*
44	*Louvers / Hail Screen*	AUTO / INT
45	***Inspection / NDT***	

FX= *100% X-Ray of all header seam, attachment & nozzle butt welds.* ***SX=*** *Spot X-Ray of 1 long seam & 1 end closure, per header*
BX= *100% X-Ray of all nozzle butt welds.* ***UT =*** *100% UT of all header seam, attachment & nozzle butt welds.* ***H*** *= Hardness testing.*

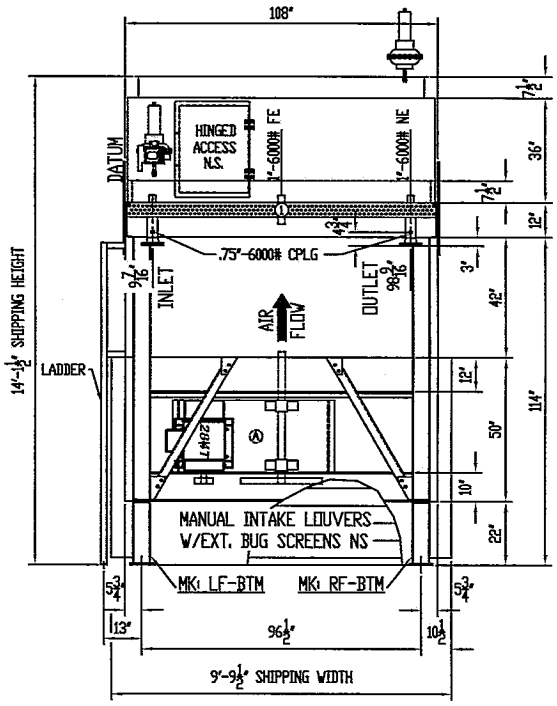
	AIR-SIDE PERFORMANCE		FAN DATA		DRIVER DATA	STRUCTURAL	
46	*Ambient Air Temp, In °F*	86	*Fan(s)*	1) MOORE-10KVT-S42	*Type*	*Guards*	FAN / DRIVE
47	*Elevation, Ft*	2221	*Blade Material*	ALUMINUM	V-BELT DRIVE BY (1) 25HP,		SOFT BUGSCREENS
48	*Air Flow, SCFM*	103,485	*HP / Fan*	22.3	1800RPM, 460/60/3, TEFC,		INTEGRAL HAIL GUARD
49	*Outlet Air Temp, °F*	109.6	*Dia, In / # Blades*	96 / 6	VFD COMP. MOTOR (CSA)		WARM AIR RECIRC SYSTEM
50	*Min Air Temp, °F*	-20	*RPM*	389	WITH 1.15 SERVICE FACTOR		LADDER & PLATFORM
51			*Tipspeed, FPM*	9776	MURPHY VS2EX VIB. SWITCH		
52	***Est. Noise Data:***	85 dBA @ 1m, 65 dBA @ 15m	*Pitch, Deg*	18.9			

