

SMITHCO Engineering Inc.

P.O. Box 571330 Tulsa, OK 74157

Ph. (918) 446-4406 FAX (918) 445-2857

AIR COOLED EXCHANGER SPECIFICATION SHEET

Date Tue*11:38 am*24-JUL-07

Proposal/Job No. 2007B-166-01

Reference 4162543

Item No. AC-1 Rev. #1

1	Customer	BEARINGS & DRIVES, INC.		
2	Plant Location	WOODCRAFT		
3	Service	STEAM CONDENSER		
4	Model	1 F24-080-2	Type	FORCED
5	Surface per Unit-Finned Tube	21,570	Fl ²	No. of Bays 1
6	Heat Exchanged	12,000,000	BTU/Hr	Bare Tubes 1,019
7	Transfer Rate-Finned Tube	6.65	Bare Tube, Service	140.76
				MTD (Eff.) 83.7 (Counter Flow) ^{°F}
				BTU/Hr. F12 °F

PERFORMANCE DATA-TUBE SIDE

9	Fluid Name	7 PSIG STEAM		Lethal Service	Yes	No <input checked="" type="checkbox"/>	IN	OUT
10	Total Fluid Entering	Lb/Hr	12,000	Density	Lb/Ft ³		.0522	59.4
11		IN		OUT	Specific Heat (Liq/Vap)	BTU/Lb°F	/ .500	1.01 / .500
12	Temperature	°F	233.0	233.0	Cond. avg (Liq/Vap)	BTU/HrFt°F	.394 /	
13	Liquid	Lb/Hr			Pour/Freeze Point	°F		
14	Vapor	Lb/Hr (MW)			Bubble Point	°F		
15	Nocond	Lb/Hr (MW)			Latent Heat	BTU/Lb		
16	Steam	Lb/Hr	12,000		Pressure	Psia	21.00	
17	Water	Lb/Hr		12,000	Pressure Drop Allow/Calc	Psi	1.00 / 0.57	
18	Viscosity (Liq/Vap)	Cp	.013	.2497 /	Fouling resist, Inside	ft ² hr °F/BTU	0.00100	

PERFORMANCE DATA-AIR SIDE

20	Air Quantity	SCFM	121,300	Lb/Hr	546,000	Altitude	Ft	500
21	Air Quantity/Fan	ACFM	64,530			Temperature In	°F	95.0
22						Temperature Out	°F	186.2
23								

DESIGN - MATERIAL - CONSTRUCTION

25	Design Pressure	50	Psig	Test Pressure	65	Psig	Design Temperature	300 / MDMT -20	°F	
26	TUBE BUNDLE	HEADER, Type PLUG BOX				TUBE Material SA-179 SMLS				
27	Size	7.9 x 24.0		Material	SA-516 GR-70					
28	No. 1	No. Tube Rows	4	No. Passes	1	Slope	0.1875	In/Ft	OD 1.000	
29	Bays	1	In Parallel	In Series	Plug	A1051822		No./Bundle	162	
30	Bundles	1	In Parallel	In Series	Gasket	CS1813		Length	24.0	
31	Pass Arrangement (Top to Bottom)	Corrosion Allowance				0.0625	In	FIN Type L-TENSION		
32	Rows / Pass	4 / 1		Size In Nozzle (2)	6.00	SCH XS	SA-106B	In	Material	
33	Turbulators	NO		Size Out Nozzle (1)	3.00	SCH XS	SA-106B	In	OD 2.250	
34	Steam Coil	NO		Rating & Facing	150 -RF SA-105		No/In	10	Support Chan. / Staple	
35	Hailscreens	NO		Vent (1)	3/4-3000	Drain (1)	3/4-3000	Code-ASME VIII, Div 1	YES	
36	Louvers	NONE (0)		TI	PI		Radiograph	NO	Heat Treat	
37	Frame Finish	HTC 1 Coat Galvanize		Header Finish	WMSB 1 Coat Metalize		Tube Hole Grooving	YES		

