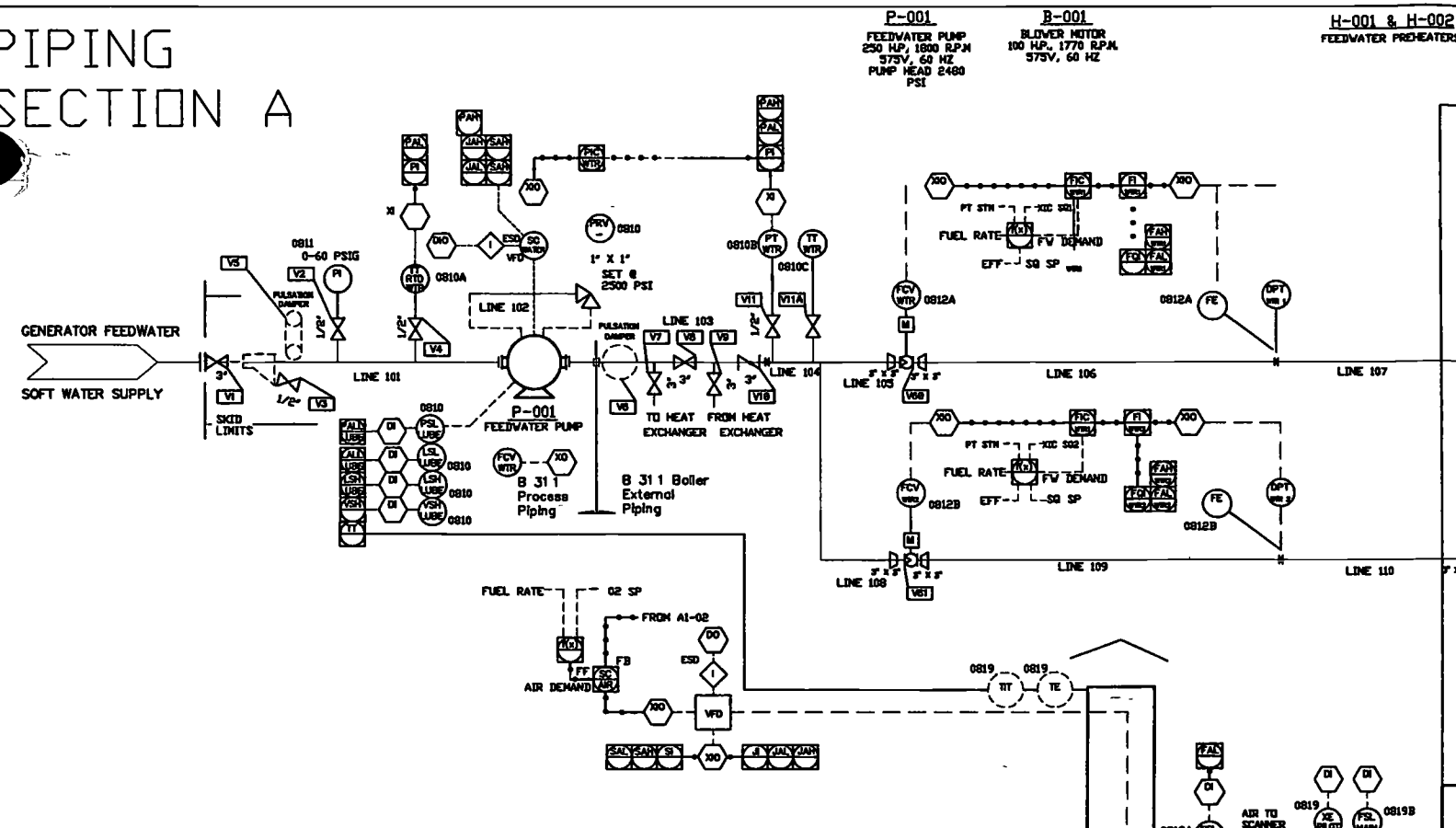
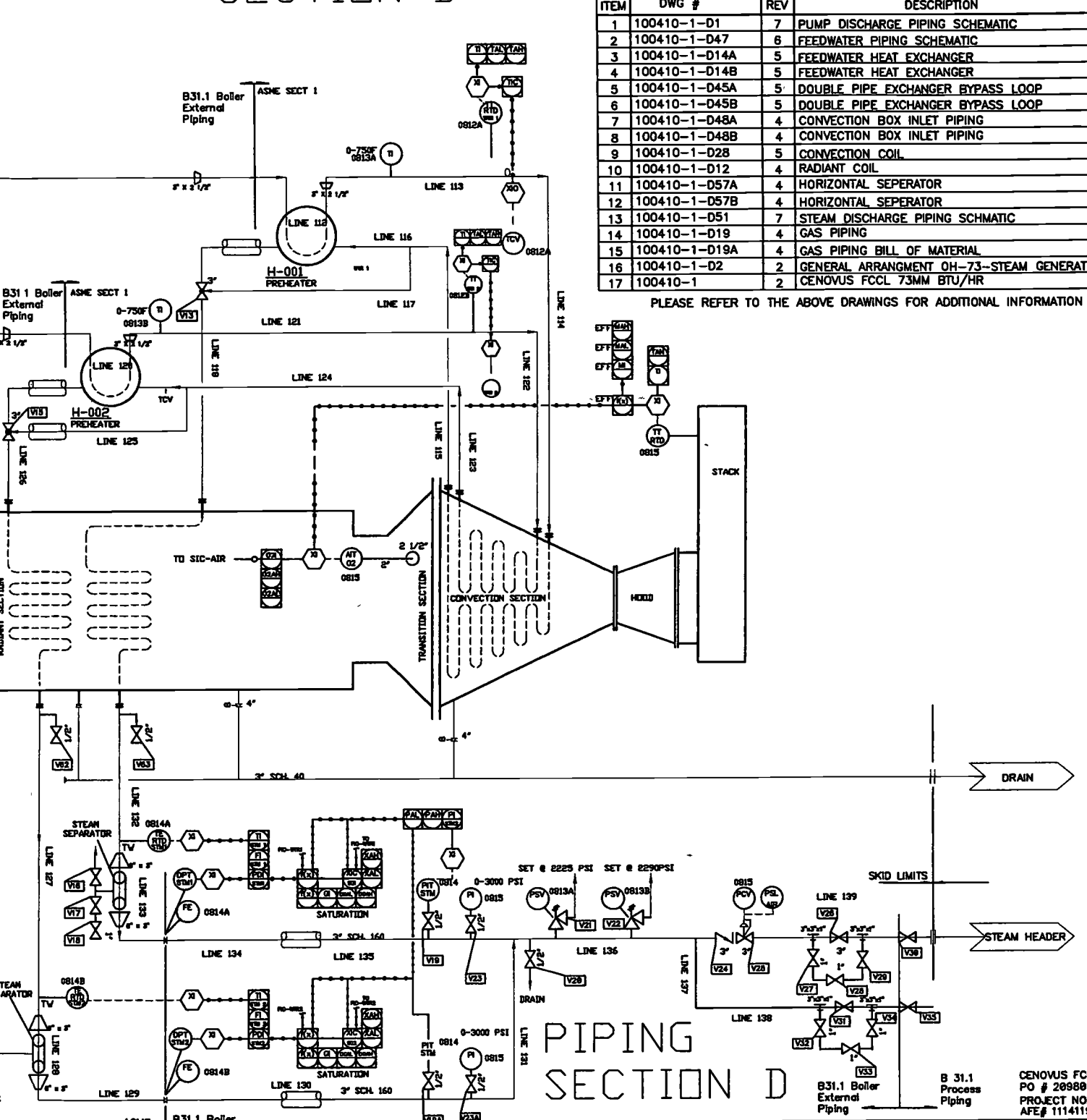


PIPING SECTION A

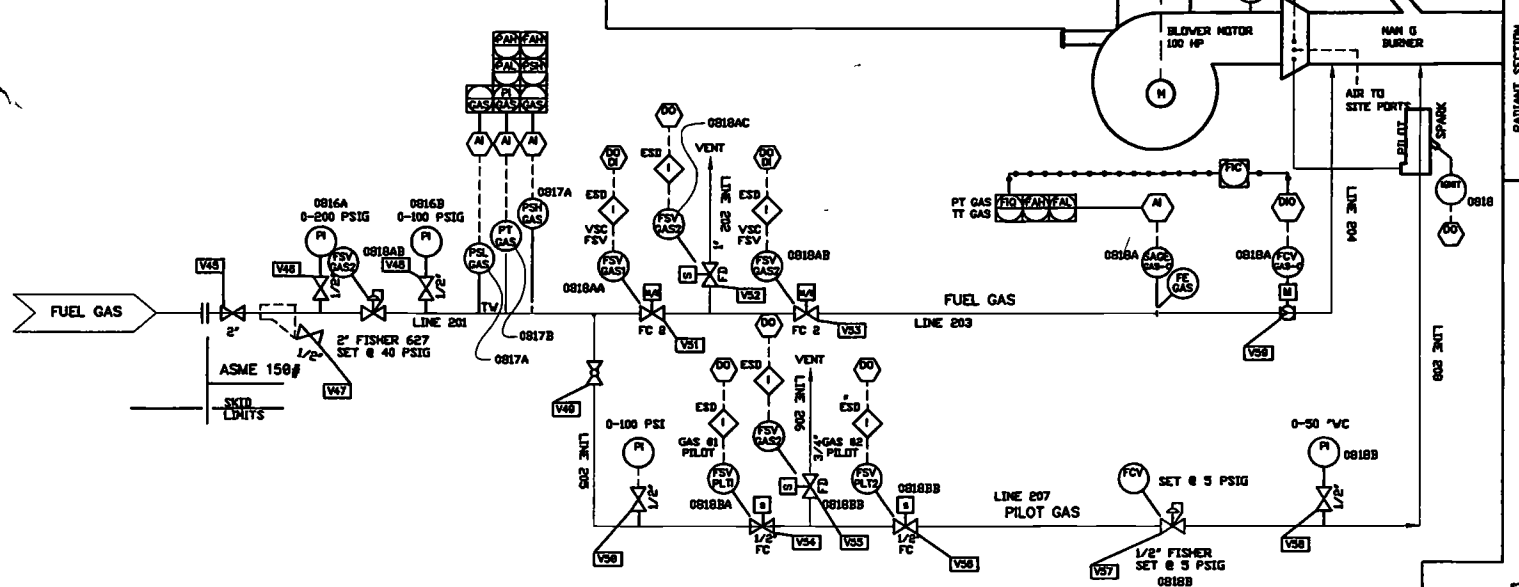


PIPING SECTION B



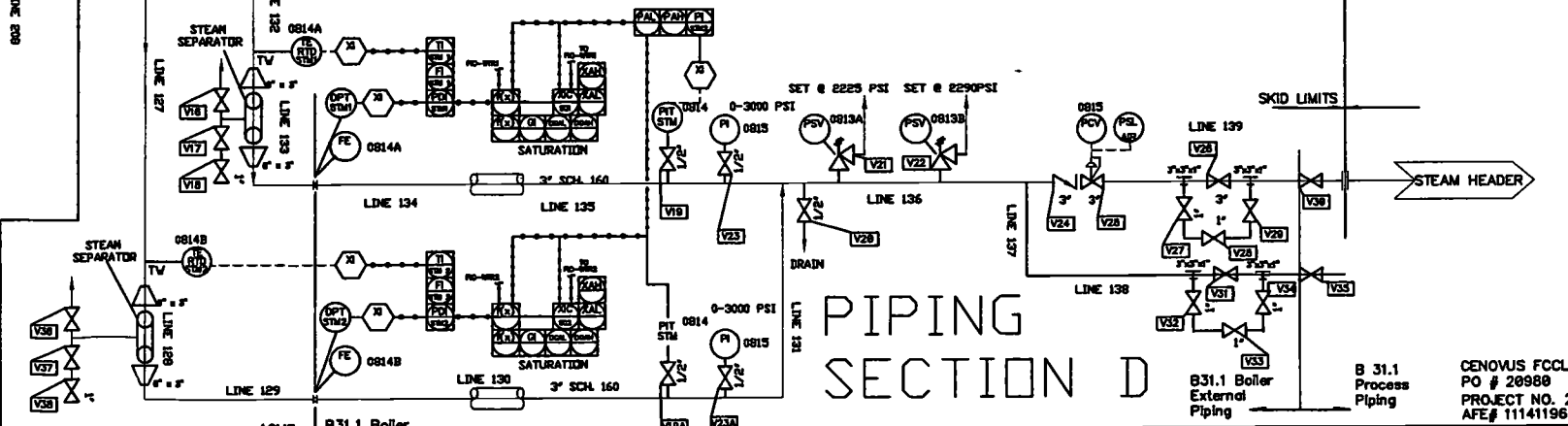
ITEM	DWG #	REV	DESCRIPTION
1	100410-1-D1	7	PUMP DISCHARGE PIPING SCHEMATIC
2	100410-1-D47	6	FEEDWATER PIPING SCHEMATIC
3	100410-1-D14A	5	FEEDWATER HEAT EXCHANGER
4	100410-1-D14B	5	FEEDWATER HEAT EXCHANGER
5	100410-1-D45A	5	DOUBLE PIPE EXCHANGER BYPASS LOOP
6	100410-1-D45B	5	DOUBLE PIPE EXCHANGER BYPASS LOOP
7	100410-1-D48A	4	CONVECTION BOX INLET PIPING
8	100410-1-D48B	4	CONVECTION BOX INLET PIPING
9	100410-1-D28	5	CONVECTION COIL
10	100410-1-D12	4	RADIANT COIL
11	100410-1-D57A	4	HORIZONTAL SEPARATOR
12	100410-1-D57B	4	HORIZONTAL SEPARATOR
13	100410-1-D51	7	STEAM DISCHARGE PIPING SCHEMATIC
14	100410-1-D19	4	GAS PIPING
15	100410-1-D19A	4	GAS PIPING BILL OF MATERIAL
16	100410-1-D2	2	GENERAL ARRANGMENT QH-73-STEAM GENERATOR
17	100410-1	2	CENOVUS FCCL 73MM BTU/HR

PLEASE REFER TO THE ABOVE DRAWINGS FOR ADDITIONAL INFORMATION



PIPING SECTION C

PIPING SECTION D

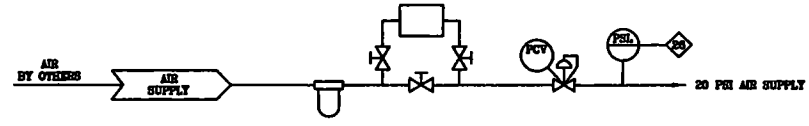


CODE ASME SECTION I
2010 EDITION
OPERATING PRES: 2150 PSI
MAWP: 2225 PSI
TEMPERATURE: MDMT -20° F
DESIGN TEMPERATURE: 700° F
OPERATING TEMPERATURE: 648° F
WELDING PROCEDURE: Q4-P1-B17
Q4-P1-ASA
HEAT TREATMENT- NONE
HYDROTEST: 3750 PSI PER SECTION I
WELDING SINGLE "V" BUTT WELD W/
FULL PENETRATION
CORROSION ALLOWANCE: 0625