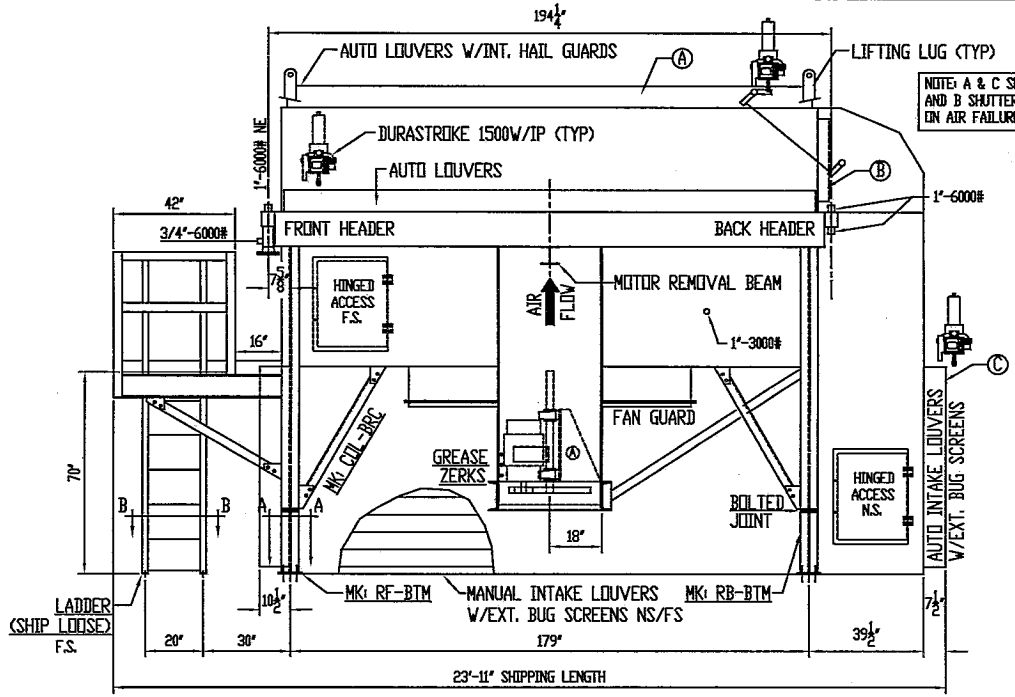
53	***Additional Info.***	
54	* - API 661 WITH STANDARD EXCEPTIONS & CLARIFICATIONS	
55		
56		
57		
58		

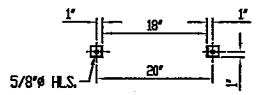
As-Built Drawings and Calculations

- Certified Drawing
- As-Built Cooler Drawing
- Shaft Detail Drawing
- CRN Drawing
- ASME Pressure Vessel Code Calculations

ITEM	SERVICE	MAWP	CODE	NOZZLES		COUPLING	REF. DIMENSION		LOUVERS	BUG SCREEN	DRIVE	FAN	FINISH
				INLET	OUTLET	V/D/PI/TI	B	C					
1	BOILER FEED WATER (5.8 CUFT VOL.)	256 PSI @ 212/-49°F	ASME	3-150 RFWN	3-150 RFWN	(4) 1-6000	-	-	AUTO	YES (SOFT)	ELECTRIC MOTOR DRIVE SHEAVES, BELTS, AND GUARDS BY AXH 25 HP(19 kW), 1800 RPM, 3P, 60 HZ, 460V, TEFC VFD ELECTRIC MOTOR W/ 1.15 SF, CSA, CL. 1, ZN. 2, GROUP IIA (A) VIB. SWITCH MURPHY VS 2EX XP	96"ø MOORE 10K, 42 VT HD 6-BLADE 18.9 PA, LH ROTATION 389 RPM @ 22.3 HP REQ'D (17 kW) ø2.4375" BORE WITH .625 x .3125 KWY.	STRUCTURE SIDE FRAMES GALVANIZED HEADERS METALIZED
		1765 kPa @ 100/-45°C				(2) .75-6000							





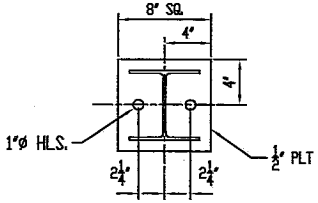


SECTION B-B

FAN ROTATION

NOTE: ALL DIMENSIONS ARE IN INCHES.