MECHANICAL EQUIPMENT

39	FAN Mfg & Model	COFIMCO 2134-04-24L/B3T		DRIVER Type	ELECTRIC MOTOR		SPEED REDUCER Type V-BELT		
40	No./Bay	2	RPM	434	S.F.	1.15	Insul/TR	CLASS F / B	
41	Dia.	7.0	Ft.	No. Blades	4	No./Bay	2	Frame	254T HP 15.0
42	Pitch	ADJUSTABLE		Angle°	6.6	RPM (2)	1750 Duty CHEM		
43	Matl, Blade	ALUMINUM		Hub	EXT ALUM		Enclosure	TEFC V & D None	
44	HP/Fan, Des.	8.1	DBA	85. @ 3'	V/P/C	460/3/60		Space Heater	NO
								Vibration Switch	NONE

STRUCTURE

WALKWAYS

45	Mounting	GRADE		Inlet Header	in. None		
46	Windload - PSF	30.0	Seismic	None		Outlet/Return	in. None
47	Finish	HTC 1 Coat Galvanize		Drive Access	in. None		

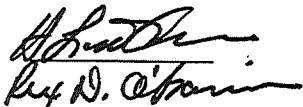
NOTES

48	Coil Volume (ft ³):	20.	
49	Assembled Drive, Structure & Bundles (Within Shipping Restrictions)		
50			
51			
52			
53			
54			
55	Plot Area	8.0 x 24.0	ft
	Weight Bundle	7,505	Lbs
	Total Shipping	15,540	Lbs

Smithco Engineering Incorporated
P.O. Box 571330
Tulsa, Oklahoma 74157-1330
(918) 446-4406

Customer: BEARINGS & DRIVES, INC.
Customer P.O. No.: 4162543
Item no.: AC-1
Service :STEAM CONDENSER

Date: 07-16-2007

Approved: 
R. D. O'Brien

Header Design Calculations
Per ASME Code Section VIII Division 1 2004 /A06 Appendix 13
Fig. 13-2(A) Vessels of Rectangular Cross Section
Sketch (1)

Job No.:2007B1661 (Inlet Header)
Short side = Cover Plate
Design Press.(P): 50. PSI Test Press.: 65. PSI
Design Temp.: 300. Deg. F / -20. Deg. F MDMT
Material: SA-516 GR-70
Allow. Membrane Stress: 20000. PSI
Allow. Bending and Total Stress: 30000. PSI (1.5 x Membrane Stress)
Corrosion Allowance: 0.0625 Inch
Long side Sheet Thickness: 1.0000 Inch
Long side Sheet Thickness Less Corr. Allow.= t2 = 0.9375 Inch
Short Side Thickness: 0.3750 Inch
Short Side Thickness Less Corr. Allow. = t1 = 0.3125 Inch
H (corroded) = 5.3750 In
h (corroded) = 7.7500 In
Horz. Tube Pitch (Pitch): 2.3125 In
D (Hole diameter): 1.0709
E= 1.0(see 13-4-g-1)
Bending & Membrane eff, eb = em = (Pitch - D)/Pitch = 0.5369
Short side eb = em = 1.0000
Long side eb = em = 0.5369
c = (c1 or c2)
c1 = t1/2 = 0.156250 In
c2 = t2/2 = 0.468750 In
a = H/h = 0.693548
I1 = t1³/12 = 0.002543 In**4
I2 = t2³/12 = 0.068665 In**4
K = (I2/I1) a =18.725807
Lv = Vessel length = 94.6250 Inches

Job No.:2007B1661 Tube wall and Nozzle Neck Calculations

Tube Wall:

Design Pressure (P): 50. PSI
Tube OD (D): 1.00 In.
Tube stress (S): 13400. PSI

Minimum wall = $P * D/2 / (.4 * P + S) = 0.0019$ In.
Actual wall: 0.0830 In.

Nozzle neck:

Inlet nozzle:

Design Pressure (P): 50. PSI
Nozzle OD (D): 6.625 In.
Nozzle stress (S): 17100. PSI
Corrosion (C): 0.0625 In.

Calculated wall = $P * D/2 / (.4 * P + S) + C = 0.0722$ In.
Minimum wall: 0.3780 In.