BYIS MFG. LLC.
WINFIELD, KS

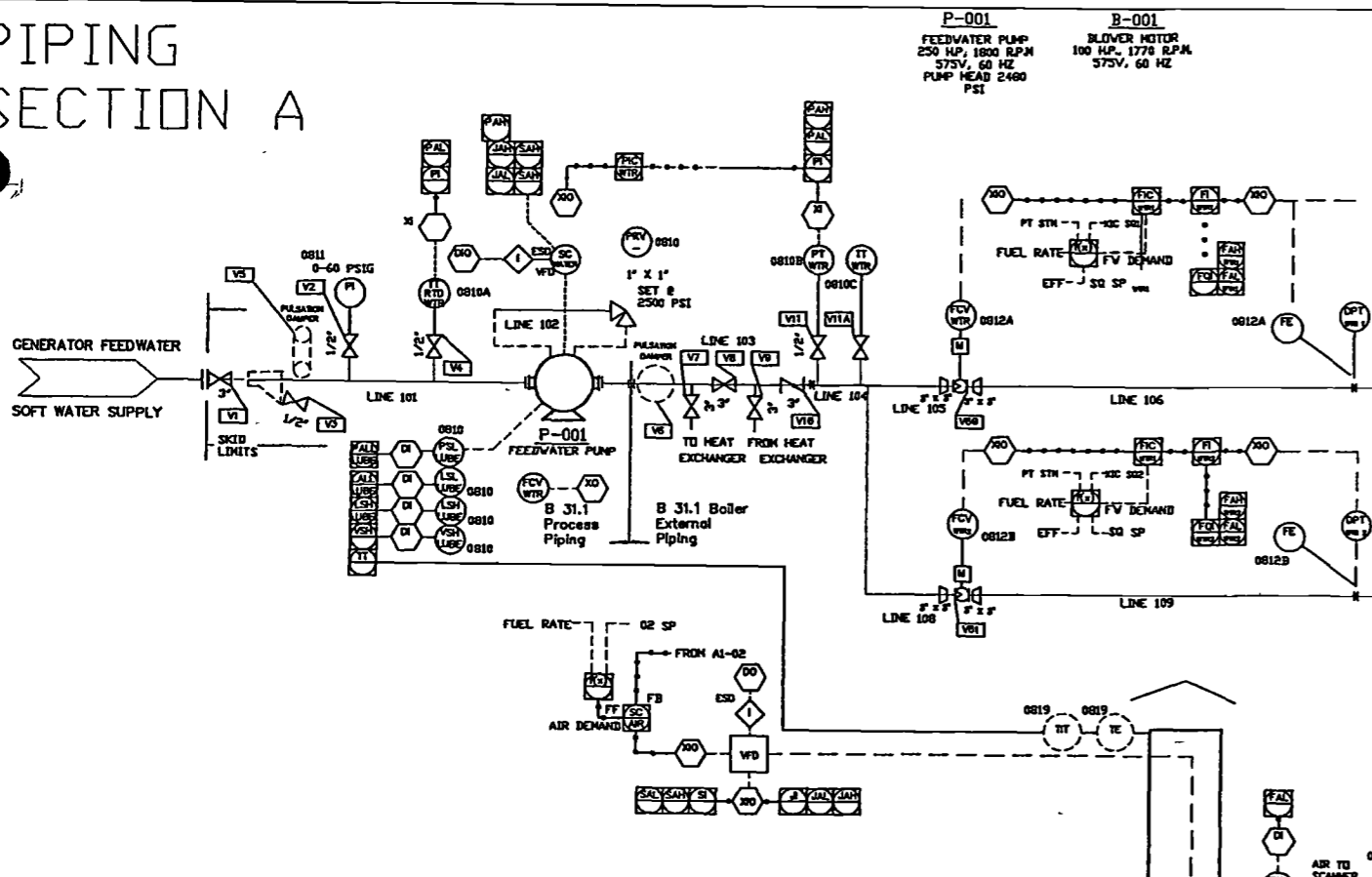
P. & I. DIAGRAM

DRAWN	SMC 6/24/11	DRAWING & CONTRACT NO.	REV.
CHECKED			
APPROVED		CENOVUS FCCL	7
SCALE		100410-1	

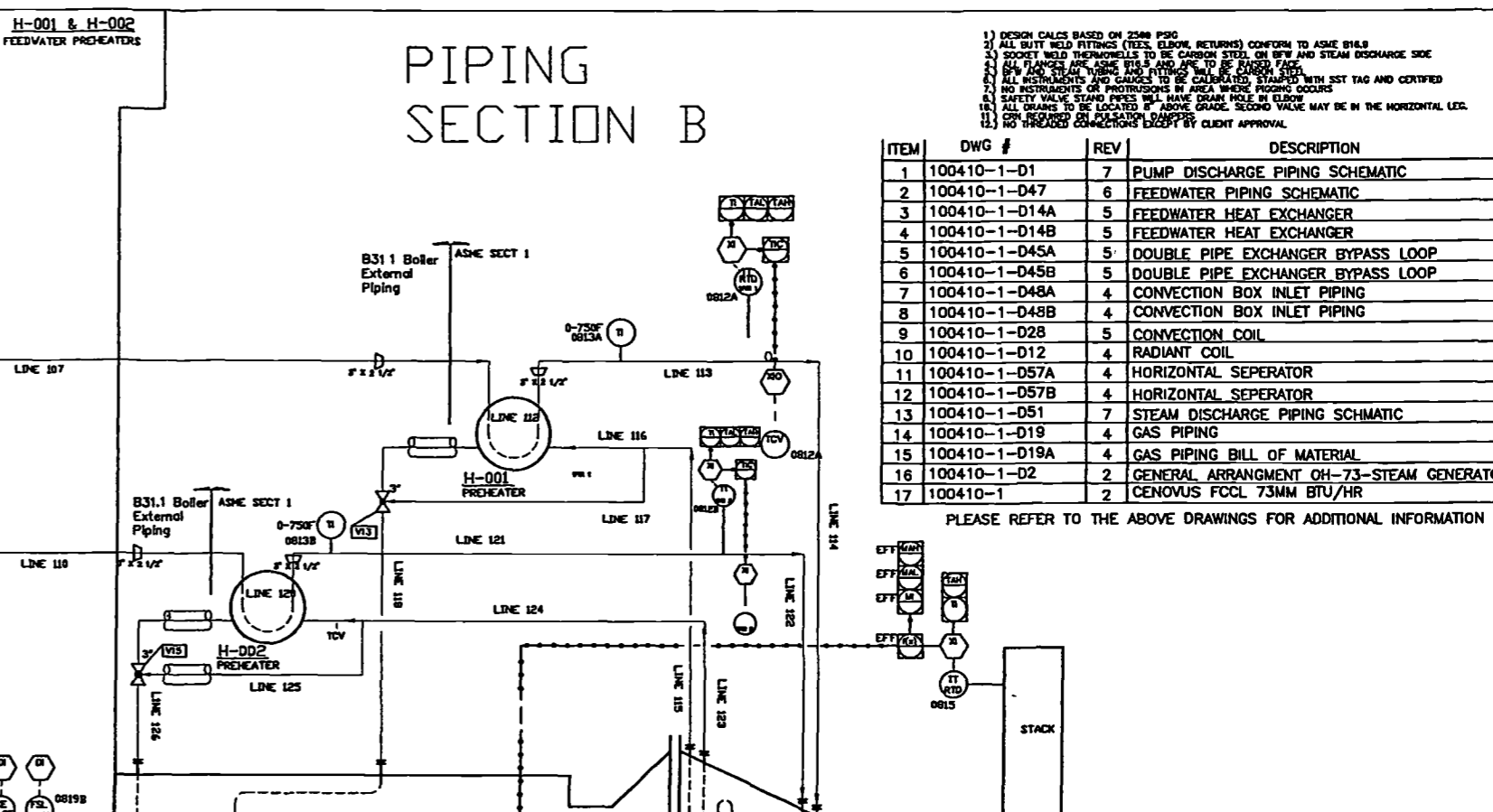


CENOVUS FCCL
PO # 26988
PROJECT NO. 2013
AFE# 11141196

PIPING SECTION A



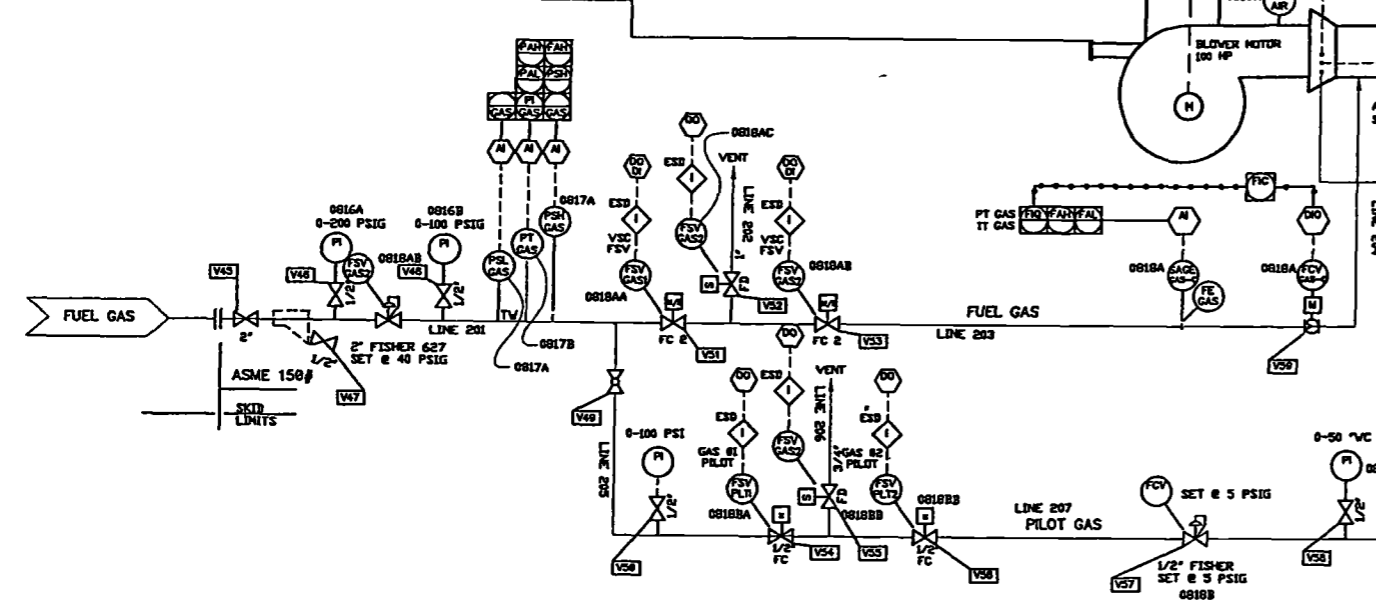
PIPING SECTION B



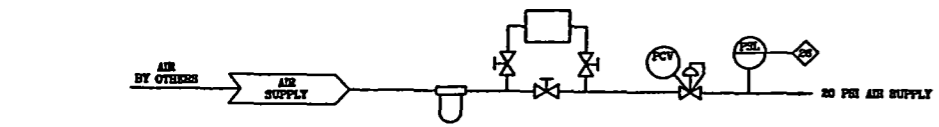
- 1) DESIGN CALCS BASED ON 2500 PSIG
- 2) ALL BUTT WELD FITTINGS (EXCL. ELBOW RETURNS) CONFORM TO ASME B16.9
- 3) SOCKET WELD FITTINGS TO BE CARBON STEEL ON BW AND STEAM DISCHARGE SIDE
- 4) ALL FLANGES ARE ASME B16.5 AND ARE TO BE RIVETED FACE
- 5) ALL AND STEAM TRIM AND FITTINGS TO BE CARBON STEEL
- 6) ALL INSTRUMENTS AND GAUGES TO BE CALIBRATED, STAMPED WITH SST TAG AND CERTIFIED
- 7) NO INSTRUMENTS OR PROTRUSIONS IN AREA WHERE PIPING OCCURS
- 8) SAFETY VALVE STAND PIPES WILL HAVE DRAIN HOLE IN ELBOW
- 9) ALL DRAINS TO BE LOCATED 8" ABOVE GRADE. SECOND VALVE MAY BE IN THE HORIZONTAL LEG.
- 10) CON. REQUIRED ON SATURATION DRAINS
- 11) NO THROUGH CONNECTIONS EXCEPT BY CLIENT APPROVAL

ITEM	DWG #	REV	DESCRIPTION
1	100410-1-D1	7	PUMP DISCHARGE PIPING SCHEMATIC
2	100410-1-D47	6	FEEDWATER PIPING SCHEMATIC
3	100410-1-D14A	5	FEEDWATER HEAT EXCHANGER
4	100410-1-D14B	5	FEEDWATER HEAT EXCHANGER
5	100410-1-D45A	5	DOUBLE PIPE EXCHANGER BYPASS LOOP
6	100410-1-D45B	5	DOUBLE PIPE EXCHANGER BYPASS LOOP
7	100410-1-D48A	4	CONVECTION BOX INLET PIPING
8	100410-1-D48B	4	CONVECTION BOX INLET PIPING
9	100410-1-D28	5	CONVECTION COIL
10	100410-1-D12	4	RADIANT COIL
11	100410-1-D57A	4	HORIZONTAL SEPERATOR
12	100410-1-D57B	4	HORIZONTAL SEPERATOR
13	100410-1-D51	7	STEAM DISCHARGE PIPING SCHEMATIC
14	100410-1-D19	4	GAS PIPING
15	100410-1-D19A	4	GAS PIPING BILL OF MATERIAL
16	100410-1-D2	2	GENERAL ARRANGMENT OH-73-STEAM GENERATOR
17	100410-1	2	CENOVUS FCCL 73MM BTU/HR

PLEASE REFER TO THE ABOVE DRAWINGS FOR ADDITIONAL INFORMATION



PIPING SECTION C



PIPING SECTION D

GENIVAR

1. PROCEED.
2. PROCEED, CHANGE AS NOTED AND RESUBMIT BY DATE _____
3. DO NOT PROCEED, CHANGE AS NOTED AND RESUBMIT BY DATE _____
4. DATA ACCEPTED FOR INFORMATION ONLY

THIS REVIEW SHALL NOT MEAN THAT GENIVAR APPROVES THE DETAILED DESIGN INHERENT IN THE DRAWING. THUS, AUTHORIZATION TO PROCEED DOES NOT RELIEVE CONTRACTOR / VENDOR OF ITS RESPONSIBILITY OR LIABILITY UNDER THE CONTRACT / PURCHASE ORDER

BY: *[Signature]* DATE: *May 27, 13*

CODE ASME SECTION I
2010 EDITION
OPERATING PRESS: 2150 PSI
MAWP: 2225 PSI
TEMPERATURE: MDMT -20° F
DESIGN TEMPERATURE: 700° F
OPERATING TEMPERATURE: 648° F
WELDING PROCEDURE Q4-P1-B17
Q4-P1-ASA
HEAT TREATMENT- NONE
HYDROTEST 3750 PSI PER SECTION I
WELDING SINGLE "V" BUTT WELD W/
FULL PENETRATION
CORROSION ALLOWANCE: .0626

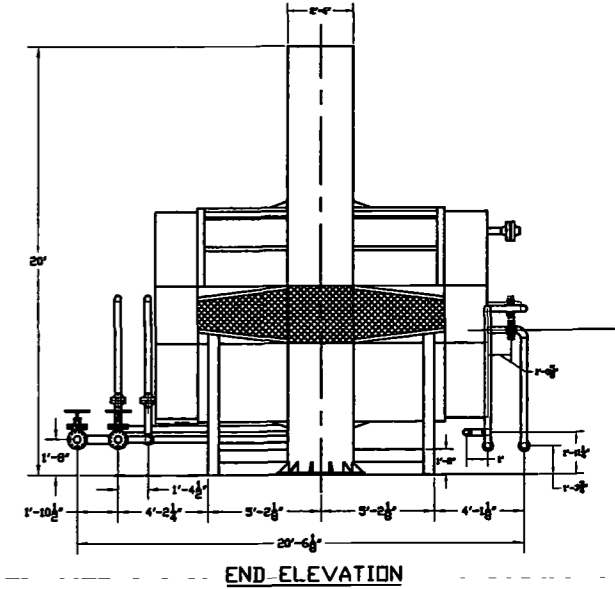
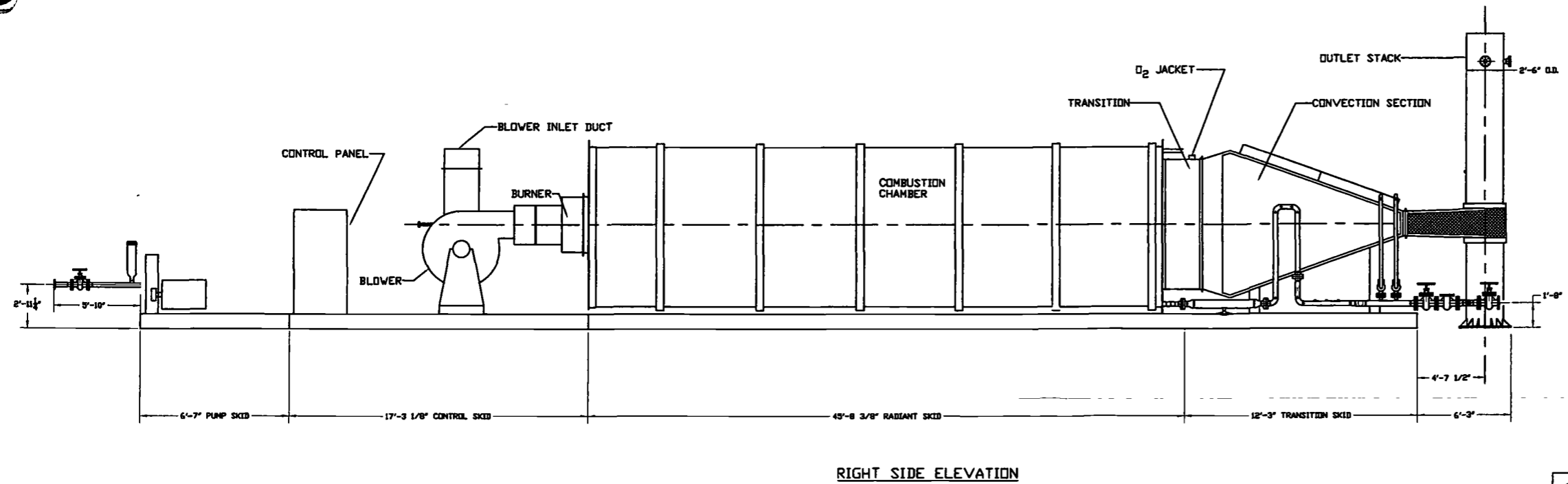
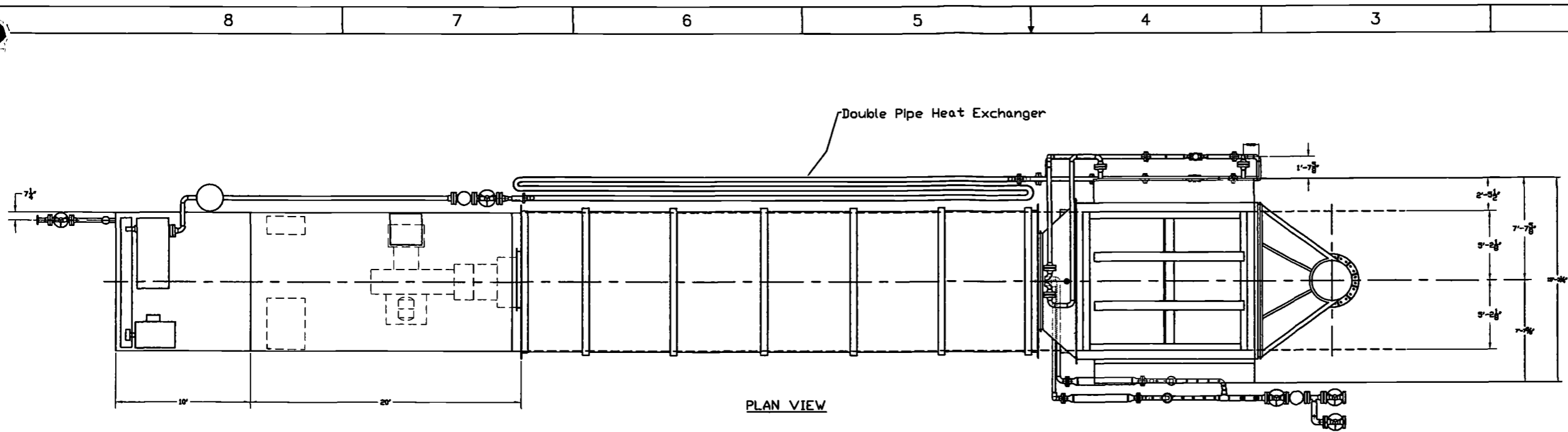
GENIVAR

Project #: 2013-00 Submission #: 005
 PO #: 20980 Tag #: B-810
 VDDR: Rev# 7 VSQ #: -
 Received Date: May 27, 13 Circulation Y/N: N

BYIS MFG. LLC.
WINFIELD, KS

P. & I. DIAGRAM

DRAWN	SMC/6/24/11	DRAWING & CONTRACT NO.	REV
CHECKED			
APPROVED		CENOVUS FCCL	7
SCALE		100410-1	



ASME SECTION 1
 RADIANT 2033 SQUARE FEET
 CONVECTION 14,465 SQUARE FEET
 NATURAL GAS FIRED

CODE ASME SECTION I
 2010 ADDITION
 MAWP: 2225 PSI
 TEMPERATURE MDMT -20° F
 DESIGN TEMPERATURE 700° F
 OPERATING TEMPERATURE 646° F
 WELDING PROCEDURE Q4-P1-S17
 Q4-P1-A5A
 HEAT TREATMENT- NONE
 HYDROTEST: 3750 PSI PER SECTION I
 WELDING SINGLE "V" BUTT WELD W/
 FULL PENETRATION
 CORROSION ALLOWANCE: 0625
 RADIOGRAPHIC: 100% RADIANT
 TUBES, 10% CONVECTION TUBES, 10%
 EXT PIPING