RELEASED
FABRICATION OF THIS ORDER HAS BEGUN



SECTION A-A

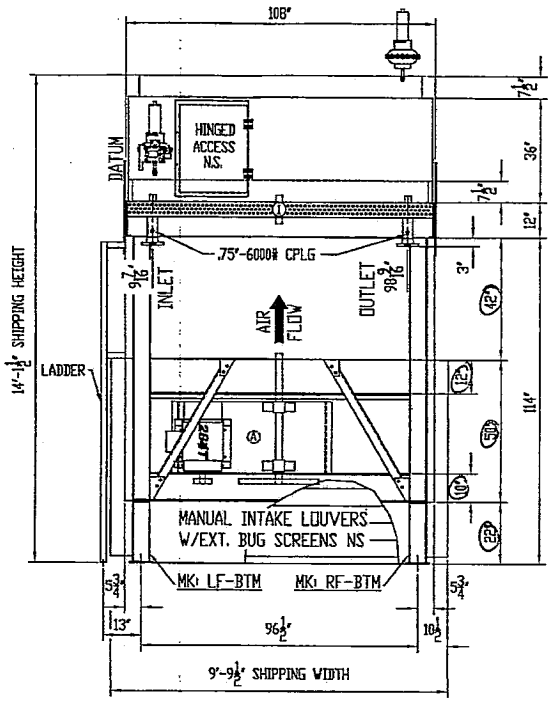
REV	REVISION DESCRIPTION	BY	CK	APP	DATE
5	CHG'D MOTOR DESC.	MIKE	L.W.		02/27/12
4	ADDED TO MOTOR DESC.	MIKE	L.W.		02/13/12
3	ADDED CPLG IN PLENUM, LABLED CPLGS & CORRECTED kPa	MIKE	L.W.		02/08/12
2	ADDED MOTOR REMOVAL BEAM	MIKE	L.W.		01/24/12
1	ADDED CUSTOMER COMMENTS & RELEASED	MIKE	L.W.		01/18/12

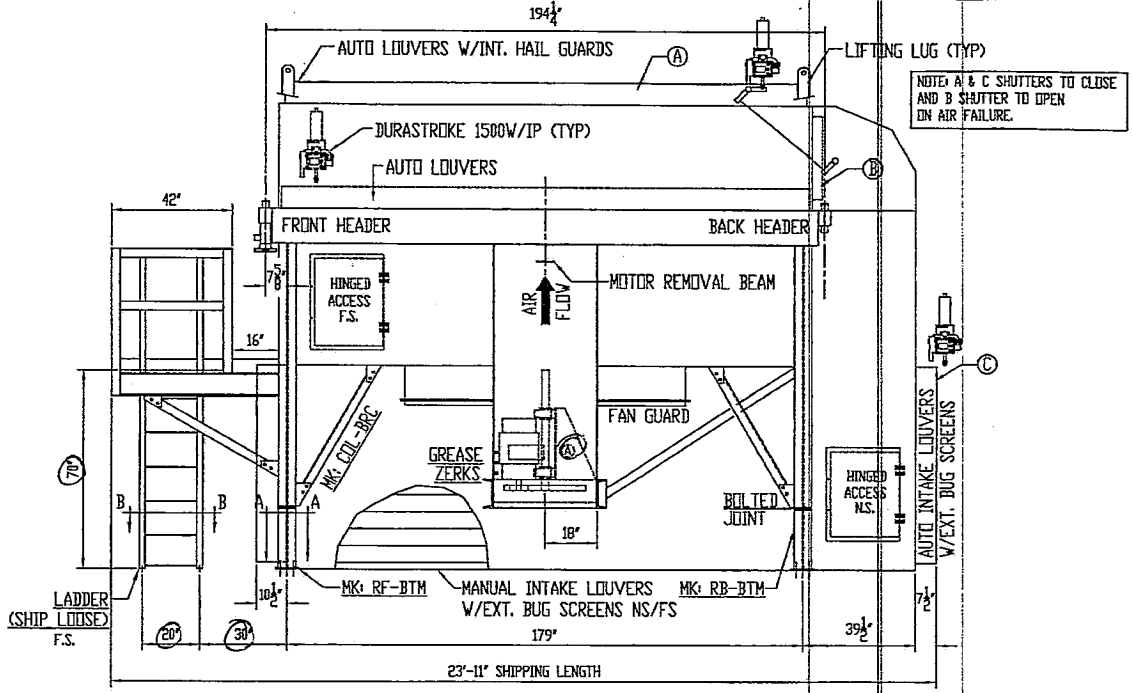
FOR: MURPHY OIL CANADA ESTIMATED DRY WEIGHT 13,100# (SHIPPING)
P.O. NO: 1780-009 (Vista) 54115097-207 (Murphy)
CUST. TAG NUM: AC-5020
USER: MURPHY OIL COMPANY Ltd.
JOBSITE: CADOTTE PILOT CSS
JOB NO: 118455
WORK ORDER NO: -
DR: J.J. DATE: 12/19/11
CK: J.S. DATE: 12/29/11