Outlet nozzle:

Design Pressure (P): 50. PSI
Nozzle OD (D): 3.500 In.
Nozzle stress (S): 17100. PSI
Corrosion (C): 0.0625 In.

Calculated wall = $P * D/2 / (.4 * P + S) + C = 0.0676$ In.
Minimum wall: 0.2625 In.

Job No.: 2007B1661 (Outlet Header)

(1) Membrane Stress

Short-Side Plates

$$S_m = Ph / (2t_{1em}) = 780. \text{ PSI} \quad (1)$$

Long-Side Plates

$$S_m = PH / (2t_{2em}) = 267. \text{ PSI} \quad (2)$$

(2) Bending Stress

Short-Side Plates

$$(S_b)_N = \pm \frac{Pc_1}{12I_{1eb}} [1.5H^2 - h^2 \left(\frac{1+a^2K}{1+K} \right)] = -2632. \text{ PSI} \quad (3)$$

$$(S_b)_Q = - \frac{Ph^2c_1}{12I_{1E}} \left(\frac{1+a^2K}{1+K} \right) = 8462. \text{ PSI} \quad (4)$$

Long-Side Plates

$$(S_b)_M = - \frac{Ph^2c_2}{12I_{2eb}} [1.5 - \left(\frac{1+a^2K}{1+K} \right)] = -5803. \text{ PSI} \quad (5)$$

$$(S_b)_Q = - \frac{Ph^2c_2}{12I_{2E}} \left(\frac{1+a^2k}{1+K} \right) = 940. \text{ PSI} \quad (6)$$

(3) Total Stress

Short-Side Plates

$$(ST)_N = EQ(1) + EQ(3) = 3412. \text{ PSI} \quad (7)$$

$$(ST)_Q = EQ(1) + EQ(4) = 9242. \text{ PSI} \quad (8)$$

Long-Side Plates

$$(ST)_M = EQ(2) + EQ(5) = 6070. \text{ PSI} \quad (9)$$

$$(ST)_Q = EQ(2) + EQ(6) = 1207. \text{ PSI} \quad (10)$$

(4) End Plate Stress UG 34, EQ. (3) & (4)

d (Corroded) = 5.3750

D (Corroded) = 9.7500

c = 0.2 (see 13-4(F))

End Plate Thickness: 0.3750 Inch

End Plate Thickness Less Corr. Allow. = T4 = 0.3125 Inch

$$Z = 3.4 - 2.4 \left(-\frac{d}{D} \right) = 2.0769 \quad \text{Max } 2.5$$

$$S = \frac{cd^2ZP}{T4^2} = 6144. \text{ PSI}$$

Header Design Calculations
Per ASME Code Section VIII Division 1 2004 /A06 Appendix 13
Fig. 13-2(A) Vessels of Rectangular Cross Section
Sketch (1)

Job No.:2007B1661 (Outlet header)
Short side = Cover Plate
Design Press.(P): 50. PSI Test Press.: 65. PSI
Design Temp.: 300. Deg. F / -20. Deg. F MDMT
Material: SA-516 GR-70
Allow. Membrane Stress: 20000. PSI
Allow. Bending and Total Stress: 30000. PSI (1.5 x Membrane Stress)
Corrosion Allowance: 0.0625 Inch
Long side Sheet Thickness: 1.0000 Inch
Long side Sheet Thickness Less Corr. Allow.= t2 = 0.9375 Inch
Short Side Thickness: 0.3750 Inch
Short Side Thickness Less Corr. Allow. = t1 = 0.3125 Inch
H (corroded) = 5.3750 In
h (corroded) = 9.7500 In
Horz. Tube Pitch (Pitch): 2.3125 In
D (Hole diameter): 1.0709
E= 1.0(see 13-4-g-1)
Bending & Membrane eff, eb = em = (Pitch - D)/Pitch = 0.5369
Short side eb = em = 1.0000
Long side eb = em = 0.5369
c = (c1 or c2)
c1 = t1/2 = 0.156250 In
c2 = t2/2 = 0.468750 In
a = H/h = 0.551282
I1 = t1³/12 = 0.002543 In**4
I2 = t2³/12 = 0.068665 In**4
K = (I2/I1) a =14.884615
Lv = Vessel length = 94.6250 Inches