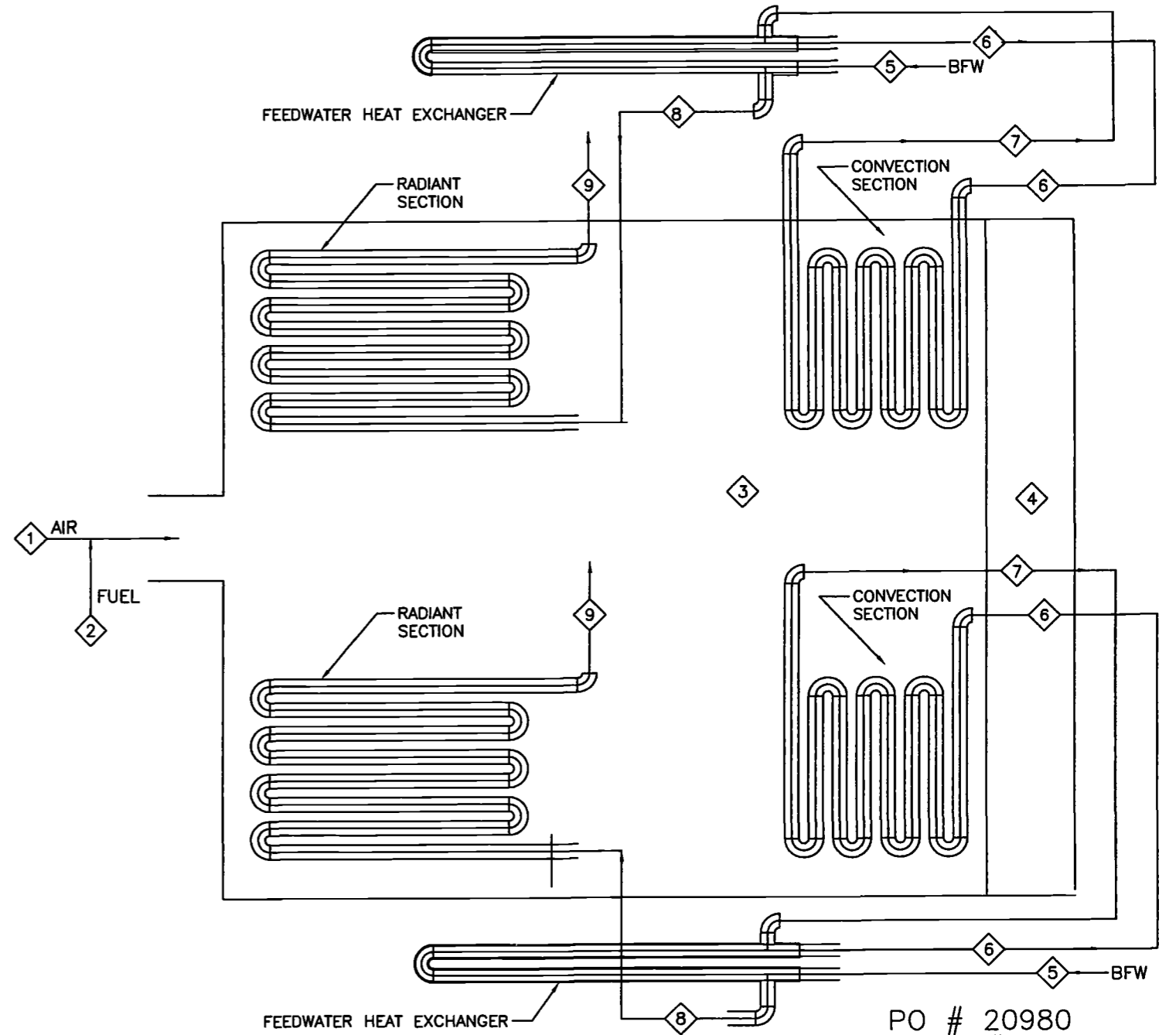
CENOVUS FCCL
 PO# 20980
 PROJECT# 1938
 AFE# 11141196

BYIS MANUFACTURING, LLC WINFIELD, KANSAS			
GENERAL ARRANGEMENT OH-73-STEAM GENERATOR			
DRAWN	SMO	8-2-11	DRAWING & CONTRACT NO.
CHECKED			100410-1-D2
APPROVED			REV.
SCALE	NONE		2

MAWP 2225 psig
2150 psig Service

		1	2	3	4	5	6	7	8	9
		Air	Fuel	Flue gas	Flue gas	Water	Water	Water	Water	Steam
Flow Rate	SCFM	16,600								
	MSCFD		1,989							
	lb _m /sec		18.73	18.73	17.55	17.55	17.75	17.75	17.75	17.75
Temperature	°F	80	1648	350	80	140	450	395	646	
Pressure	psig				2480	2,367	2,364	2,340	2,290	
Pressure Drop	inches H ₂ O			3						
Enthalpy	BTU/lb _m				48	108	440	376	612	
Quality	wt%						0	0	80	
specific Gravity			0.6							
BTU Value	BTU/SCF		1,000							
Sulfur By Wt.	ppm									
Oxygen				3						
Gross Eff. %				83						
Net Eff. %				93						

	Duty ft	Heating Surface	Avg heat flux
	MMBTU per hr	Extended ft ²	BTU/Hr/ sq.ft.
Radiant Section	27.7	2,033	13,625
Convection Section	35.3	14,465	2,440



PO # 20980
PROJ. # 1938
AFE #11141196

BYIS MFG. LLC

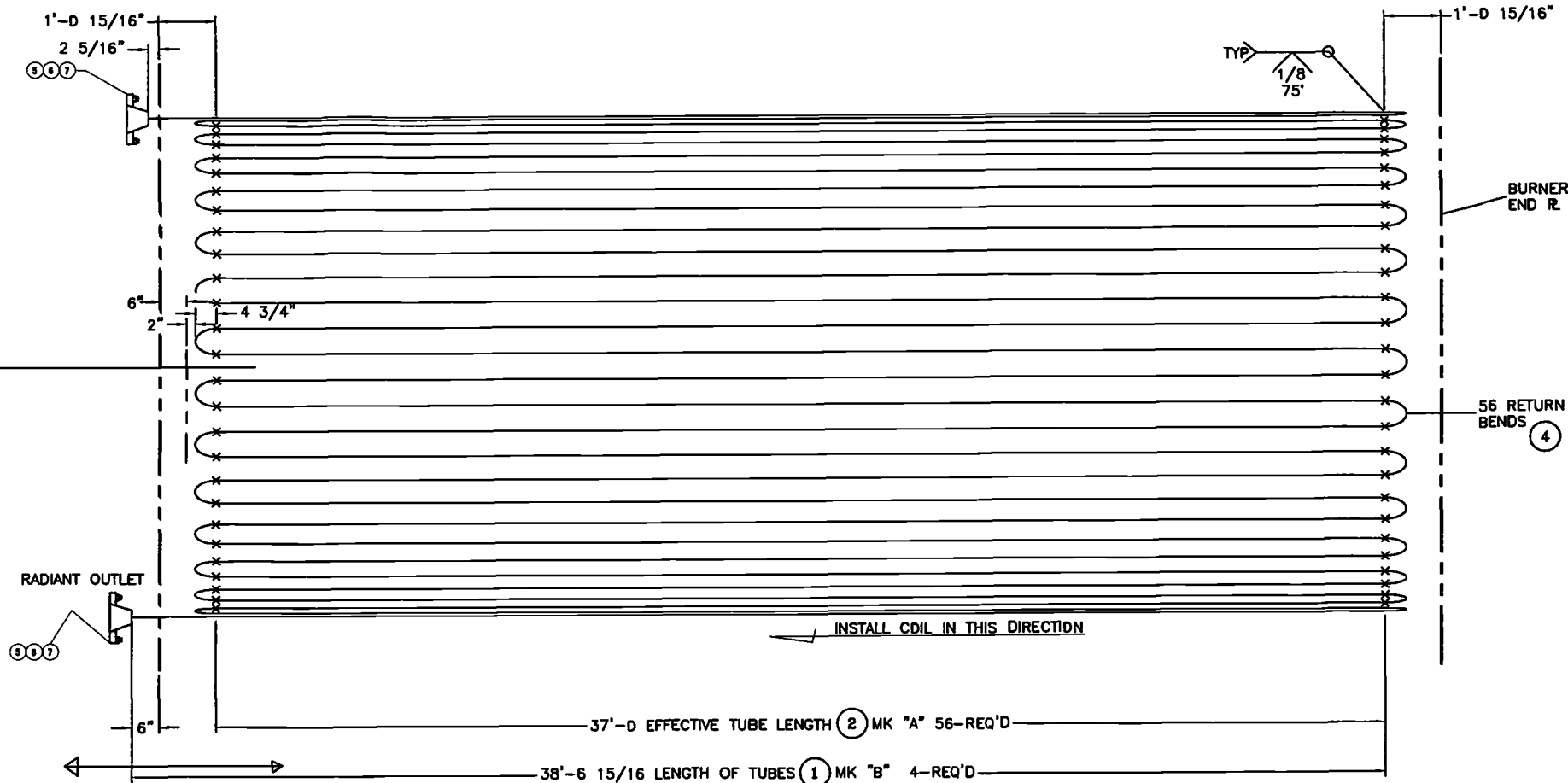
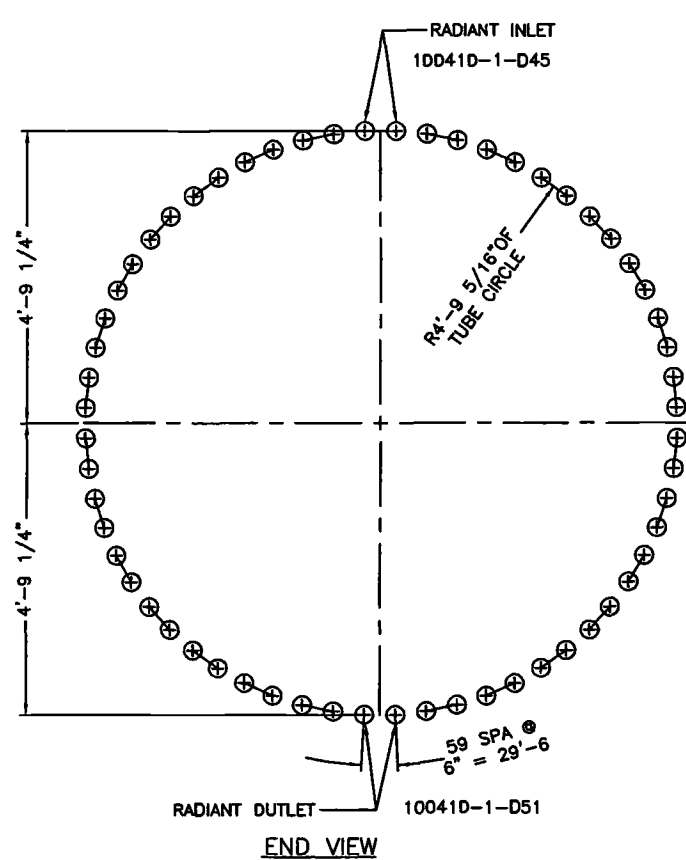
Winfield, KS

CENOVUS FCCL
73 MM BTU/HR.

DRAWN:	8/5/11	DRAWING NO.	REV
CHECKED:	8/5/11	100410-1	2
APPROVED:			
SCALE:			

PIPING SECTION B PER P&ID

BILL OF MATERIAL				QTY SHOWN FOR 1 UNIT	
ITEM	QTY.	DESCRIPTION	LENGTH	MATL.	WT. (LBS)
1	4	PIPE 3" SCH 160 x BxB	38'-6 15/16"	SML'S SA-106B	2210
2	56	PIPE 3" SCH 160 x BxB	37'-0"	SML'S SA-106B	30,937
3					
4	58	RETURN BENDS 3" SCH 160 x 180° S R		SML'S STL SA-234 WPB	580
5	2	3" BLUE SKY SCH 160		SA-105N	
6	8	3/4" - 10 UNC X 6" BOLT		SA-193 B7	
7	8	3/4" - 10 UNC NUT		SA-194 2H	
8					



CODE ASME SECTION I
 2010 ADDITION
 MAWP: 2225 PSI
 TEMPERATURE: MDMT -20° F.
 DESIGN TEMPERATURE: 700°F
 OPERATING TEMPERATURE: 646°F
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-A5A
 HEAT TREATMENT- NDNE
 HYDROTEST: 3750 PSI PER SECTION I
 WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE: 0625
 RADIOGRAPHY 100% RADIANT TUBES

NOTES:
 USE CODE QUALIFIED WELDERS
 SHOP TO CONSIDER WELD SHRINKAGE
 TEST PER CONSTRUCTION SHEET
 EFFECTIVE HEATING SURFACE 2033 SQ. FT.

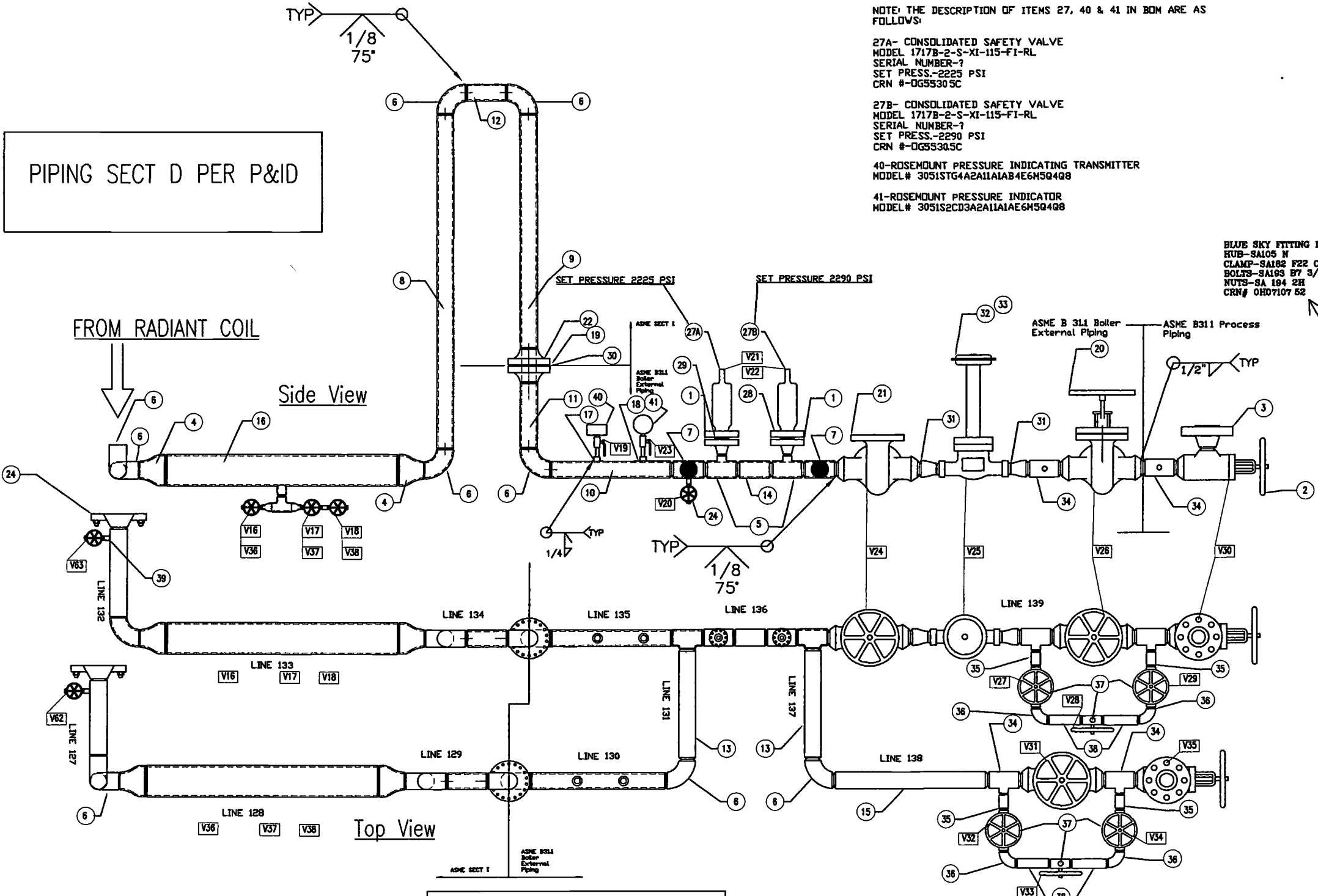
CENOVUS FCCL
 PO# 20980
 PROJECT# 1938
 AFE# 11141196

BYIS MFG. LLC.
 WINFIELD, KANSAS

RADIANT COIL

DRAWN	BY	071211	CAD FILE	-	REV
CHECKED	BY	071211	DRAWING & CONTRACT NO.		
APPROVED			100410-1-D12		4
SCALE					

PIPING SECT D PER P&ID



NOTE: THE DESCRIPTION OF ITEMS 27, 40 & 41 IN BOM ARE AS FOLLOWS:

27A- CONSOLIDATED SAFETY VALVE
MODEL 1717B-2-S-XI-115-F1-RL
SERIAL NUMBER-7
SET PRESS.-2225 PSI
CRN #-DG5530.5C

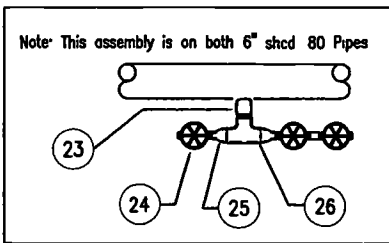
27B- CONSOLIDATED SAFETY VALVE
MODEL 1717B-2-S-XI-115-F1-RL
SERIAL NUMBER-7
SET PRESS.-2290 PSI
CRN #-DG5530.5C

40-ROSEMOUNT PRESSURE INDICATING TRANSMITTER
MODEL# 3051STG4A2A11A1AB4E6M5Q4Q8

41-ROSEMOUNT PRESSURE INDICATOR
MODEL# 3051S2CD3A2A11A1AE6M5Q4Q8

BLUE SKY FITTING INFO
HUB-SA105 N
CLAMP-SA182 F22 CLASS 3
BOLTS-SA193 B7 3/4" X 6"
NUTS-SA 194 2H
CRN# 0H07107 52

CODE ASME SECTION I
2010 ADDITION
MAWP 2225 PSI
TEMPERATURE: MDMT -20° F.
DESIGN TEMPERATURE: 700°F
OPERATING TEMPERATURE: 648°F
WELDING PROCEDURE Q4-P1-B17
Q4-P1-A5A
HEAT TREATMENT- NONE
HYDROTEST: 3750 PSI PER SECTION I
WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
CORROSION ALLOWANCE: 0625
RADIOGRAPHY: 10% EXT PIPING