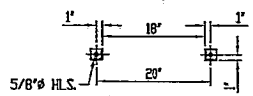
AXH air-coolers

CERTIFIED DRAWING FOR:
MODEL 96BZF-R QUANTITY: 1
- DWG. NO. 118455-CRT
SCALE: FULL DATE: 12/19/2011 REV 5

ITEM	SERVICE	MAWP	CODE	NOZZLES		COUPLING	REF. DIMENSION		LOUVERS	BUG SCREEN	DRIVE	FAN	FINISH
				INLET	OUTLET	V/D/PI/TI	B	C					
1	BOILER FEED WATER (5.8 CUFT VOL.)	256 PSI @ 212/-49°F	ASME	3-150 RFWN	3-150 RFWN	(4) 1-6000	-	-	AUTO	YES (SOFT)	ELECTRIC MOTOR DRIVE SHEAVES, BELTS, AND GUARDS BY AXH 25 HP(19 kW), 1800 RPM, 3P, 60 HZ, 460V, TEFC VFD ELECTRIC MOTOR (CSA) W/ 1.15 SF (A) VIB. SWITCH MURPHY VS 2EX XP	96"ø MOORE 10K, 42 VT HD 6-BLADE 18.9 PA, LH ROTATION 389 RPM @ 22.3 HP REQ'D (17 kW) ø2.4375" BORE WITH .625 x .3125 KWY.	STRUCTURE SIDE FRAMES GALVANIZED HEADERS METALIZED
		12.26 kPa @ 100/-45°C		3-150 RFWN	3-150 RFWN	(2) .75-6000							

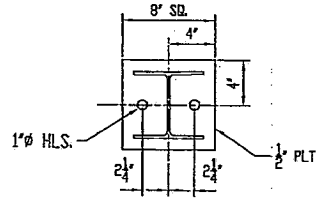






SECTION B-B

FAN ROTATION



SECTION A-A

NOTE: ALL DIMENSIONS ARE IN INCHES.

RELEASED
FABRICATION OF THIS ORDER HAS BEGUN

REV	REVISION DESCRIPTION	BY	CK	APP	DATE
2	ADDED MOTOR REMOVAL BEAM	MKE	L.W.		01/24/12
1	ADDED CUSTOMER COMMENTS & RELEASED	AXH AIR COOLERS QC CERTIFIED	L.W.		01/18/12

FOR: MURPHY OIL CANADA ESTIMATED DRY WEIGHT 13,100# (SHIPPING)
P.O. NO: 1780-009 (Visto) 54113097-207 (Murphy)
CUST. TAG NUM: AC-5020
USER: MURPHY OIL COMPANY Ltd.
JOBSITE: CADOTTE PILOT CSS
JOB NO: 118455
WORK ORDER NO: -
DR: J.J. DATE: 12/19/11
CK: J.S. DATE: 12/29/11