Job No.: 2007B1661 (Inlet Header)

(1) Membrane Stress

Short-Side Plates

$$S_m = Ph / (2t_{1em}) = 620. \text{ PSI} \quad (1)$$

Long-Side Plates

$$S_m = PH / (2t_{2em}) = 267. \text{ PSI} \quad (2)$$

(2) Bending Stress

Short-Side Plates

$$(S_b)_N = \pm \frac{Phc_1}{12I_{1eb}} [1.5H^2 - h^2 \left(\frac{1+a^2K}{1+K} \right)] = -3293. \text{ PSI} \quad (3)$$

$$(S_b)_Q = - \frac{Ph^2c_1}{12I_{1E}} \left(\frac{1+a^2K}{1+K} \right) = 7801. \text{ PSI} \quad (4)$$

Long-Side Plates

$$(S_b)_M = - \frac{Ph^2c_2}{12I_{2eb}} \left[1.5 - \left(\frac{1+a^2K}{1+K} \right) \right] = -3159. \text{ PSI} \quad (5)$$

$$(S_b)_Q = - \frac{Ph^2c_2}{12I_{2E}} \left(\frac{1+a^2k}{1+K} \right) = 867. \text{ PSI} \quad (6)$$

(3) Total Stress

Short-Side Plates

$$(ST)_N = EQ(1) + EQ(3) = 3913. \text{ PSI} \quad (7)$$

$$(ST)_Q = EQ(1) + EQ(4) = 8421. \text{ PSI} \quad (8)$$

Long-Side Plates

$$(ST)_M = EQ(2) + EQ(5) = 3426. \text{ PSI} \quad (9)$$

$$(ST)_Q = EQ(2) + EQ(6) = 1134. \text{ PSI} \quad (10)$$

(4) End Plate Stress

UG 34, EQ. (3) & (4)

d (Corroded) = 5.3750

D (Corroded) = 7.7500

c = 0.2 (see 13-4(F))

End Plate Thickness: 0.3750 Inch

End Plate Thickness Less Corr. Allow. = T4 = 0.3125 Inch

$$Z = 3.4 - 2.4 \left(-\frac{d}{D} \right) = 1.7355 \quad \text{Max } 2.5$$

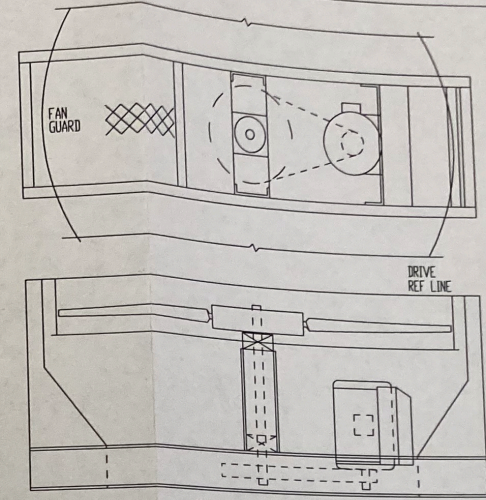
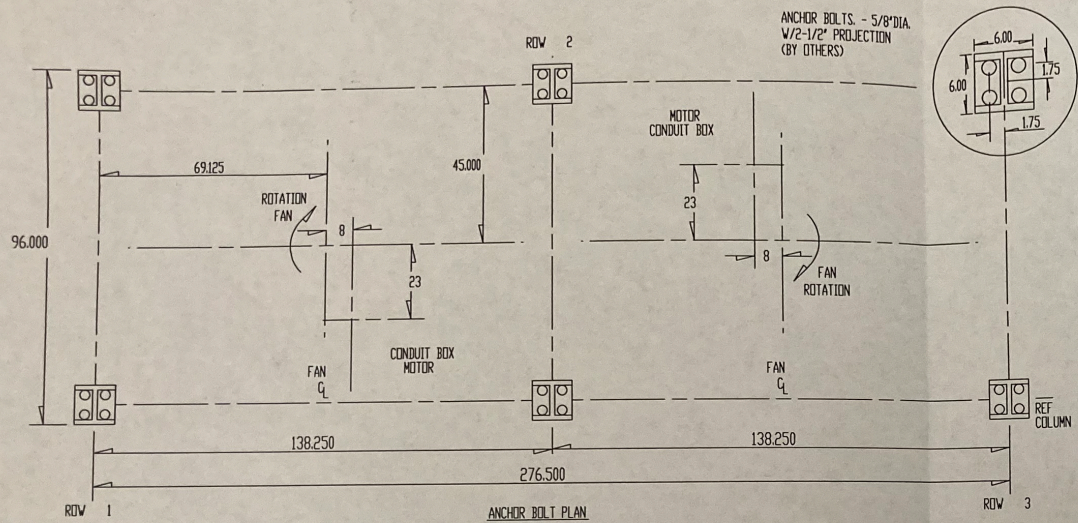
$$S = \frac{cd^2ZP}{T4^2} = 5134. \text{ PSI}$$