ITEM	PART No.	UOM	QTY	DESCRIPTION
1		----	2	1 1/2"-1500 lb. RFWN SA105
2		----	1	3" EDWARDS ANGLE VALVE 1500# CRN# 0C834.5C BODY ASTM A-105, BONNET A105 WEL
3		----	4	3"-1500 lb. RFWN Flange SA105
4		----	4	6 x 3 Sched. XXH Reducer SA234 WPB
5		----	2	3" X 3" X 1 1/2" TEE SCH 160 SA234 WPB
6		----	14	3" L.R. 90° Elbow (Schd. 160) SA234 WPB
7		----	2	3" Tee (Schd. 160) SA234 WPB
8		----	2	3" Schd. 160 Pipe 70" Long SA106 GR B
9		----	2	3" Schd. 160 Pipe 49" Long SA106 GR B
10		----	2	3" Schd. 160 Pipe 38" Long SA106 GR B
11		----	2	3" Schd. 160 Pipe 14" Long SA106 GR B
12		----	2	3" Schd. 160 Pipe 8.500" Long SA 106 GR B
13		----	2	3" Schd 160 Pipe 16" Long SA106 GR B
14		----	1	3" Schd. 160 Pipe 8" Long SA106 GR B
15		----	1	3" Schd. 160 Pipe 31" Long SA106 GR B
16		----	2	6" Schd. XXH Pipe 48" Long SA106 GR B
17		----	2	3/4"-3000 lb. Weldolet SA105
18		----	2	1"-3000 lb. Weldolet SA105
19	0814A, 0814B FE	----	2	3"-1500 Lb. Orifice Flange Assm. SA105
20		----	2	3" VELAN GATE VALVE CRN# 0C0991.62 BODY ASTM A-105, YOKE: CS WELDED
21		----	1	3" VELAN CHECK VALVE CRN# 0C0991.62 BODY ASTM A-105, YOKE: CS WELDED
22		----	32	BOLTS. SA 193 B7 1 1/8" X 7" W/ SA 194 2-H NUTS
23		----	2	1 1/2"-3000 lb. Weldolet SA105
24		----	2	3" BLUE SKY SCH 160
25		----	4	1 1/2 x 1" Schd. 160 Reducer SA234 WPB
26		----	2	1 1/2 Tee" Schd. 160 SA234 WPB
27	0813A, 0813B PSV	----	2	CONSOLIDATED SAFETY VALVE SA-105 CRN# 0G5530.5C
28		----	8	BOLTS: SA 193 B7 1" X 5 1/2" W/ SA 194 2-H NUTS
29		----	2	GASKET: 1 1/2" X 1500# SPIRAL WOUND GASKET
30		----	1	ORIFICE PLATE 5/32 FOR 3" 1500# RFWN
31		----	2	3" X 2" SCH 160 CONC REDUCER SA234 WPB
32	0815 PCV	----	1	FISHER PRESSURE CONTROL VALVE ASTM A-105 CRN# 0C8768.52
33	0815 PSL AIR	----	1	FISHER PRESS SWITCH SS316L
34		----	4	3" X 3" X 1" TEE SCH 160 SA234 WPB
35		----	4	1" SCH 160 SA 106 GR B PIPE 3" LONG
36		----	4	1" L.R. 90° Elbow (Schd. 160) SA234 WPB
37		----	6	VOGT FLOWSERVE, 1" 1500# VALVE CRN# 0C0580.52 BODY ASTM A-105, YOKE: CS WELDED
38		----	4	1" SCH 160 SA 106 GR B PIPE 8" LONG
39		----	2	1/2" SCH 160 SA 106 GR B PIPE 1.375" LONG
40	0814 PIT STEAM	----	2	ROSEMOUNT PRESS INDICATOR TRANSMITTER CRN# 0F0792.2 BODY & BONNET A79 316
41	0815 PI	----	2	ROSEMOUNT PRESSURE INDICATOR CRN# 0F0792.2 BODY & BONNET A79 316
42		----	2	3" 1500# Spiral Wound Gasket
V	16, 17, 18, 20,	----	4	VOGT FLOWSERVE, 1" 1500# VALVE CRN# 0C0580.52 BODY ASTM A-105, YOKE: CS WELDED
V	19, 19A, 23, 23A	----	4	FLOWSERVE, 1/2" 1500# VALVE CRN# 0C0580.52 BODY ASTM A-105, YOKE: CS WELDED
V	21	----	1	CONSOLIDATED SAFETY VALVE SA-105 SET@2225 CRN# 0G05530
V	22	----	1	CONSOLIDATED SAFETY VALVE SA-105 SET@2290 CRN 0G05530.
V	24	----	1	3" VELAN CHECK VALVE CRN# 0C0991.62 BODY ASTM A-105, YOKE: CS WELDED
V	25	----	1	2" FISHER 657 CONTROL VALVE CRN# 0C8768.52 BODY & FLANGE ASTM A-105
V	26, 31	----	2	3" VELAN GATE VALVE CRN# 0C0991.62 BODY ASTM A-105, YOKE: CS WELDED
V	27, 28, 29	----	3	VOGT FLOWSERVE, 1" 1500# VALVE CRN# 0C0580.52 BODY ASTM A-105, YOKE: CS WELDED
V	30, 35	----	2	3" EDWARDS ANGLE VALVE 1500# CRN# 0C834.5C BODY ASTM A-105, BONNET A105 WEL
V	32, 33, 34	----	3	VOGT FLOWSERVE, 1" 1500# VALVE CRN# 0C0580.52 BODY ASTM A-105, YOKE: CS WELDED
V	36, 37, 38	----	3	VOGT FLOWSERVE, 1" 1500# VALVE CRN# 0C0580.52 BODY ASTM A-105, YOKE: CS WELDED
V	62, 63	----	2	FLOWSERVE, 1/2" 1500# VALVE CRN# 0C0580.52 BODY ASTM A-105, YOKE: CS WELDED

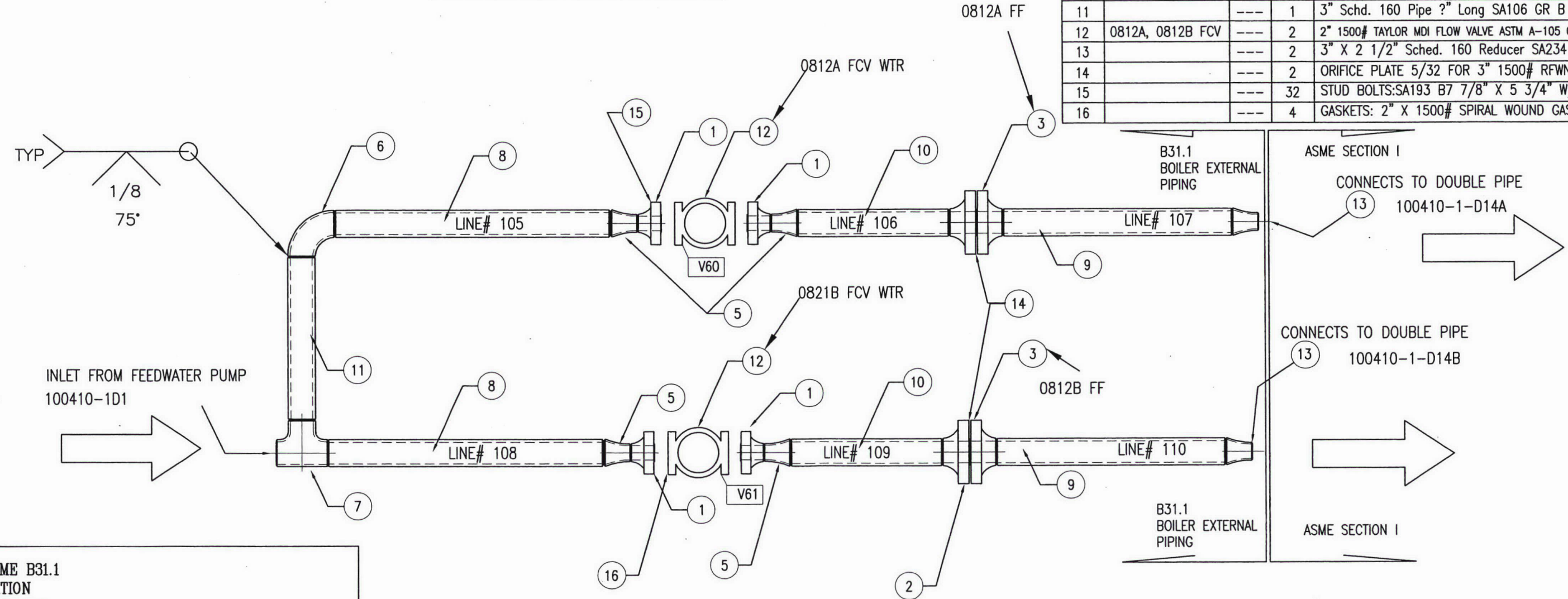
This drawing is the property of BYIS and is subject to return upon request. It is to be used only for the purpose for which it was expressly loaned and is not to be used in any way detrimental to the interest of this Company.

F				UNLESS OTHERWISE SPECIFIED 1 TOLERANCES X = ± .06 XX = ± .03 XXX = ± .010 FRACTIONS ± 1/32 ANGLES ± 1/2°	DR.	SG	Steam Discharge Piping Schematic	
E					CK.			
D								
C						APP.		
B						SCALE	DATE	DWG. NO.
A				2. REMOVE ALL BURRS & SHARP EDGES 3. CORNER RADII .03 4. ALL DIMS. IN INCHES 5. MACHINE	NS	081111	100410-1-D51	
REV.	DATE	ECN.	CHK.		7			

CENOVUS FCCL
PO# 20980
PROJECT# 1938
AFE# 11141196

PIPING SECT A PER PI&D

ITEM	PART No.	UOM	QTY	DESCRIPTION
1		---	4	2"-1500 lb. RFWN SA105
2			16	STUD BOLTS:SA193 B7 1 1/8" X 7" W/SA194 2-H NUTS
3	0812A, 0812B FE	---	4	3"-1500 lb. Oriface Flange Assm. SA105
4		---	-	NOT USED
5		---	4	3 x 2 Sched. 160 Reducer SA234 WPB
6		---	1	3" 90° Elbow (Schd. 160) SA234 WPB
7		---	1	3" Tee (Schd. 160) SA234 WPB
8		---	3	3" Schd. 160 Pipe ?" Long SA106 GR B
9		---	2	3" Schd. 160 Pipe ?" Long SA106 GR B
10		---	2	3" Schd. 160 Pipe ?" Long SA106 GR B
11		---	1	3" Schd. 160 Pipe ?" Long SA106 GR B
12	0812A, 0812B FCV	---	2	2" 1500# TAYLOR MDI FLOW VALVE ASTM A-105 CRN# OC8909.5C
13		---	2	3" X 2 1/2" Sched. 160 Reducer SA234 WPB
14		---	2	ORIFICE PLATE 5/32 FOR 3" 1500# RFWN SA-105
15		---	32	STUD BOLTS:SA193 B7 7/8" X 5 3/4" W/SA194 2-H NUTS
16		---	4	GASKETS: 2" X 1500# SPIRAL WOUND GASKETS

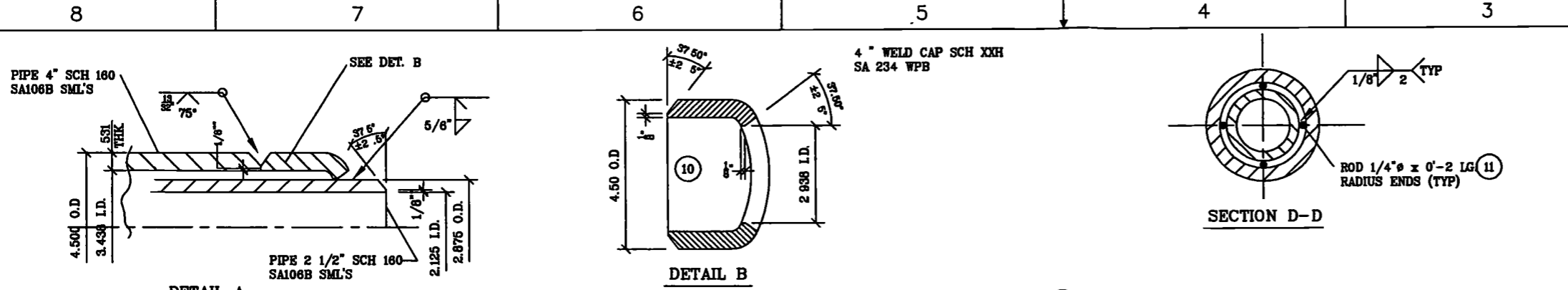


CODE ASME B31.1
 2010 EDITION
 MAWP: 2480 PSI
 TEMPERATURE: MDMT -20F
 DESIGN TEMPERATURE: 30
 OPERATING TEMPERATURE: 30
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-A5A
 HEAT TREATMENT- NONE
 HYDROTEST: 3750 PSI
 WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE: .0625
 RADIOGRAPHY: 0 EXT PIPING

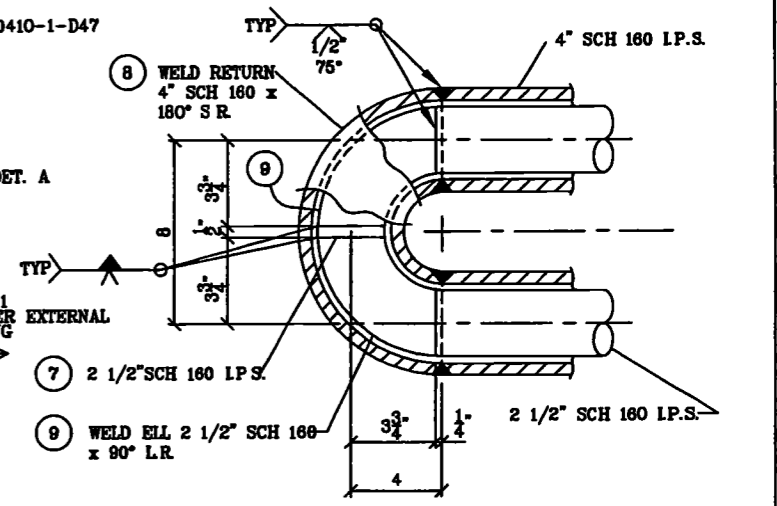
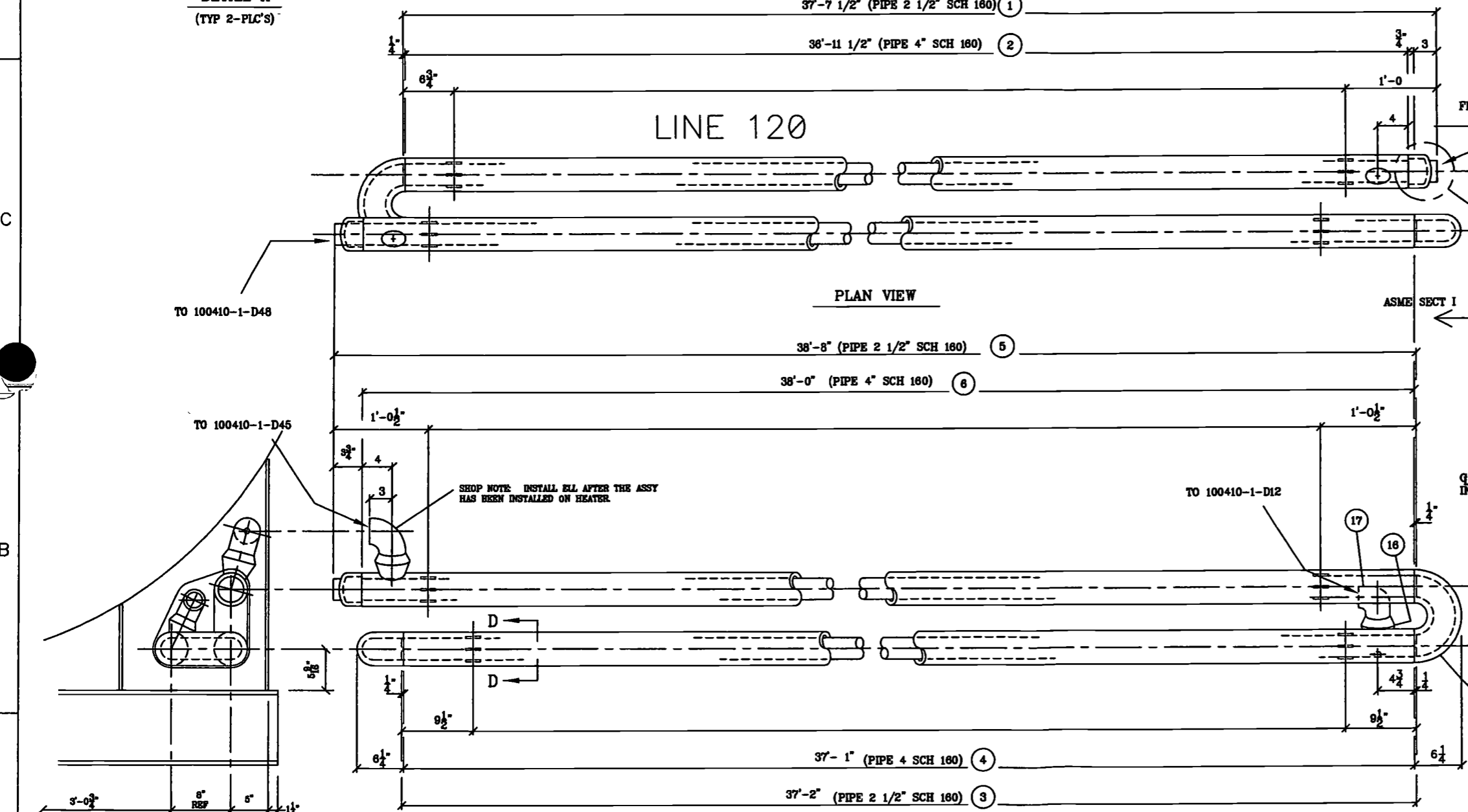
CENOVUS FCCL
 PO# 20980
 PROJECT # 1938
 AFE # 11141196

This drawing is the property of BYIS and is subject to return upon request. It is to be used only for the purpose for which it was expressly loaned and is not to be used in any way detrimental to the interest of this Company.