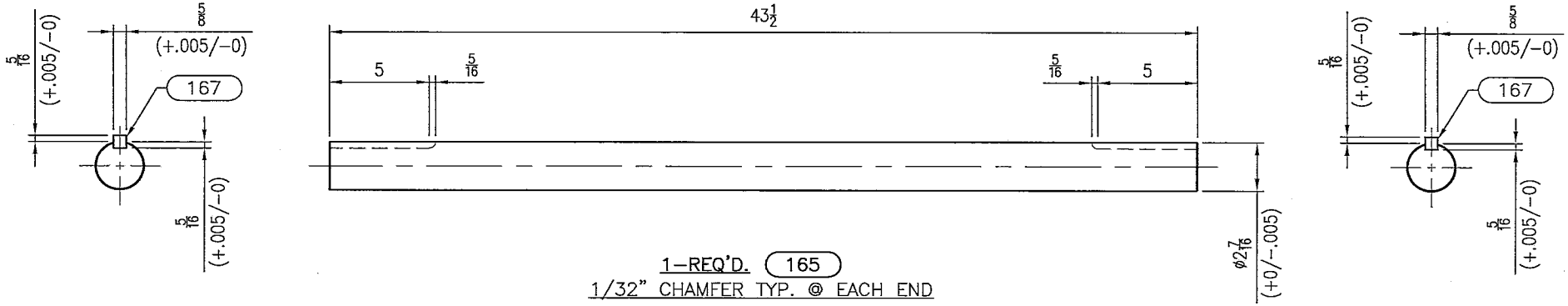
AXH air-coolers

CERTIFIED DRAWING FOR:
MODEL 96BZF-R QUANTITY: 1
- DWG. NO. 118455-CRT
SCALE: FULL DATE: 12/19/2011 REV 2

KP 3-22-12

WISCO
W D R
Initials:
Date: 3-22-12
117

BILL OF MATERIAL						
MARK	QTY	DESCRIPTION	WIDTH	LENGTH	WEIGHT	
165	1	2.4375" DIA. (C1045 MATERIAL)		3'-7 1/2"	58	C
167	2	KEYSTOCK - 5/8" SQUARE		4 1/2"	1	C
				TOTAL WEIGHT	59	

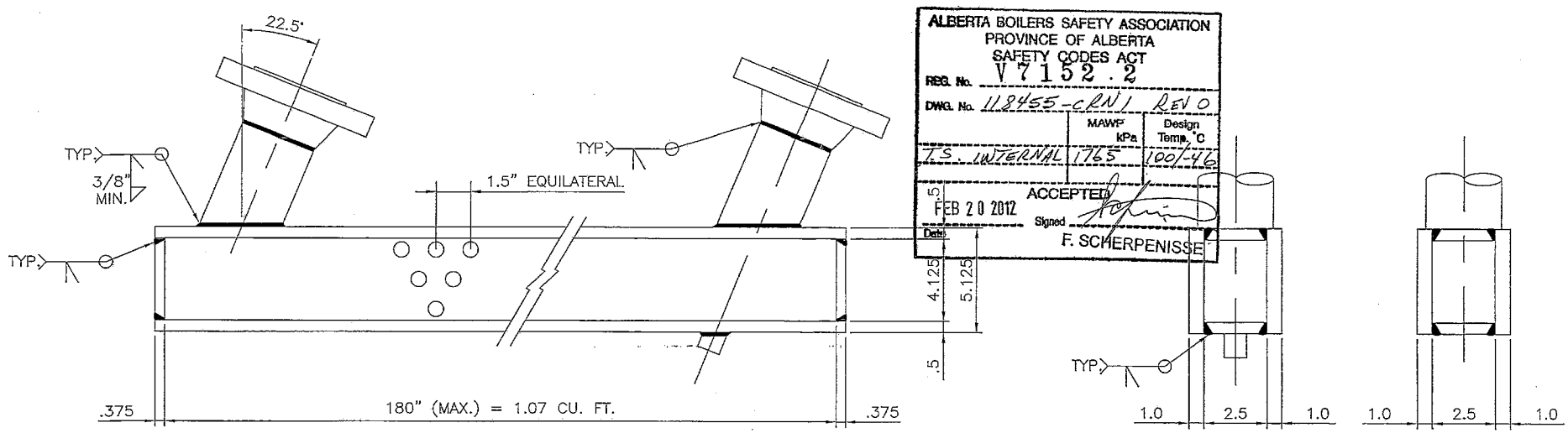


1-REQ'D. (165)
1/32" CHAMFER TYP. @ EACH END

REV	DESCRIPTION	BY CK'D	CK'D DATE
2			
1			

air-coolers
CLAREMORE, OKLAHOMA

CUSTOMER:		DRAWN BY: CB	CHECKED BY: JB
P.O. NO.:		SCALE: 1=5	
PROJECT:	118455 (1-UNIT)	DATE: 01/27/2012	
DESCRIPTION:	2-7/16" SHAFT DETAIL 96BZF-R	JOB NUMBER: 118455	SHEET: SHD
LOCATION:			REV. NO.: 0