DRY HEAD	WET HEAD	WIND VERT	WIND HORIZ	SEIS VERT	SEIS HORIZ	SNOW	PLAT	NOZZ VERT	NOZZ HORIZ	TOTAL
1.7	1.9	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	2.7
3.4	3.7	1.7	0.8	0.0	0.0	0.0	0.0	0.0	0.0	5.4
1.7	1.9	0.8	0.4	0.0	0.0	0.0	0.0	0.0	0.0	2.7

FAN CFM/DC 2134-04-24L/B3T
 84 IN. DIAMETER 4 BLADE
 65000 ACFM 6.6 DEG.
 DRIVE REDUCER
 BELTS (4) 3VX-850
 SHEAVES FAN 19.0 MOTOR 4.8
 BEARINGS 1.9375 IN.
 BEARINGS 41 IN. LG. 1.9375 DIA.

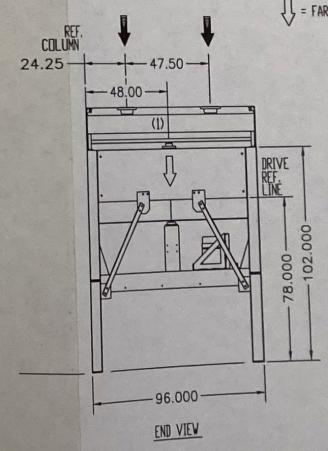
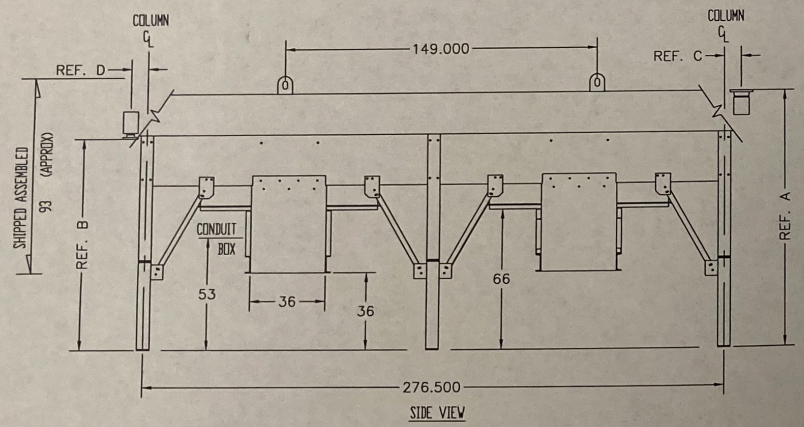
MOTOR HP 15.0 RPM 1750 /0.
 254T TEFC
 INSULATION CLASS F /B TEMP RISE 460 /3/60 SINGLE WINDING VARIABLE TORQUE
 AMPS(100%FLA 20. LRA 116.