REV.	DATE	ECN. NO.	CHK.	UNLESS OTHERWISE SPECIFIED	DR.	SG	FEED WATER PIPING SCHEMATIC	
F				1. TOLERANCES				
E				.X = ± .06	CK.			
D				.XX = ± .03	APP.			
C				.XXX = ± .010				
B				FRACTIONS ± 1/32	SCALE	NS	DATE	DWG. No.
A				ANGLES ± 1/2°			08-11-11	100410-1-D47
6				2. REMOVE ALL BURRS & SHARP EDGES				
				3. CORNER RADII .03				
				4. ALL DIMS. IN INCHES				
				5. MACHINE				



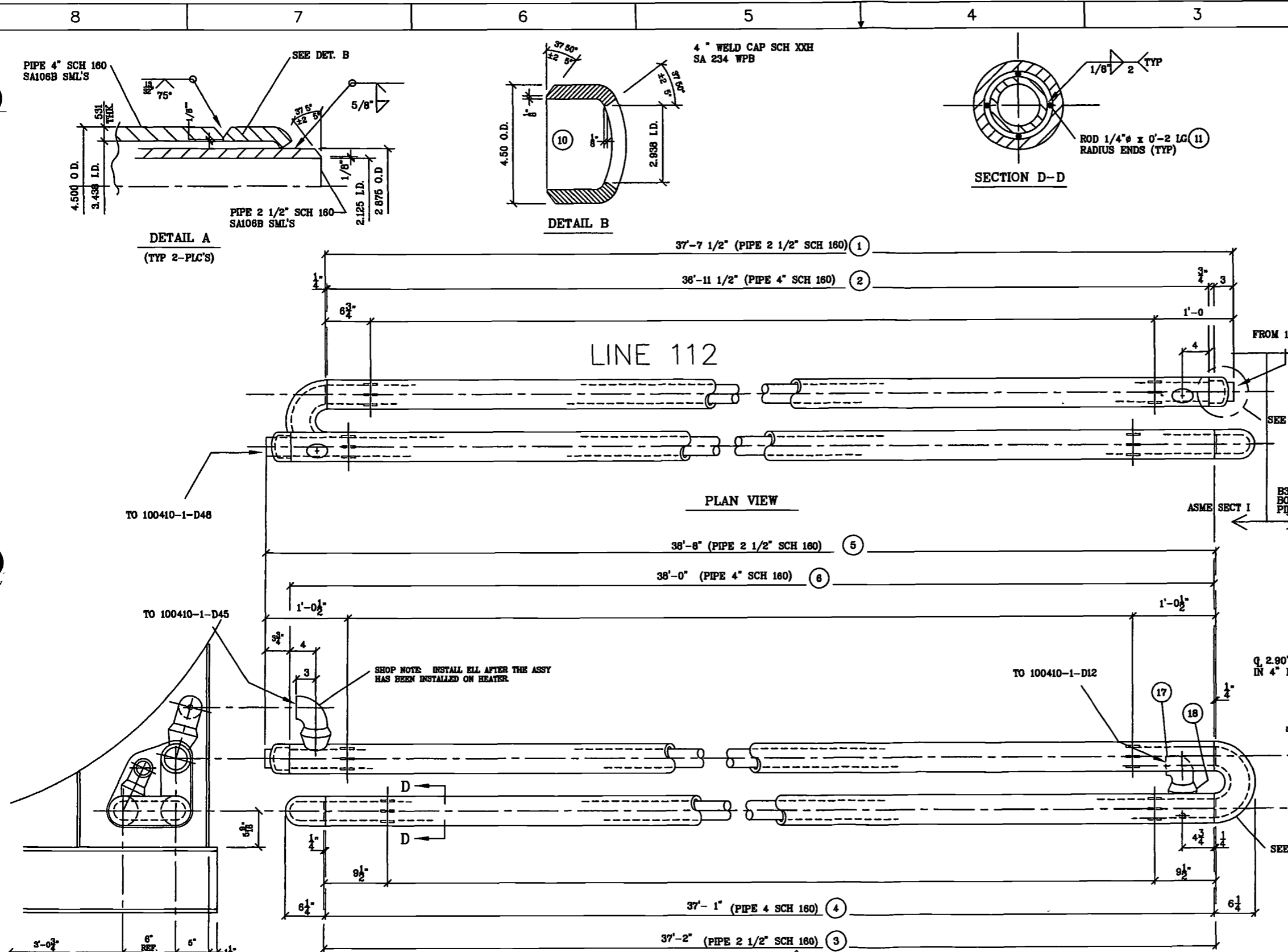
BILL OF MATERIAL					
ITEM	QTY	DESCRIPTION	LENGTH	MATL	WT
1	1	PIPE 2 1/2" SCH 160 x BxB	18'-0"	SA106B SML'S	180
2	1	PIPE 4" SCH 160 x	17'-9"		397
3	1	PIPE 2 1/2" SCH 160 x	17'-8"		177
4	1	PIPE 4" SCH 160 x	17'-8"		400
5	1	PIPE 2 1/2" SCH 160 x	18'-2"		183
6	1	PIPE 4" SCH 160 x	18'-7"		419
7	1	PIPE 2 1/2" SCH 160 x	0'-1/2"		1
8	2	WELD RETURN 4" SCH 160 x 180° S R.		SA234 WPB	68
9	4	WELD ELL 2 1/2" SCH 160 x 90° L R.		SA234 WPB	32
10	2	WELD CAP 4" SCH XXH		SA234 WPB	12
11	48	ROD 1/4" x 3"	0'-2"	C.S.	
12	1	THREDOLET 6 x 1/2 x 3000#		SA105	
13	1	PIPE PLUG 1/2" LP.S. HEX HD SOLID		SA105	
14	1	WELDOLET 4 x 2 1/2 x SCH 160		SA105	
15	1	WELD ELL 2 1/2" SCH 160 x 90° S R.		SA234 WPB	
16	1	WELDOLET 4 x 3 x SCH 160		SA105	
17	1	WELD ELL 3" SCH 160 x 90° S R.		SA234 WPB	



CODE ASME SECTION I
2010 ADDITION
MAWP 2225 PSI
TEMPERATURE: MDMT -20° F
DESIGN TEMPERATURE: 700° F
OPERATING TEMPERATURE: 648° F
WELDING PROCEDURE Q4-P1-B17
Q4-P1-A5A
HEAT TREATMENT- NONE
HYDROTEST: 3750 PSI PER SECTION I
WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
CORROSION ALLOWANCE: .0625
RADIOGRAPHY: 10% EXT PIPING

CENOVUS FCCL
PO# 20980
PROJECT # 1938
AFE # 11141196

BYIS MANUFACTURING, LLC			
WINFIELD, KANSAS			
FEEDWATER HEAT EXCHANGER			
NO.	REVISION	BY	DATE
DRAWN	SMc	8/22/11	DRAWING & CONTRACT NO.
CHECKED	WY	8/22/11	100410-1 D14B
APPROVED			5
SCALE	NONE		



BILL OF MATERIAL					
ITEM	QTY	DESCRIPTION	LENGTH	MATL.	WT
1	1	PIPE 2 1/2" SCH 160 x 8xB	18'-0"	SA106B SML'S	180
2	1	PIPE 4" SCH 160 x	17'-8"		397
3	1	PIPE 2 1/2" SCH 160 x	17'-8"		177
4	1	PIPE 4" SCH 160 x	17'-8"		400
5	1	PIPE 2 1/2" SCH 160 x	18'-2"		183
6	1	PIPE 4" SCH 160 x	18'-7"		418
7	1	PIPE 2 1/2" SCH 160 x	0'-1/2"		1
8	2	WELD RETURN 4" SCH 160 x 180° S.R.		SA234 WPB	68
9	4	WELD ELL 2 1/2" SCH 160 x 90° L.R.		SA234 WPB	32
10	2	WELD CAP 4" SCH XXH		SA234 WPB	12
11	48	ROD 1/4" x 3"	0'-2"	C.S.	
12	1	THREDOLET 6 x 1/2 x 3000#		SA105	
13	1	PIPE PLUG 1/2" LP.S. HEX HD SOLID		SA105	
14	1	WELDOLET 4 x 2 1/2 x SCH 160		SA105	
15	1	WELD ELL 2 1/2" SCH 160 x 90° S.R.		SA234 WPB	
16	1	WELDOLET 4 x 3 x SCH 160		SA105	
17	1	WELD ELL 3" SCH 160 x 90° S.R.		SA234 WPB	

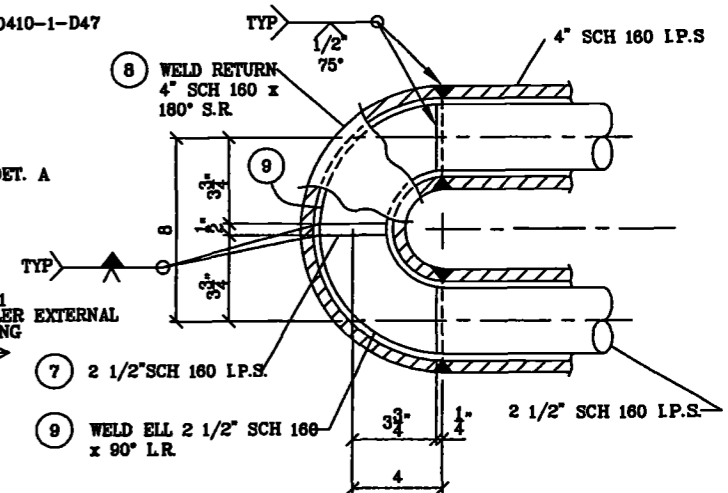
DETAIL A
(TYP 2-PLC'S)

DETAIL B

SECTION D-D

PLAN VIEW

SIDE ELEVATION



DETAIL C
(TYP 2-PLC'S)

CODE ASME SECTION I
2010 ADDITION
MAWP-2225 PSI
TEMPERATURE MDMT -20° F.
DESIGN TEMPERATURE: 700°F
OPERATING TEMPERATURE: 648°F
WELDING PROCEDURE Q4-P1-B17
Q4-P1-A5A
HEAT TREATMENT- NONE
HYDROTEST: 3750 PSI PER SECTION I
WELDING SINGLE "V" BUTT WELD W/ FULL
PENETRATION
CORROSION ALLOWANCE: .0625
RADIOGRAPHY 10% EXT PIPING

CENOVUS FCCL
PO# 20980
PROJECT # 1938
AFE # 11141196

NO.	REVISION	BY	DATE
BYIS MANUFACTURING, LLC WINFIELD, KANSAS			
FEEDWATER HEAT EXCHANGER			
DRAWN	Smc	8/22/11	DRAWING & CONTRACT NO.
CHECKED	WY	8/22/11	REV.
APPROVED			100410-1 D14A
SCALE	NONE		5

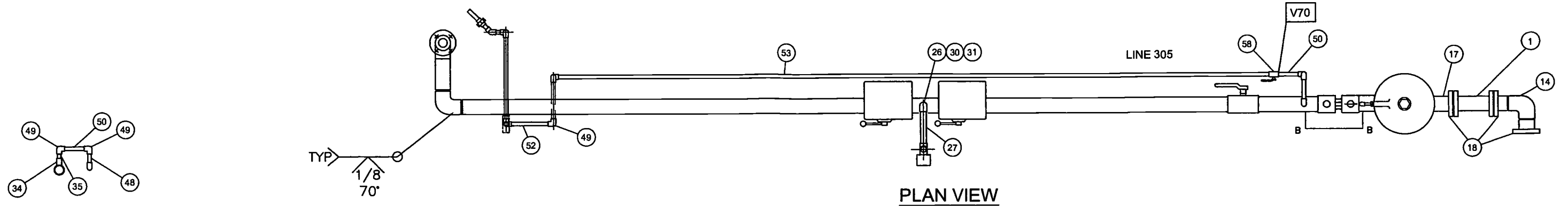
ITEM	PART No	UOM	QTY	DESCRIPTION	ITEM	PART No.	UOM	QTY	DESCRIPTION
1		----	1	4" SUREFLOW STRAINER OC8564.52	56		----	1	1/2" PIPE SCH 40 SA 106 GR B
2		----	1	2" PIPE (SCH 40) SA106 GR B	57		----	1	HEX BUSHING 3/4" X 1/2" X 3000# SW SA105
3		----	1	2" ELBOW (SCH 40) SA 234 WPB	58		----	1	VALVE 1/2" APOLLO BALL VALVE SW CRN# OC1098.52 A105, SA216 WCB
4		----	5	1/2" NPT 3000# COUPLING SA-105	59	0828 SV 1	----	1	REGULATOR, FISHER Y690, 3/4" CRN# OC8768.52 CS
5		----		NOT USED	60	0827BB 0827BA	----	2	SOLENOID VALVE, ASCO #8030A16 CRN: OC12239 52
6		----	1	2" PIPE (SCH 40) SA106 GR.B	61	0826 PI GAS	----	1	PRESSURE GAUGE 1/2" CON 0-100 PSI CRN: OF8388 52
7		----		NOT USED	62	0827B PI	----	1	PRESSURE GAUGE 1/2" CON 0-5 PSI RANGE CRN. OF8388.52
8		----		NOT USED	63		----	2	L 2 X 2 X 1/4" SA36
9		----	1	2" PIPE (SCH 40) SA106 GR.B	64		----	2	U-BOLT
10		----	1	2" PIPE (SCH 40) SA106 GR.B	65		----	2	U-BOLT
11		----		NOT USED	66		----	1	U-BOLT
12		----		NOT USED	67		----	2	NOT USED
13		----	1	1/2" 3000# SW CPLG SA105	68	0826 PVC GAS	----	1	2" FISHER REGULATOR 627 CRN# OC8768 52 CS
14		----	1	2" 90 DEG ELBOW (SCH 40) SA 234 WPB	69		----	1	2" PIPE SCH 40 SA106 GR.B
15	0827 FCV GAS/AIR	----	1	FISHER 150 V-BALL WCC CONTROL VALVE CRN# OC8912.5C2	70		----	1	1/2" PIPE SCH 40 SA 106 GR B
16		----	1	2" PIPE (SCH 40) SA106 GR.B	71		----	1	1/2" PIPE SCH 40 SA 106 GR B
17		----	1	2" PIPE (SCH 40) SA106 GR B	72		----	2	1/2" ELBOW SCH 40 SA234 WPB
18		----	16	2"150# FLG. SOF SA105	73		----	8	1/2" 3000# SW CPLG SA105
19		----	56	BOLTS SA 193 B7 5/8" X 3 1/4" W/ SA 194 2H NUTS	74		----	1	2" PIPE (SCH. 40) SA106 GR.B
20		----	16	GASKET 2" 150# SPIRAL WOUND GASKET	75	0828 PT GAS	----	1	ROSEMOUNT PRESSURE TRANS CRN# OF0792.2 BODY & BONNET-ALLOY A-479 316 MODEL# 3051STG4A2A11A1AB4E6M5Q4Q8
21		----		NOT USED	76		----	1	KUNKLE SAFETY VALVE SET@ 50 PSI, MODEL# 910BGF01, CRN# 0G00787 52, BODY SA216 GR WCB, BONNETT STEEL A108 GR 1117
22		----		NOT USED	77		----	1	1 1/2" PIPE (SCH. 40) SA106 GR B TOE
23	0827AA FSV GAS 1	----	1	2" MAXON 5000S GAS VALVE CRN# OC2221.5C2 BODY CS	78		----	1	1 1/2" 3000# SW COUPLING SA105
24	0827AB FSV GAS 2	----	1	2" MAXON 5000S GAS VALVE CRN# OC2221.5C2 BODY CS					
25		----	1	2" APOLLO BALL VALVE SW CRN# OC10908 52 A105, SA216 WCB					
26		----	1	1/2" PIPE (SCH 40) SA106 GR.B					
27		----	1	1/2" PIPE (SCH 40) SA106 GR.B					
28		----	1	1/2" PIPE (SCH 40) SA106 GR.B					
29		----	1	1/2" PIPE (SCH 40) SA106 GR B					
30		----	2	1/2" COUPLING 3000# SW SA105					
31		----	1	1/2" ELBOW (SCH 40) SA234 WPB					
32		----	1	VENT CAP					
33	0827AC FSV GAS 3	----	1	ASCO SOLENOID VALVE CRN: OC12239 52					
34		----		NOT USED					
35		----		NOT USED					
36		----		NOT USED					
37		----		NOT USED					
38		----		NOT USED					
39		----		NOT USED					
40		----	1	IMPERIAL #788-FSS MALE CONN, 1/2" TUBE-1/2 MPT					
41		----	6	LIN FT 1/2" ODX .035 WL TUBING (SS)					
42		----	1	1/2" PIPE (SCH 40) SA106 GR.B					
43		----	1	1/2" 3000# SW COUPLING SA 105 THRD					
44		----	1	1/2" ANDERSON NEEDLE VALVE CRN# OC08302.2 A108					
45	0827A PSL SWITCH	----	1	UNITED ELECTRIC PRESSURE SWITCH CRN# OF82285 52					
46	0827A PSH SWITCH	----	1	UNITED ELECTRIC PRESSURE SWITCH OF82285 52					
47		----		NOT USED					
48		----	1	1/2" PIPE (SCH 40) SA106 GR B					
49		----	10	1/2" ELBOW (SCH 40) SA 234 WPB					
50		----	1	1/2" PIPE (SCH 40) SA106 GR B					
51	0827BA FSV PILOT	----	1	ASCO SOLENOID VALVE CRN: OC12239.52					
52		----	1	1/2" PIPE (SCH 40) SA106 GR B					
53		----	1	1/2" PIPE (SCH 40) SA106 GR.B					
54		----	1	1/2" PIPE (SCH 40) SA106 GR.B					
55		----	1	1/2" PIPE (SCH 40) SA106 GR.B					