ALBERTA BOILERS SAFETY ASSOCIATION
PROVINCE OF ALBERTA
SAFETY CODES ACT
REG. No. V7152.2
DWG. No. 118455-CRN1 REV 0

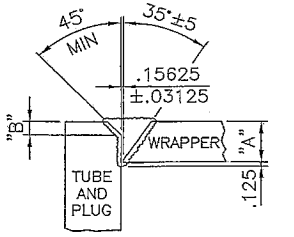
	MAWP kPa	Design Temp. °C
T.S. INTERNAL	1765	100/-46

ACCEPTED
Date FEB 20 2012
Signed F. SCHERPENISSE

CROSS SECTION – SIDE VIEW

CROSS SECTION – END VIEW

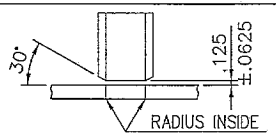
NOTE: DIMENSION "B" IS ACTUAL WELD BEVEL PREPERATION FOR FABRICATION. DIMENSION "a2" REPRESENTS THE REQUIRED AMOUNT OF FUSION PER APPENDIX 28.



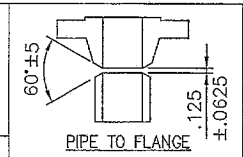
TYP. JOINT DETAIL

"A"	"B"
.375"	NONE
.5"	NONE
.625"	NONE
.75"	.125
.875"	.125
1.0"	.125
1.125"	.1875
1.25"	.1875
1.375"	.25"
1.5"	.25"
1.625"	.375"
1.75"	.375"
2.0"	.5"
2.25"	.5"
2.5"	.625"
2.75"	.625"
3.0"	.6875"

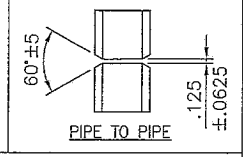
END PLATE BEVEL



PIPE, COUPLING OR FLANGE TO HEADER



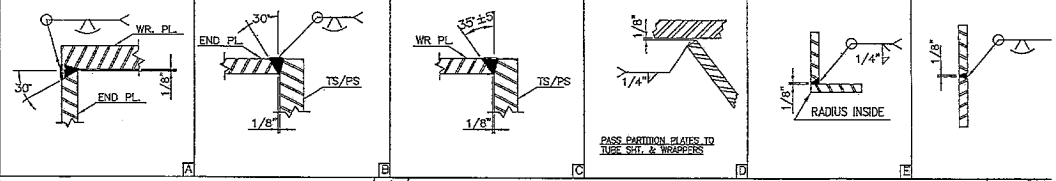
PIPE TO FLANGE



PIPE TO PIPE

WELD PROCEDURES (LOW TEMP.)

≤ 1/2"	P1–P1–11	≤ 1/2"	P1–P1–11	≤ 1/2"	P1–P1–10	S.S.	P1–P8–03	≤ 1/2"	P1–P1–11	≤2"NPS	P1–P1–14
≥ 5/8"	P1–P1–08	≥ 5/8"	P1–P1–08	≥ 5/8"	P1–P1–07	C.S.	P1–P1–11	≥ 5/8"	P1–P1–08	≥ 5/8"	P1–P1–08