SHOP RUN IN TEST



FAN & DRIVE DETAILS
 ONE REPD AS SHOWN
 ONE REPD OPPOSITE HAND

↓ = THIS END
 ↓ = FAR END



SERVICE	NOZZLES INLET				OUTLET			
	#	RF	SCH	XS	#	RF	SCH	XS
EAM CONDENSER	2				1			

REFERENCE DIMENSIONS				BUNDLE WEIGHT	COUPLINGS		SHUTTER-OPERATOR	HAIL SCR. CODE	DESIGN PRESS.
A	B	C	D		V&D	TEMP			
21.625	100.250	8.125	8.125	7500	3/4-3000		none	NO	ASME 50

TOLERANCES: (ALL DIMENSIONS IN INCHES) ±1/8" PER 10" - 0"
 MECHANICAL EQUIPMENT
 NOZZLE ±1/8"
 STRUCTURAL- HAND TOOL CLEAN
 WITH 1 COAT GALVANIZE
 FRAME- HAND TOOL CLEAN
 WITH 1 COAT GALVANIZE
 HEADER- WHITE METAL BLAST CLEAN
 WITH 1 COAT METALIZE

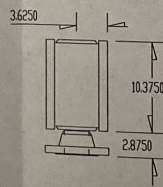
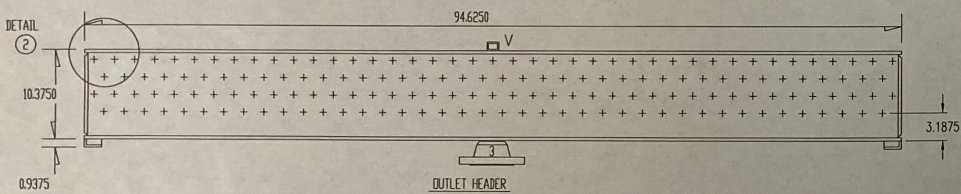
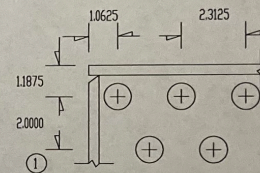
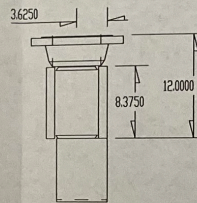
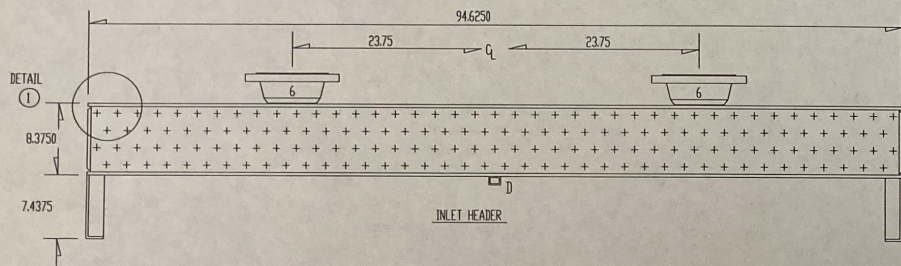
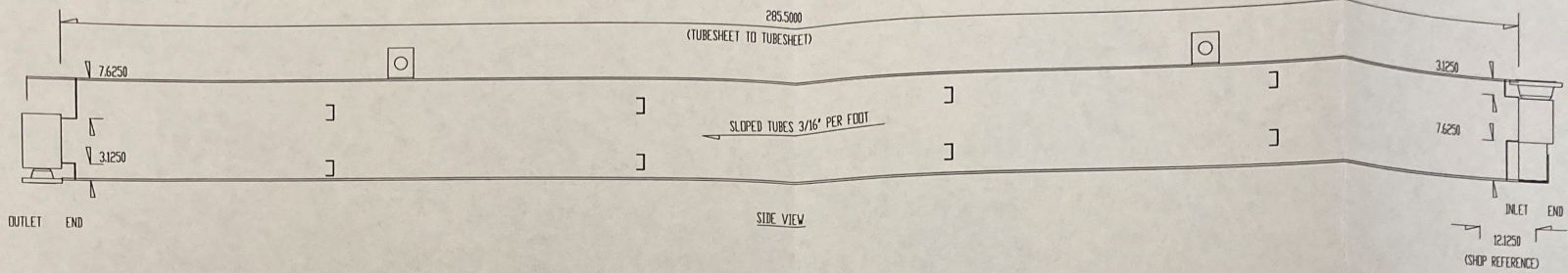
CUSTOMER LOCATION: WOODCRAFT
 REFERENCE: 4162543