SECTION C PER P&ID

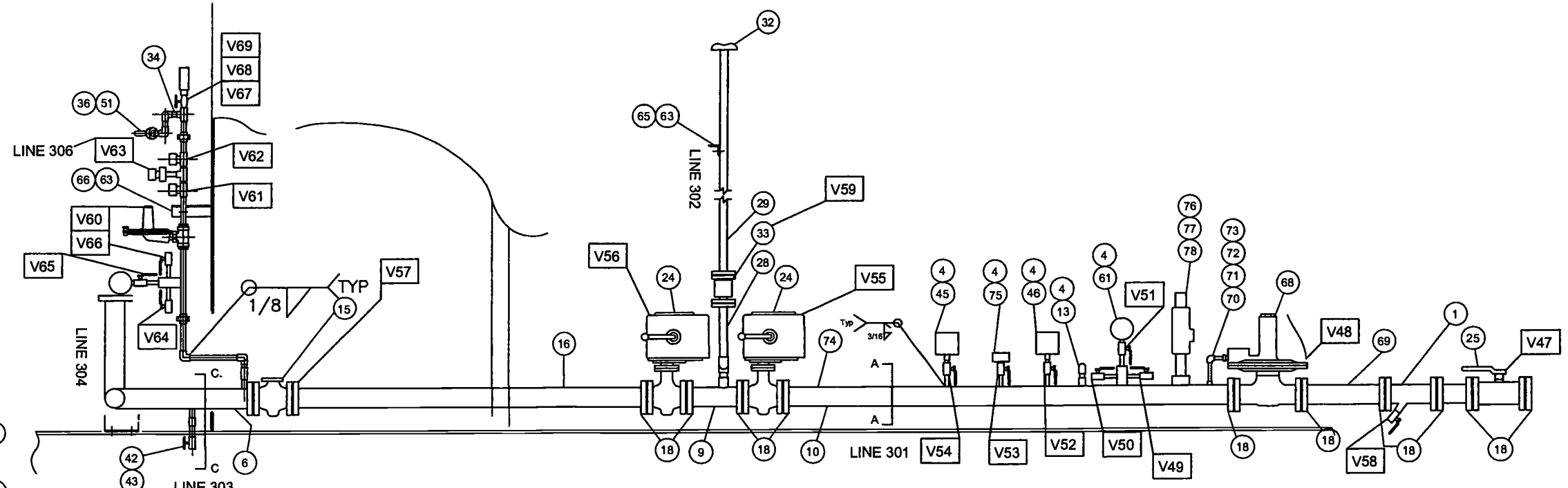
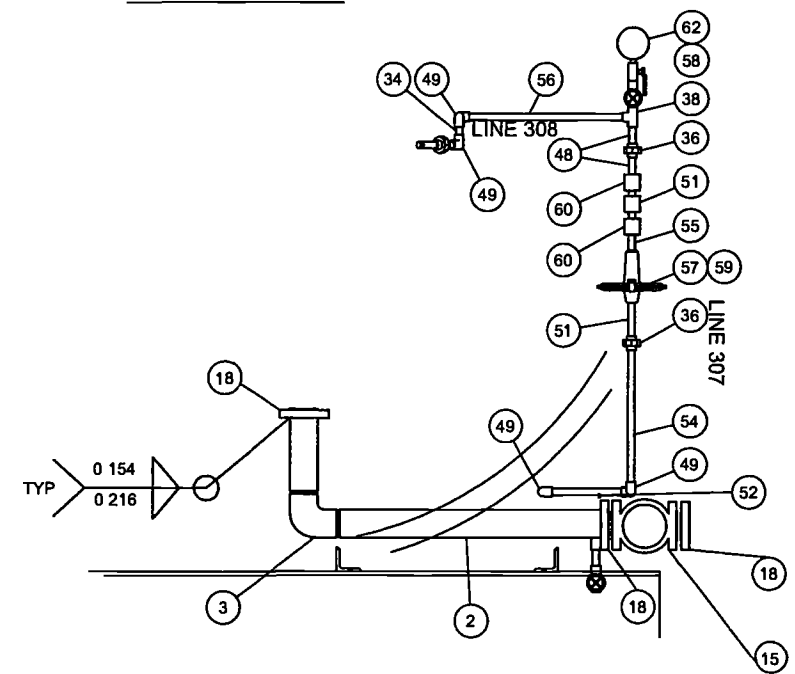
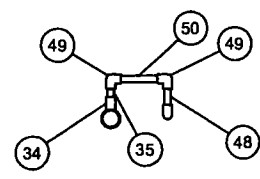
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DESIGN PRESSURE AND TEMP: 150 psi @ 100 F
HYDROTEST: 225 psi @ 70 F
MIN TEMP. 32 F
CORROSION ALLOWANCE: NONE
RADIOGRAPHY: NONE

BYIS MFG. LLC			
Winfield, KS			
GAS PIPING			
BILL OF MATERIAL			
DRAWN	KML	---	DRAWING NO.
CHECKED		---	
APPROVED			100410-1-D19A
SCALE			4

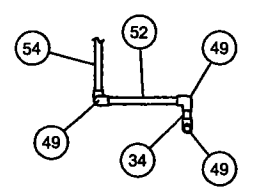
PIPING SECTION 3 PER PI&D



SECTION A-A



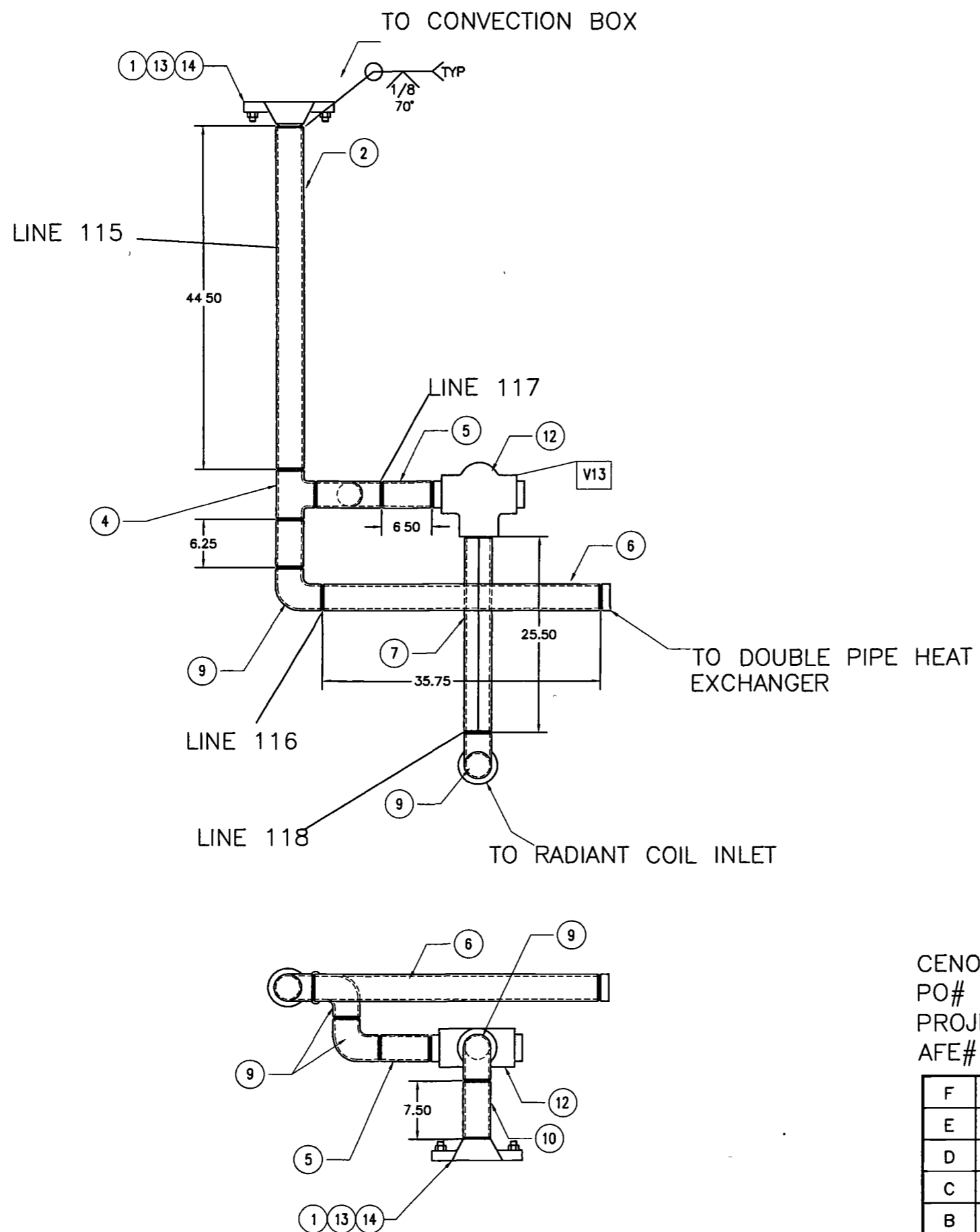
SECTION C PER P&ID



SECT. C-C

NOTE
SEE DWG -D19A FOR BILL OF MATERIAL

BYIS MFG. LLC				
Winfield, KS				
GAS PIPING				
DRAWN	KML	-/-	DRAWING NO	REV
CHECKED		-/-	100410-1-D19	4
APPROVED				
SCALE				



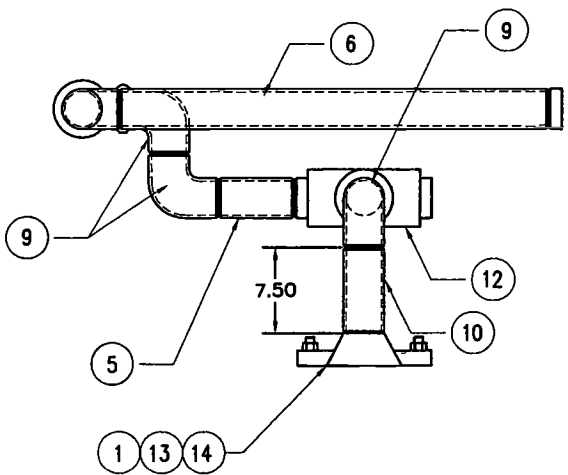
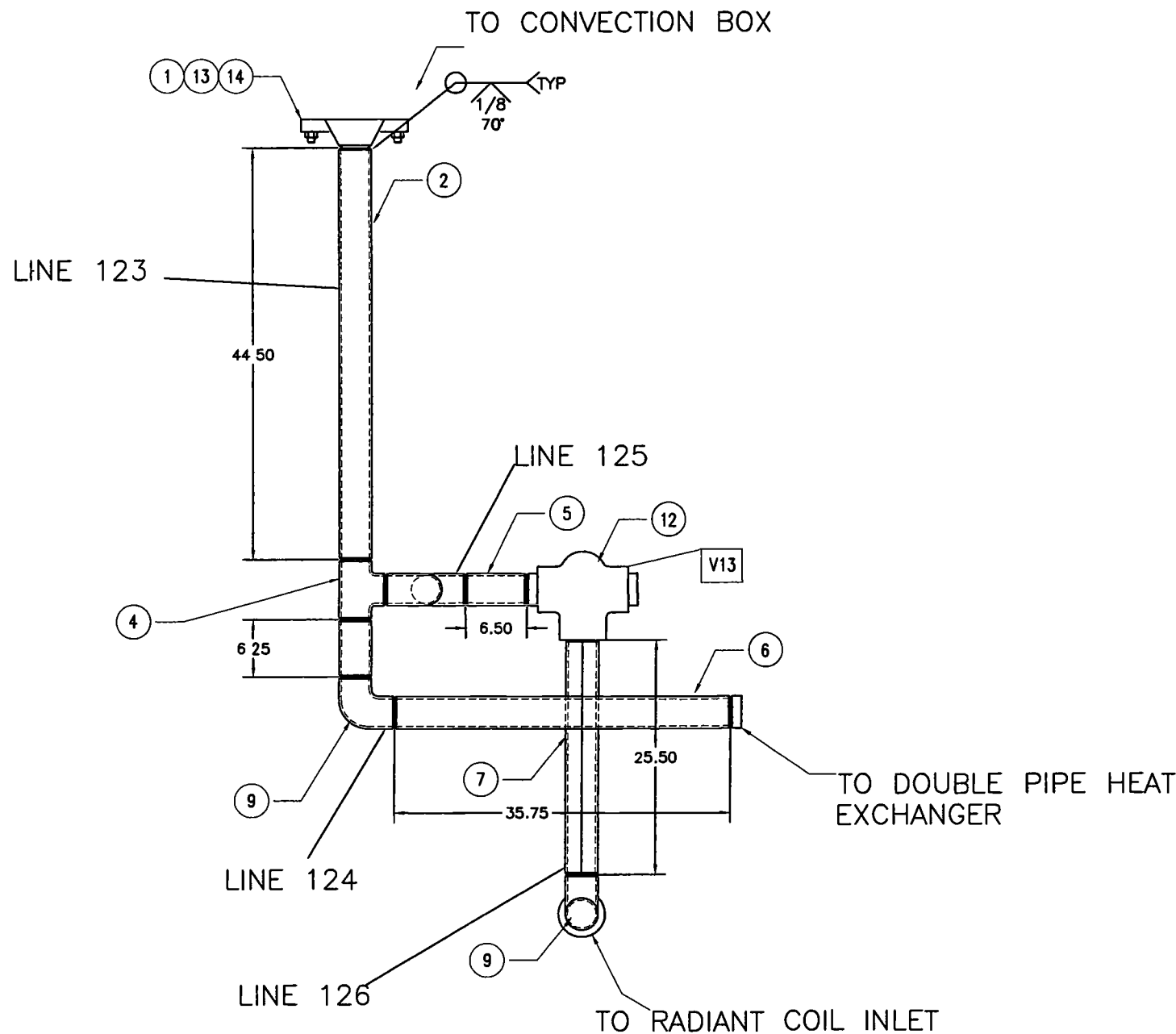
BLUE SKY FITTING INFO
 HUB-SA105 N
 CLAMP-SA182 F22 CLASS 3
 BOLTS-SA193 B7 3/4" X 6"
 NUTS-SA 194 2H
 CRN# OH07107 52

ITEM	PART No.	UOM	QTY	DESCRIPTION
1		----	2	3" BLUE SKY SCH 160 SA-105N
2		----	1	3" PIPE 44 1/2" LG. (SCH. 160) SA106 GR. B
3		----	-	NOT USED
4		----	1	3 X 3 X 3 WELD TEE SCH 160 SA106 GR.B
5		----	1	3" PIPE 6 1/2" LG. (SCH. 160) SA106 GR B
6		----	1	3" PIPE 35 3/4" LG. (SCH. 160) SA106 GR.B
7		----	1	3" PIPE 25 1/2" LG. (SCH. 160) SA106 GR B
8		----	----	NOT USED
9		----	3	3" SR WELD ELL SCH. 160 SA234 WPB
10		----	1	3" PIPE 7 1/2" LG. (SCH. 160) SA106 GR B
11		----	----	NOT USED
12		----	1	2" BY-PASS VALVE EDWARDS ASTM A-105 CRN# 008934.5C BODY A105, BONNET A105, WELL
13			8	3/4" - 10 UNC x 6" BOLT SA-193 B7
14			8	3/4" - 10 UNC NUT SA-194 2H

CODE ASME SECTION I
 2010 EDITION
 MAWP: 2225 PSI
 TEMPERATURE: MDMT -20° F.
 DESIGN TEMPERATURE: 700°F
 OPERATING TEMPERATURE: 646°F
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-A5A
 HEAT TREATMENT- NONE
 HYDROTEST: 3750 PSI PER SECTION I
 WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE: 0625
 RADIOGRAPHY: 10% EXT PIPING

CENOVUS FCCL
 PO# 20980
 PROJECT# 1938
 AFE# 11141196

REV.	DATE	ECN. NO.	CHK.	UNLESS OTHERWISE SPECIFIED	DR.	SMc	BYIS MANUFACTURING, LLC. DOUBLE PIPE EXCHANGER BY PASS LOOP	SCALE NS	DATE 07-31-11	DWG. No. 100-410-1-D45 A
F				1. TOLERANCES						
E				X = ± .06	CK.	WY				
D				XX = ± .03	APP.					
C				.XXX = ± .010						
B				FRACTIONS ± 1/32						
A				ANGLES ± 1/2°						
5				2 REMOVE ALL BURRS & SHARP EDGES						
				3 CORNER RADII .03						
				4 ALL DIMS. IN INCHES						
				5 MACHINE						



BLUE SKY FITTING INFO
 HUB-SA105 N
 CLAMP-SA182 F22 CLASS 3
 BOLTS-SA193 B7 3/4" X 6"
 NUTS-SA 194 2H
 CRN# OH07107.52

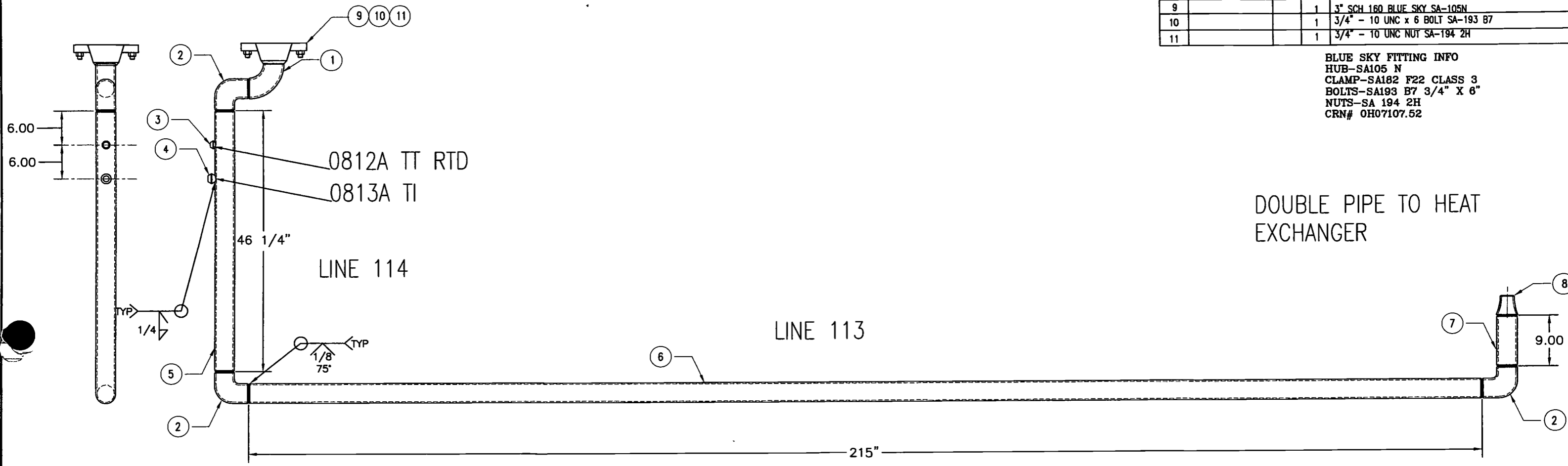
ITEM	PART No.	UOM	QTY	DESCRIPTION
1		---	2	3" BLUE SKY SCH 160 SA-105N
2		---	1	3" PIPE 44 1/2" LG. (SCH. 160) SA106 GR. B
3		---	-	NOT USED
4		---	1	3 X 3 X 3 WELD TEE SCH 160 SA106 GR B
5		---	1	3" PIPE 6 1/2" LG. (SCH. 160) SA106 GR.B
6		---	1	3" PIPE 35 3/4" LG. (SCH. 160) SA106 GR.B
7		---	1	3" PIPE 25 1/2" LG. (SCH. 160) SA106 GR B
8		---	---	NOT USED
9		---	3	3" SR WELD ELL SCH. 160 SA234 WPB
10		---	1	3" PIPE 7 1/2" LG. (SCH. 160) SA106 GR B
11		---	---	NOT USED
12		---	1	2" BY-PASS VALVE EDWARDS ASTM A-105 CRN# DC834.SC BODY A105, BONNET A105, WEL
13			8	3/4" - 10 UNC x 6" BOLT SA-193 B7
14			8	3/4" - 10 UNC NUT SA-194 2H