NOTE: VESSELS CONSTRUCTED UNDER THIS REGISTRATION SHALL BE ASME CODE STAMPED "U" & REGISTERED WITH THE NATIONAL BOARD

REV	DESCRIPTION	BY	CK'D	DA
2				
1				

MATERIALS		DESIGN INFORMATION			
PLATE	SA 516–70N	DESIGN PRESSURE	256 P.S.I.	CAN. REG. NO.	2
FLANGES	3"–150# RFWN SCH 160 (SA–350–LF2 CLASS–1)	DESIGN TEMPERATURE	212/–50°F	BOX TYPE	.625"–3 ROW
PIPE	3" SCH 160 (SA–333 GR.6)	HYDROSTATIC TEST	333 P.S.I.		
TUBES	.625"ø x .060" MIN. WALL (SA214 STEEL)	CORROSION ALLOWANCE	0.0625		
PLUGS	.75" x 16 UNF3A x .75" LG. SHLDR (SA–350–LF2 CLASS–1)	DESIGN CODE	2010 ASME SECTION VIII, DIV. 1, APPX. 13 & 28, NO AD.		
COUPLING	1"–6000# (SA–350–LF2 CLASS–1)				
MACHINING		IMPACT EXEMPT	UCS–66(a) CURVE D, UCS–66(g) & UCS–68(c)		
TUBE HOLES – DRILLED AND REAMED TO 0.633"± .002"		P.W.H.T.	400°F HEATING, .5 HR HOLD @ 1150°F, 500°F COOLING		
TUBE HOLES – GROOVED PER TEMA–C 7.44		PREHEAT	NONE	NDT TEST	DYE PENETRANT PER UG–93d3
PLUG HOLES – TAPPED FOR 0.75"–16 UNF–1B.		CHARPY IMPACT TEST	NONE		

air-coolers
CLAREMORE, OKLAHOMA

CAN' REG' DWG. FOR: *BOILER FEED WATER*

CUSTOMER *MURPHY OIL*

DRAWN: JJ	CHECKED: JS
SCALE: NONE	
DATE: 02/15/2012	

JOB NUMBER	SHEET	REV.
118455	CRN1	0

AXH air-coolers
401 EAST LOWRY ROAD, CLAREMORE, OK 74017
OF: 918-283-9200 / FX: 918-283-9229

ASME PRESSURE VESSEL CODE SECTION VIII-DIVISION 1 (2010 EDITION, NO ADDENDA)
STRESS CALCULATIONS FOR NON-REINFORCED RECTANGULAR CROSS SECTION HEADERS
WRAPPER AS SHORT-SIDE PLATE / TUBE AND PLUG SHEET AS LONG-SIDE PLATE