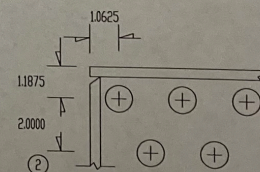
PIPING, EQUIPMENT OUTLINE & ANCHOR BOLT PLAN
 MODEL 1 F 24-80 -2 QUANTITY 1

DATE	10/04/07
CERTIFIED BY:	David Collins
DATE	10/04/07

REV 1: FINAL CERTIFIED DC 10/04/07
 REV 0: SENT FOR APPROVAL DC 7/19/07



TUBE SHEET SIDE



REV B FINAL CERTIFIED DC 10/04/07
 REV D SENT FOR APPROVAL DC 7/17/07

MACHINING	DRILL	REAM	SPECIAL
TUBE HOLE	0.9375	1.010	± 0.002 DIG
PLUG HOLE	0.9312	# SF 1.375	TAP 1.0000
NOZZLE	IN (2) 6.00	# 150	# RF SCH XS
VENT	OUT (1) 3.00	# 150	# RF SCH XS
WEIGHT	1400	DRAIN	Ø 3/4-3000

INLET	TUBE	PLUG	THICK	LENGTH	WIDTH	BEVELS
INLET	COVER	0.3750	0.3750	94.6250	8.3750	NONE
INLET	END	0.3750	0.3750	4.9375	4.9375	LONG SIDES
RETURN	TUBE	PLUG	1.0000	94.6250	10.3750	NONE
RETURN	COVER	0.3750	0.3750	94.6250	4.9375	LONG SIDES
RETURN	END	0.3750	0.3750	4.9375	9.3125	ALL SIDES

MATERIAL	SPECIFICATIONS	STOCK
PLATE	SA-516 GR-70	NORM
FLG	SA-105	STOCK
PIPE	SA-106B	STOCK
CPLG	SA-105	STOCK

TUBES	162	TF	41	ROWS	4	PASS	1	LGTH	288	IN.
TUBE OD	1.000	X	0.063	MATL	SA-179 SMLS					
FIN TYPE	L-TENSION									
PLUG QTY	324	TYPE	A105	-1822						
GASKET	CS	-1813								
EXPANDER	0.8340	LENGTH	10.0000							
FRAME - THICK	0.1875									
LENGTH	298	IN. DEPTH	19.5000	X	3					
SUPPORT	4	BINDER	4	CLOSER	4	94.250				
SUPPORT TYPE	- SCALLOPED CHANNEL									
STAPLED ENDS										
F. FOOT	6" X	7.4375								
B. FOOT	6" X	0.9375								

WELD PROCEDURES	PIPE-FLG	GWPO1	/FVPO1
FLG-HEAD	GWPO1	/SVPO1	
HAND WLD	GWPO1	/FVPO1	
AUTO WLD	AWPO1	/	

PLATE TOLERANCES	± 1/16"
------------------	---------

TEST PRESSURE:	65	TIME:	60 MIN
HEADS:	WHITE METAL BLAST CLEAN		
FRAME:	w/ 1 metalize		
	HAND TOOL CLEAN		
	w/ 1 galvanized		
COIL VOLUME:	20	CUBIC FEET	
DESIGN TEMP:	300	F	
DESIGN PRESSURE:	50	PSIG	
MINT:	-20	F	
CORROSION ALLOWANCE:	0.0625		
CERTIFIED BY:	David Collis	DATE:	10/04/07
TOLERANCES	LENGTH & WIDTH	± 0.025"	PER 10' - 0"
TUBE PROJECTION	API	661	