CODE ASME SECTION I
 2010 EDITION
 MAWP: 2225 PSI
 TEMPERATURE: MDMT -20° F
 DESIGN TEMPERATURE: 700° F
 OPERATING TEMPERATURE: 646° F
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-A5A
 HEAT TREATMENT- NONE
 HYDROTEST: 3750 PSI PER SECTION I
 WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE: .0625
 RADIOGRAPHY: 10% EXT PIPING

CENOVUS FCCL
 PO# 20980
 PROJECT# 1938
 AFE# 11141196

F				UNLESS OTHERWISE SPECIFIED 1. TOLERANCES X = ± .06 XX = ± .03 XXX = ± .010 FRACTIONS ± 1/32 ANGLES ± 1/2" 2. REMOVE ALL BURRS & SHARP EDGES 3. CORNER RADII .03 4. ALL DIMS. IN INCHES 5. MACHINE	DR.	SMc	BYIS MANUFACTURING, LLC. DOUBLE PIPE EXCHANGER BY PASS LOOP		
E					CK.	WY			
D					APP.				
C					SCALE	DATE	07-31-11	DWG. NO	100-410-1-D45 B
B					NS				
A									
REV.	DATE	ECN. NO.	CHK.						
5									

CONVECTION BOX



ITEM	PART No.	UOM	QTY	DESCRIPTION
1		----	1	3" LR 90° WELD ELL (SCH 160) SA234 WPB
2		----	3	3" SR 90° WELD ELL (SCH. 160) SA234 WPB
3	0812A TT RTD	----	1	1/2" THREDOLET 3000# SA105
4	0813A TI	----	1	3/4" THREDOLET 3000# SA105
5		----	1	3" SCH. 160 PIPE 46 1/4" LG. SA106 GR. B
6		----	1	3" SCH. 160 PIPE 215" LG. SA106 GR. B
7		----	1	3" SCH. 160 PIPE 9" LG. SA106 GR B
8		----	1	3" x 2 1/2" SCH 160 REDUCER SA234 WPB
9			1	3" SCH 160 BLUE SKY SA-105N
10			1	3/4" - 10 UNC x 6 BOLT SA-193 B7
11			1	3/4" - 10 UNC NUT SA-194 2H

BLUE SKY FITTING INFO
HUB-SA105 N
CLAMP-SA182 F22 CLASS 3
BOLTS-SA193 B7 3/4" X 6"
NUTS-SA 194 2H
CRN# OH07107.52

DOUBLE PIPE TO HEAT EXCHANGER

CODE ASME SECTION I
2010 ADDITION
MAWP: 2225 PSI
TEMPERATURE: MDMT -20° F.
DESIGN TEMPERATURE: 700°F
OPERATING TEMPERATURE: 646°F
WELDING PROCEDURE Q4-P1-B17
Q4-P1-A5A
HEAT TREATMENT- NONE
HYDROTEST: 3750 PSI PER SECTION I
WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
CORROSION ALLOWANCE: .0625
RADIOGRAPHY: 10% EXT PIPING

CENOVUS FCCL
PO# 20980
PROJECT# 1938
AFE# 11141196

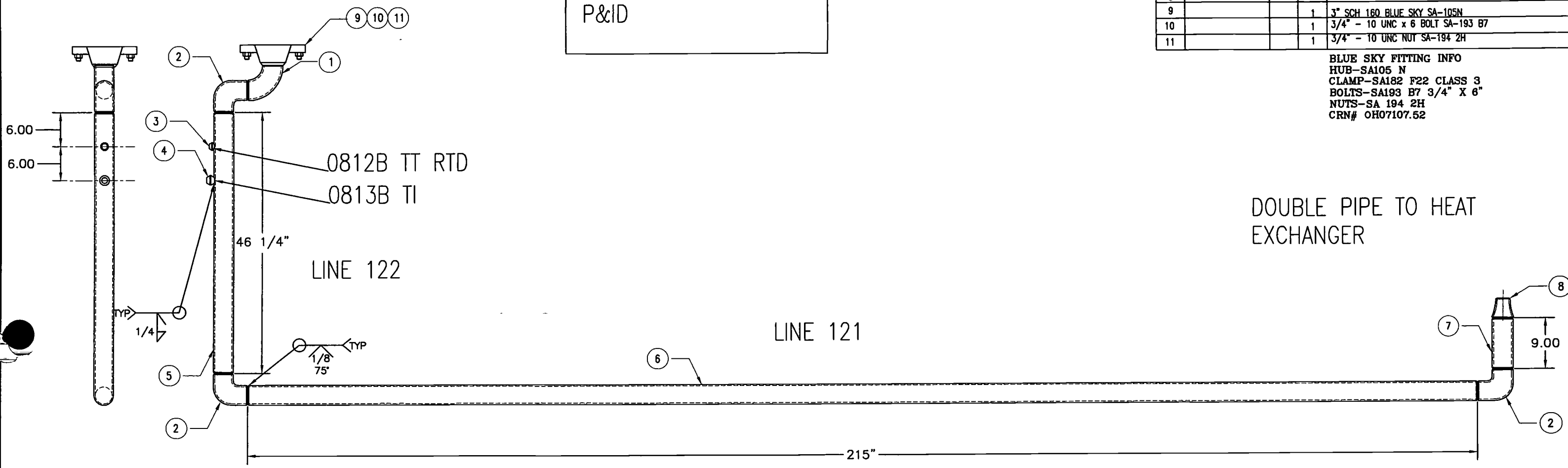
F				UNLESS OTHERWISE SPECIFIED 1. TOLERANCES X = ± .06 XX = ± .03 XXX = ± .010 FRACTIONS ± 1/32 ANGLES ± 1/2° 2. REMOVE ALL BURRS & SHARP EDGES 3. CORNER RADIUS .03 4. ALL DIMS. IN INCHES 5. MACHINE	DR.	SMc	BYIS MANUFACTURING, LLC. CONVECTION BOX INLET PIPING	
E					CK.	WY		
D						APP.		
C						SCALE	DATE	DWG. NO.
B						NS	07-31-11	100-410-1-D48A
REV.	DATE	ECN. NO.	CHK.					
4								

CONVECTION BOX

PIPING SECTION B PER P&ID

ITEM	PART No.	UOM	QTY	DESCRIPTION
1		---	1	3" LR 90° WELD ELL (SCH. 160) SA234 WPB
2		---	3	3" SR 90° WELD ELL (SCH. 160) SA234 WPB
3	0812B TT RTD	---	1	1/2" THREDOLET 3000# SA105
4	0813B TI	---	1	3/4" THREDOLET 3000# SA105
5		---	1	3" SCH. 160 PIPE 46 1/4" LG. SA106 GR. B
6		---	1	3" SCH. 160 PIPE 215" LG. SA106 GR. B
7		---	1	3" SCH. 160 PIPE 9" LG. SA106 GR.B
8		---	1	3" x 2 1/2" SCH 160 REDUCER SA234 WPB
9			1	3" SCH 160 BLUE SKY SA-105N
10			1	3/4" - 10 UNC x 6 BOLT SA-193 B7
11			1	3/4" - 10 UNC NUT SA-194 2H

BLUE SKY FITTING INFO
 HUB-SA105 N
 CLAMP-SA182 F22 CLASS 3
 BOLTS-SA193 B7 3/4" X 6"
 NUTS-SA 194 2H
 CRN# OH07107.52



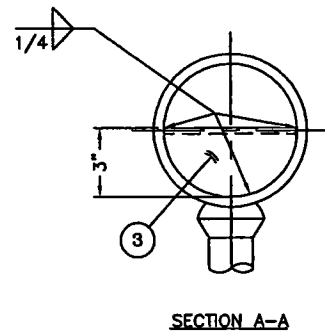
DOUBLE PIPE TO HEAT EXCHANGER

CODE ASME SECTION I
 2010 ADDITION
 MAWP: 2225 PSI
 TEMPERATURE: MDMT -20° F.
 DESIGN TEMPERATURE: 700°F
 OPERATING TEMPERATURE: 646°F
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-A5A
 HEAT TREATMENT- NONE
 HYDROTEST: 3750 PSI PER SECTION I
 WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE: .0625
 RADIOGRAPHY: 10% EXT PIPING

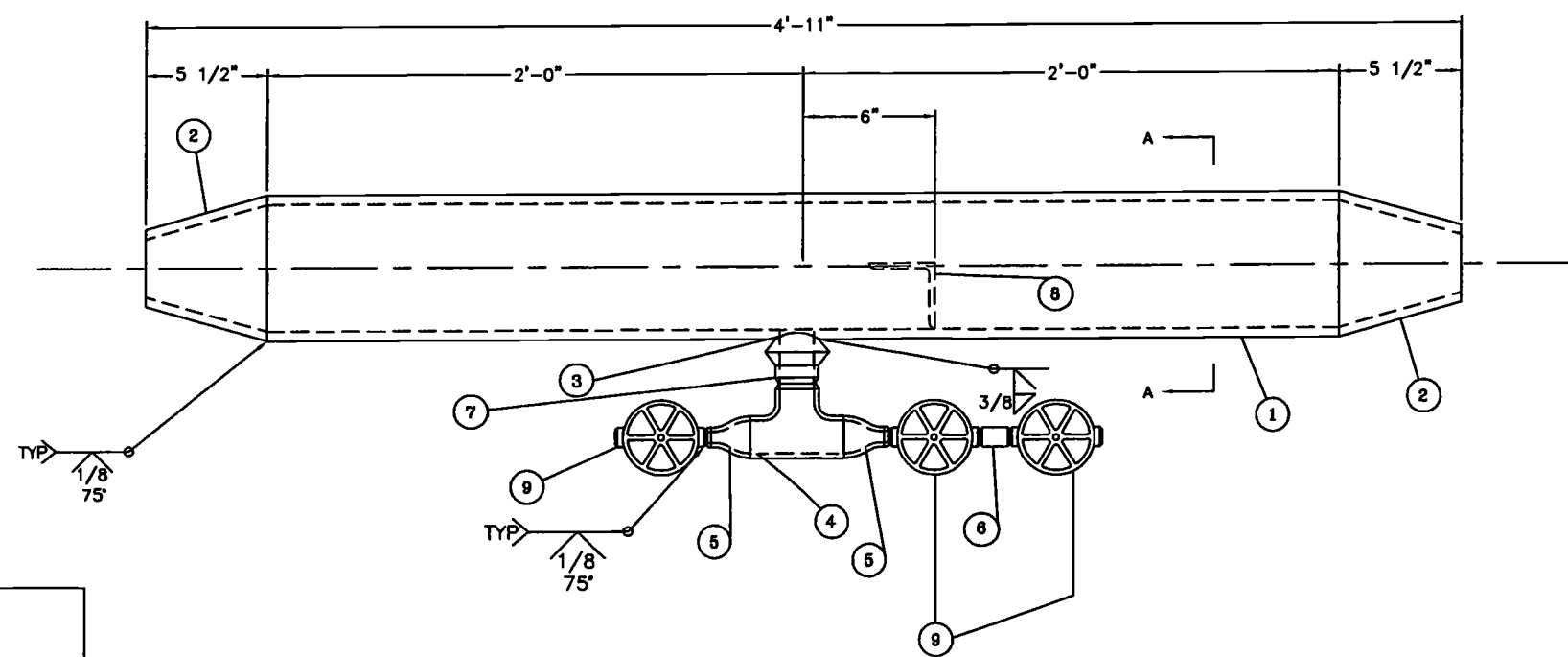
CENOVUS FCCL
 PO# 20980
 PROJECT# 1938
 AFE# 11141196

F				UNLESS OTHERWISE SPECIFIED 1 TOLERANCES X = ± .06 .XX = ± .03 .XXX = ± .010 FRACTIONS ± 1/32 ANGLES ± 1/2" 2. REMOVE ALL BURRS & SHARP EDGES 3. CORNER RADII .03 4. ALL DIMS IN INCHES 5. MACHINE ✓	DR.	SMc	BYIS MANUFACTURING, LLC. CONVECTION BOX INLET PIPING		
E					CK.	WY			
D					APP.				
C					SCALE	DATE	07-31-11	DWG. NO.	100-410-1-D48B
B					NS				
A									
REV.	DATE	ECN. NO.	CHK.						
4									

BILL OF MATERIAL				QTY SHOWN FOR 1 UNIT	
ITEM	QTY.	DESCRIPTION	LENGTH	MATL.	WT (LBS)
1	1	PIPE 6" XXH	4'-0"	SA 106B	---
2	2	CONC. WELD RED 6 x 3 x XXH		SA234 WPB	---
3	1	WELDOLET 6 x 1 1/2 x SCH XXS		SA 105	---
4	1	WELD TEE 1 1/2 SCH 160		SA234 WPB	---
5	2	CONC. WELD RED. 1 1/2 x 1" x SCH 160		SA234 WPB	---
6	2	PIPE 1" SCH 160 x	BxB	SA106B	---
7	1	PIPE 1 1/2" SCH 160 x	BxB	SA106B	---
8	1	ANGLE 3 x 3 x 1/4 x	0'-5 3/4"	A36	---
9	3	1"-1500# GATE VALVE, VOGT CRN# OC0580.92		ASTM A-105	---



LINE 128

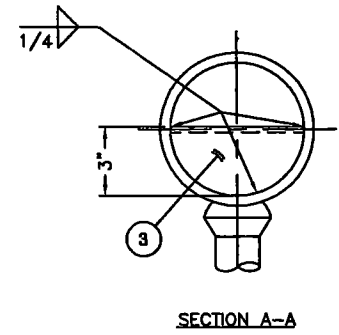


CODE ASME SECTION I
 2010 ADDITION
 MAWP: 2225 PSI
 TEMPERATURE: MDMT -20° F.
 DESIGN TEMPERATURE: 700°F
 OPERATING TEMPERATURE: 646°F
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-A5A
 HEAT TREATMENT- NONE
 HYDROTEST: 3750 PSI PER SECTION I
 WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE: .0625
 RADIOGRAPHY: 10% EXT PIPING

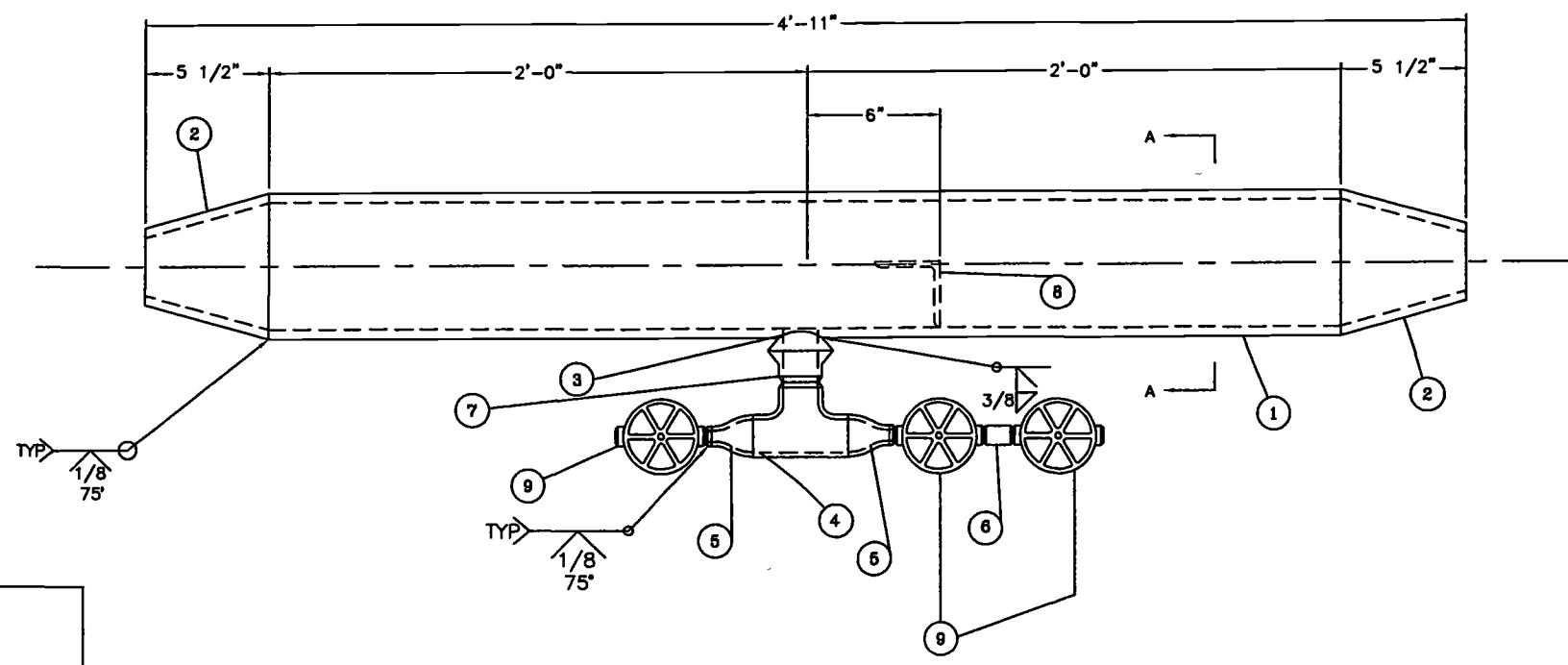
CENOVUS FCCL
 PO# 20980
 PROJECT# 1938
 AFE# 11141196

BYIS MFG. LLC. WINFIELD, KANSAS			
HORIZONTAL SEPERATOR			
DRAWN	-	072111	CAD FILE: 100410-1
CHECKED	-	072111	DRAWING & CONTRACT NO.
APPROVED	-		100410-1-D57A
SCALE	-		4