1	REFERENCE NAME | DATE | REF. NO.	VISTA PROJECTS / MURPHY OIL CORP.							02/15/12	118455
2	SERVICE NO.			1		2	3	4	5	
3	SERVICE LABEL			BF WATER						
4	SERVICE TAG NO.			118455.1						
5	SECTION DESIGN PRESSURE, ACTUAL | MAX	PSIG	P	256	256					
6	SECTION HYDRO TEST, MULTIPLIER | PSIG @100°F			1.3	333					
7	DESIGN TEMP, MAX | MIN	°F		212	-50.0					
8	CORROSION ALLOWANCE	IN	CA	0.0625						
9	TUBE O.D.	IN		0.6250						
10	TUBE GAUGE	BWG		16						
11	TUBE MIN WALL THICKNESS	IN		0.0600						
12	TUBE MATERIAL			SA214 STEEL						
13	TUBE PITCH	IN	pt	1.5000						
14	TUBE VERTICAL SPACING	IN		1.299038						
15	SHLDR PLUG PITCH DIA.	IN	DE	0.7192						
16	TUBE ROWS			3						
17	FLANGE DIA	IN		3						
18	FLANGE CLASS			150RF						
20	NOZZLE TO HEADER CONNECTION TYPE			SET-ON PIPE						
19	NOZZLE CONNECTION SCH			S160						
20	NOZZLE CONNECTION, OD | AVG ID	IN		3.5000	2.6240					
21	WRAPPER SPAN	IN	H	2.5000						
22	TUBE/PLUG SPAN	IN	h	4.1250						
23	WRAPPER THICKNESS	IN	t1	0.5000						
24	TUBE/PLUG THICKNESS	IN	t2	1.0000						
25	END PLATE THICK, ACTUAL | MINIMUM	IN	ts	0.3750	0.3750					
26	OUTSIDE DIMENSIONS, WRAPPER | TUBE/PLUG	IN		4.5000	5.1250					
27	HEADER MATERIAL			SA516-70N						
28	FLANGE MATERIAL			SA350-LF2						
29	NOZZLE CONN. MATERIAL			SA333GR6						
30	END PLATE FACTOR/JOINT EFFICIENCY		C/E	0.2						
31	STRESS ALLOWABLE, HEADER MATERIAL	PSI	(S)h	20000						
32	STRESS ALLOWABLE, NOZZLE CONN.	PSI	(S)n	17100						
33	STRESS ALLOWABLE, TUBES	PSI	(S)t	13400						
34	PRESSURE MAX, HEADER BOX	PSIG		739						
35	PRESSURE MAX, FLANGE	PSIG		256						
36	PRESSURE MAX, NOZZLE CONN.	PSIG		3382						
37	PRESSURE MAX, TUBE	PSIG		3040						
38	ASME CALCULATIONS PER APPENDIX 13, FIG.13-2(a), SKETCH (1) AND CALCULATIONS PER APPENDIX 13 SECTION 13-7									
39	(t1-CA)^3/12		I1	0.0070						
40	(t2-CA)^3/12		I2	0.0687						
41	(I2/I1)*a		K	6.0774						
42	3.4-2.4*((H+CA*2)/(h+CA*2)) OR 2.5 MAX.		Z	1.9176						
43	(H+CA*2)/(h+CA*2)		a	0.6176						
44	(t1-CA)/2		c1	0.2188						
45	(t2-CA)/2		c2	0.4688						
46	(pt-DE)/pt		em,eb	0.5205						
47	STRESS TYPE AT ASME SECTION			STRESS PSI / % OF MAXIMUM STRESS (NOTE B)						
48	MEMBRANE STRESS - SHORT-SIDE (WRAPPER) / LONG-SIDE (TUBE/PLUG)			SHORT						
49	(1) (P*(h+CA*2))/(2*(t1-CA))		(Sm)N	1243	6%					
50	(2) (P*(H+CA*2))/(2*em*(t2-CA))		(Sm)M	689	3%					
51	BENDING STRESS - SHORT-SIDE (WRAPPER)									
52	(3) ((P*c1)/(12*I1))*(-1.5*(H+CA*2)^2+(h+CA*2)^2*(1+a^2*K)/(1+K))		(Sb)N	1248	4%					
53	(4) ((P*(h+CA*2)^2*c1)/(12*I1))*(1+a^2*K)/(1+K))		(Sb)Q	5664	19%					
54	BENDING STRESS - LONG-SIDE (TUBE/PLUG)									
55	(5) ((P*(h+CA*2)^2*c2)/(12*eb*I2))*(-1.5+(1+a^2*K)/(1+K))		(Sb)M	5211	17%					
56	(6) ((P*(h+CA*2)^2*c2)/(12*I2))*((1+a^2*K)/(1+K))		(Sb)Q	1233	4%					
57	TOTAL STRESS - SHORT-SIDE (WRAPPER)									
58	(7) EQ(1)+EQ(3)		(ST)N	2491	8%					
59	(8) EQ(1)+EQ(4)		(ST)Q	6907	23%					
60	TOTAL STRESS - LONG-SIDE (TUBE/PLUG)									
61	(9) EQ(2)+EQ(5)		(ST)M	5900	20%					
62	(10) EQ(2)+EQ(6)		(ST)Q	1922	6%					
63	STRESS - END PLATES PER UG-34(3)									
64	P*Z*(C/E)*((H+CA*2)/(tS-CA))^2		(S)EP	6928	35%					

(A) ALL DIMENSIONS ARE LISTED AS UNCORRODED. ALL STRESS CALCULATIONS ARE BASIS FULLY CORRODED DIMENSIONS.
(B) MAXIMUM STRESS IS ALLOWABLE HEADER STRESS (S)h FOR MEMBRANE AND END PLATES, 1.5 X (S)h FOR BENDING AND TOTAL STRESSES.