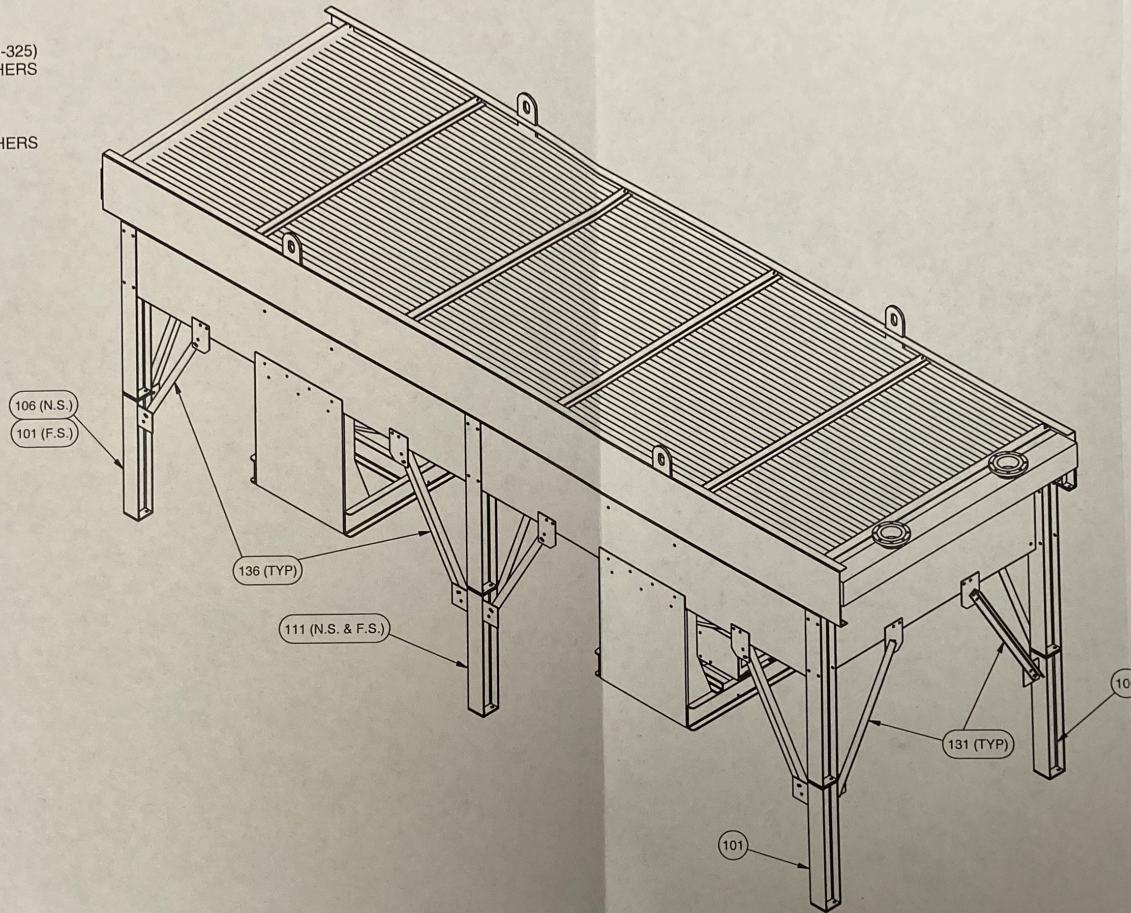
AIR COOLED DIVISION						
BUNDLE DETAILS						
APPROV'D	REV 1					
7	-18 - 200					
SERVICE	STEAM CONDENSER					
ITEM	AC-1					
MFG	WELD	FIN	ASMBL	STRUC	INSP	CUST
1	2		2	1	1	0
QTY	1	WEIGHT	7500	2007	B 166	1

Fit



NOTES:

1) ALL CONNECTIONS USE 5/8" X 2" (SA-325) BOLT W/ NUT, LOCK, & (2) FLATWASHERS EXCEPT AT COLUMN SPLICES.

2) USE 5/8" X 2 1/2" (SA-325) BOLT W/ NUT, LOCK, & (2) FLATWASHERS AT COLUMN SPLICES.



FOR INFORMATION ONLY
NOT FOR REVIEW.

	SMITHCO ENGINEERING, INC. Tulsa, Oklahoma	
	1 F24-80-2 FIELD ERECTION	
ENGR: DC	CK'D BY: 	DATE: 7/1/2008
JOB NO: 07B166	DWG NO: 166B-FE	
REV: 0	SCALE:	QTY: 1