BILL OF MATERIAL				QTY SHOWN FOR 1 UNIT	
ITEM	QTY.	DESCRIPTION	LENGTH	MATL.	WT (LBS)
1	1	PIPE 6" XXH	4'-0"	SA 106B	---
2	2	CONC. WELD RED. 6 x 3 x XXH		SA234 WPB	---
3	1	WELDOLET 6 x 1 1/2 x SCH XXS		SA 105	---
4	1	WELD TEE 1 1/2 SCH 160		SA234 WPB	---
5	2	CONC WELD RED. 1 1/2 x 1" x SCH 160		SA234 WPB	---
6	2	PIPE 1" SCH 160 x	BxB	SA106B	---
7	1	PIPE 1 1/2" SCH 160 x	BxB	SA106B	---
8	1	ANGLE 3 x 3 x 1/4 x	0'-5 3/4"	A36	---
9	3	1"-1500# GATE VALVE, VOGT CRN# 000580.92		ASTM A-105	---



LINE 133



CODE ASME SECTION I
 2010 ADDITION
 MAWP: 2225 PSI
 TEMPERATURE: MDMT -20° F.
 DESIGN TEMPERATURE: 700°F
 OPERATING TEMPERATURE: 646°F
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-A5A
 HEAT TREATMENT- NONE
 HYDROTEST: 3750 PSI PER SECTION I
 WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE: .0625
 RADIOGRAPHY: 10% EXT PIPING

CENOVUS FCCL
 PO# 20980
 PROJECT# 1938
 AFE# 11141196

BYIS MFG. LLC.			
WINFIELD, KANSAS			
HORIZONTAL SEPERATOR			
DRAWN	-	073111	CAD FILE 100410-1
CHECKED	-	073111	DRAWING & CONTRACT NO.
APPROVED	-		100410-1-D57B
SCALE	-		4

Quality Control Plan							
Date: 7/7/11							
Customer: Cenovus Energy Inc.		Supplier: BYIS MFG LLC		JOB NO. 100410		EQUIPMENT: 73MM BTU/HR Steam Gen	
PROJECT# 1938-CLEAR WATER LAKE							
CUSTOMER PO: 20980		ISSUE: #1					
INSPECTION REQ. R=REVIEW, H=HOLD, I= INSPECT, W=WITNESS, AU=AUDIT, O=OBSERV							
ITEM NO.	INSP. ATTRIBUTE	PROCEDURE	DEFECT ACCEPT LEVEL	VERIFY DOCUMENTS	BYIS	Customer	Notes
1	Pre-inspect meet				H	H	7/7/2011
Engineering							
2	Drwg Approval	Spec's PNZ	As-Sold & Spec Proposal		R	R	REVIEW 7/18/11
3	Suppliers QAQC Proced	Per Manual	ASME	ASME		<i>20</i>	<i>7/18/11</i>
Fabrication Procedure/Qualifications							
4	Weld Procedure	Q4-P1-B17	ASME Section IX	Return Transmittal	W	R	REVIEW 7/20/11 (IN DATA BOOK)
5	Welder Qualifaction	ASME Sect X	ASME Section IX	Weld Proc & Quality	W	R	REVIEW 7/20/11 (IN DATA BOOK)
6	Pressure Testing	Hydrostatic	ASME Sect 1 Div 1	Code Data Report-Test Cert	W	W	RADIANT & CONV 10/17, STEAM PIPING 11/17
Non Destructive-Exam Procedure							
7	Radiography (RT)	10% ext, 10% Conv	ASME Sect 1 Div 1	Code Data Report	W	R	100% RADIANT 7/18 THRU 10/15 10% CONVECTION 7/18 THRU 10/15 10% EXTERNAL 7/18 THRU 11/15
8	Ultrasonic (UT)	Ultra Sound		Data Sheets	W	R	THICKNESS OF FITTINGS 7/26 THRU 9/7
9	Positive Mat'l ID	Mill test reports	ASME/ASTM	Material Certs	R	R	ALL MTR'S INCLUDED IN DATA PKG
Materials							
10	MTR's Weld Consum	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Material Certs	R	R	
11	MTR's Plate, Heads & Forgings, ETC	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Material Certs	R	R	
12	Tensile Strength	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Material Certs	R	R	VERIFIED DURING RECIEVING
13	Yield Strength	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Material Certs	R	R	VERIFIED DURING RECIEVING
14	Elogation	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Material Certs	R	R	VERIFIED DURING RECIEVING
15	Chemical Composition	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Material Certs	R	R	VERIFIED DURING RECIEVING
16	Hardness	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Material Certs			
17	UT of Fittings	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Material Certs	W	R	PERFORMED AS RECEIVED

Refractory/Insulation							
49	Materials		Heater Data Sheets	Heater Data Sheets	W	R	ALL MATERIALS CHECKED BEFORE INSTALLATION
50	Installation Procedure	Manuf standard	BYIS Drawings	Inspection Dwg/reports	R	R	WITNESSED MIXING, AND POURING
51	Personnel Qualifications						
52							
53							
54	Thickness	Vis/Dim	minus 1/4" + 1/2"	Inspection reports	I	O	ALL ACCEPTED DURING VIS/DIM CHECK
55	Curing	Manuf standard	Manuf standard	Manuf standard			CURING ACCEPTED PER MANF STANDARDS
56	Visual for Cracking	Vis/Dim	>1/8" wide, 50% deep	Inspection reports	W	R	NO CRACKS FOUND OUTSIDE OF TOLERANCE
Manufacturers Data -Final Review							
57	AI Signed Code Reports	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Code Data Report	W	R	
58	MTR's/Material Cert's	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Code Data Report	W	R	
59	NDE Reports	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Code Data Report	W	R	
60	Hydro Cert. of Test	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Code Data Report	W	R	
61	Nameplate (Correct)	ASME Sect 1 Div 1	ASME Sect 1 Div 1	Code Data Report	W	R	
Coatings							
62	Surface Prep(Blast)	SSPC	Specs & Drawings	Inspection Reports	I	AU	
63	Prime Coat (DFT)	Manuf standard	Manuf standard	Inspection Reports	I	AU	
64	Intermedlate Coat(DFT)	Manuf standard	Manuf standard	Inspection Reports	I	AU	
65	Final Coat (DFT)	Manuf standard	Manuf standard	Inspection Reports	I	AU	
66	Coating Records	Manuf standard	Manuf standard	Inspection Reports	I	AU	
Shipping Preparation							
67	Nameplate (attached)	Visual	Customer Requirements	Inspection rep/dwg	I	AU	
68	Internals Installed	Visual	Customer Requirements	Inspection rep/dwg	I	AU	
69	Rust Prevent Applied						
70	Openings/Covered/Plugs	Visual	Customer Requirements	Inspection rep/dwg	I	AU	
71	Dessicant installed	Visual	Customer Requirements	inspection rep/dwg	I	AU	
72	Internal Pigging Verified						YES
73	Final markings	Visual	Customer Requirements	Inspection rep/dwg	I	AU	
74	Spare Parts Crate/Mark	Visual	Customer Requirements	Inspection rep/dwg	I	AU	
Blower							
75	Dimensional	Visual	Per Drawings	Inspection Drawings	W	W	25 02/04/12
76	Dynamic Balance	Manuf standard	Manuf standard	Vendor Reports	W	W	25 03/04/12

77	Run Test	Manuf standard	Manuf standard	Vendor Reports	R	R	YES
Fuel Train							
78	Dimensional	Vis/Dim	BYIS Drawings	Inspection Drawings	I	R	PER APPROVED DRAWINGS
79	Coating	Manuf standard	Drawings	Inspection Drawings	I	R	ACCEPTED COATING REPORTS IN DATA BOOK
80	Interface Connections	Vis/Dim	Drawings	Inspection Drawings	I	R	
81	Junction Box	Vis/Dim	Drawings	Inspection rep/dwg	I	R	
82	Instruments	Continuity/Wiring	Electrical Schematics	Inspection Reports	I	NA	PER APPROVED DRAWINGS
83	Valves	Valve Stroke	Electrical Schematics	Inspection Reports	I	NA	
84	Pressure/Leak Test	Pressure/Leak Test	Bubble Test	Inspection Reports	W	R	<i>Hy Reviewed Hydrotest RE 6/25/05 03/04/12</i>
Control Panel							
85	Dimensional		Drawings	Wiring Diagram	I	NA	YES
86	Functional Test		Drawings	Inspection Drawings	W	H	YES
87	Dessicant In Panel		Drawings	Inspection Drawings	I	NA	YES
Crating							

BYIS MANUFACTURING

318 CEDAR LANE WINFIELD, KS 67156

Phone 620-221-4603

ORDER NO.
100410-1

CUSTOMER ORDER NO.

ASME SECTION I CODE CALCULATIONS
for
2", 2½", 3", 4" & 6" PIPING

DESIGN CONDITIONS
2500 psig @ 700°F with 0.0625" Corros.

CUSTOMER : CENOVUS FCCL
PLANT LOCATION: PELICAN LAKE
PROJECT NAME/ID NO. ID# 1938
EQUIPMENT ID NO. 100410-1

REV.	DATE	PREPARED BY	REVISION
0	9-Aug-11	dlc	ORIGINAL ISSUE PGS 1 THROUGH 8

BYIS MANUFACTURING

Winfield Ks

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2½" SCH 160 PIPE	4
3" SCH 160 PIPE	5
4" SCH 160 PIPE	6
6" XX-STG PIPE	7
HYDROTEST PRESSURE	8

DESIGN CONDITIONS:

CODE:	ASME SECTION I
DESIGN PRESSURE:	2500 PSIG
DESIGN TEMPERATURE:	700°F
CORROSION ALLOW:	0.0625"
MATERIAL:	SA-106-B

100410-1				
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BYIS MANUFACTURING

Winfield Ks

CYLINDRICAL SHELL THICKNESS (INTERNAL PRESSURE)

PIPING, DRUMS & HEADERS

2" SCH 160 SA-106 B PIPE WITH 0.0625" CORROSION ALLOWANCE

Design Pressure	2500 p s i g	ASME Code Section I	
Design Temperature	700 ° F	Edition .	2010 Addenda: ---
Corrosion Allowance	0 0625 inches	E =	1 00
Material:	SMLS SA-106 B	Inside Rad. Corr (R)	N/A inches
Allowable Stress (S):	15,600 p s i	Outside Dia. Corr (D)	2 3750 inches
y =	0 40	C =	0

Per Paragraph PG-27 2 2

(*) Thickness limited to one half inside rad.

(*) $t = (PD / (2SE + 2yP)) + C + c =$ 0.2413 inches
 use T = 0 3010 inches
 USE 2" SCH160 PIPE (2.375" O D. x 0 344" WL)

$P_a = 2SE(T - c) / D - 2y(T - c) =$ 3406 83 Max. Allow. Work Press

MIN WL CHECK: 0 344" - 12½% = 0 301" > MIN. REQ'D TKNS (t) 0.2413"

Where: t = Minimum Required Thickness, inches

T = Actual Thickness, inches

P = Design Pressure, p s i g.

R = Inside Radius Corroded, inches

D = Outside Diameter Corr., inches.

S = Allowable Design Stress at Design Temp , p.s.i.

E = Weld Joint Efficiency or Ligament Efficiency. (See PG-27 4, Note 1)

c = Corrosion Allowance, inches.

C = Minimum Allowance for Threading and Structural Stability, inches. (See PG-27 4, Note 3)

y = Temperature Coefficient (See PG-27 4, Note 6)

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BYIS MANUFACTURING

Winfield Ks

CYLINDRICAL SHELL THICKNESS (INTERNAL PRESSURE)

PIPING, DRUMS & HEADERS

2½"SCH 160 SA-106 B PIPE WITH 0.0625" CORROSION ALLOWANCE

Design Pressure	2500 p s i g.	ASME Code Section I	
Design Temperature	700 ° F	Edition :	2010 Addenda ----
Corrosion Allowance	0.0625 inches	E =	1.00
Material	SMLS SA-106 B	Inside Rad. Corr (R)	N/A inches
Allowable Stress (S).	15,600 p s i	Outside Dia. Corr. (D).	2.8750 inches
y =	0.40	C =	0

Per Paragraph PG-27 2.2

(* Thickness limited to one half inside rad.

$t = (PD / (2SE + 2yP)) + C + c =$ 0.2790 inches
 use T = 0.3281 inches
 USE 2½"SCH160 PIPE (2.875"O D x 0.375"WL)

$P_a = 2SE(T - c) / D - 2y(T - c) =$ 3112.36 Max Allow. Work. Press

MIN WL CHECK: 0.375" - 12½% = 0.3281" > MIN. REQ'D TKNS (t) 0.2790"

Where t = Minimum Required Thickness, inches

T = Actual Thickness, inches.

P = Design Pressure, p.s.i.g.

R = Inside Radius Corroded, inches

D = Outside Diameter Corr., inches.

S = Allowable Design Stress at Design Temp , p s i.

E = Weld Joint Efficiency or Ligament Efficiency. (See PG-27 4, Note 1)

c = Corrosion Allowance, inches

C = Minimum Allowance for Threading and Structural Stability, inches. (See PG-27 4, Note 3)

y = Temperature Coefficient (See PG-27 4, Note 6)

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BYIS MANUFACTURING

Winfield Ks

CYLINDRICAL SHELL THICKNESS (INTERNAL PRESSURE)

PIPING, DRUMS & HEADERS

3"SCH 160 SA-106 B PIPE WITH 0 0625"CORROSION ALLOWANCE

Design Pressure:	2500 p.s.i.g.	ASME Code Section I	
Design Temperature:	700 ° F	Edition :	2010 Addenda: ----
Corrosion Allowance	0 0625 inches	E =	1 00
Material	SMLS SA-106 B	Inside Rad. Corr (R):	N/A inches
Allowable Stress (S):	15,600 p.s.i.	Outside Dia. Corr. (D)	3 5000 inches
y =	0 40	C =	0

Per Paragraph PG-27.2.2

(*) Thickness limited to one half inside rad.

(*) $t = (PD / (2SE + 2yP)) + C + c =$

0.3261 inches

use T = 0.3832 inches

USE 3"SCH160 PIPE (3.5"O.D. x 0.438"WL)

$Pa = 2SE(T - c) / D - 2y(T - c) =$

3084 95 Max. Allow Work. Press.

MIN WL CHECK: $0.438" - 12\frac{1}{2}\% = 0.3832" > \text{MIN. REQ'D TKNS } (t) 0.3261"$

Where: t = Minimum Required Thickness, inches.

T = Actual Thickness, inches.

P = Design Pressure, p.s.i.g.

R = Inside Radius Corroded, inches.

D = Outside Diameter Corr., inches.

S = Allowable Design Stress at Design Temp., p.s.i.

E = Weld Joint Efficiency or Ligament Efficiency. (See PG-27.4, Note 1)

c = Corrosion Allowance, inches.

C = Minimum Allowance for Threading and Structural Stability, inches. (See PG-27.4, Note 3)

y = Temperature Coefficient (See PG-27.4, Note 6)

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BYIS MANUFACTURING

Winfield Ks

CYLINDRICAL SHELL THICKNESS (INTERNAL PRESSURE)

PIPING, DRUMS & HEADERS

4" SCH160 SA-106 B PIPE WITH 0.0625" CORROSION ALLOWANCE

Design Pressure:	2500 p.s.i.g.	ASME Code Section I	
Design Temperature:	700 ° F.	Edition :	2010 Addenda: ---
Corrosion Allowance:	0.0625 inches	E =	1.00
Material:	SMLS SA-106 B	Inside Rad. Corr. (R)	N/A inches
Allowable Stress (S):	15,600 p.s.i.	Outside Dia. Corr. (D)	4.5000 inches
y =	0.40	C =	0

Per Paragraph PG-27.2.2

(*) Thickness limited to one half inside rad.

$$(*) t = (PD / (2SE + 2yP)) + C + c =$$

$$\text{use } T = \begin{matrix} 0.4014 \text{ inches} \\ 0.4646 \text{ inches} \end{matrix}$$

USE 4" SCH160 PIPE (4 5" O.D. x 0.531" WL)

$$Pa = 2SE(T - c) / D - 2y(T - c) =$$

3002.53 Max. Allow. Work Press

MIN. WALL CHECK = $0.531 - 12\frac{1}{2}\%$ = 0.4646 > REQ'D MIN. TKNS (t) 0.4014"

Where: t = Minimum Required Thickness, inches.

T = Actual Thickness, inches.

P = Design Pressure, p.s.i.g.

R = Inside Radius Corroded, inches.

D = Outside Diameter Corr, inches.

S = Allowable Design Stress at Design Temp., p.s.i.

E = Weld Joint Efficiency or Ligament Efficiency. (See PG-27.4, Note 1)

c = Corrosion Allowance, inches.

C = Minimum Allowance for Threading and Structural Stability, inches. (See PG-27.4, Note 3)

y = Temperature Coefficient (See PG-27.4, Note 6)

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BYIS MANUFACTURING

Winfield Ks

CYLINDRICAL SHELL THICKNESS (INTERNAL PRESSURE)

PIPING, DRUMS & HEADERS

6" XX-STG SA 335 P11 PIPE WITH 0.0625" CORROSION ALLOWANCE

Design Pressure.	2500 p.s.i.g.	ASME Code Section I
Design Temperature	700 ° F	Edition : 2010 Addenda: ---
Corrosion Allowance.	0.0625 inches	E = 1.00
Material:	SMLS SA-335 P11	Inside Rad. Corr. (R): N/A inches
Allowable Stress (S):	15,100 p.s.i.	Outside Dia. Corr. (D): 6.6250 inches
y =	0.40	C = 0

Per Paragraph PG-27.2.2

(*) Thickness limited to one half inside rad.

(*) $t = (PD / (2SE + 2yP)) + C + c = 0.5769$ inches
 use $T = 0.864$ inches
 USE 6" XX-STG PIPE (6.625" O.D. x 0.864" WL)

$P_a = 2SE(T - c) / D - 2y(T - c) = 3564.50$ Max Allow. Work. Press

MIN. WALL CHECK = $0.864 - 12\frac{1}{2}\% = 0.756"$ > MIN REQ'D (t) 0.5614"

Where: t = Minimum Required Thickness, inches.

T = Actual Thickness, inches.

P = Design Pressure, p.s.i.g.

R = Inside Radius Corroded, inches.

D = Outside Diameter Corroded, inches.

S = Allowable Design Stress at Design Temp., p.s.i.

E = Weld Joint Efficiency or Ligament Efficiency. (See PG-27.4, Note 1)

c = Corrosion Allowance, inches.

C = Minimum Allowance for Threading and Structural Stability, inches. (See PG-27.4, Note 3)

y = Temperature Coefficient (See PG-27.4, Note 6)

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BYIS MANUFACTURING

Winfield Ks

HYDROTEST PRESSURE

Per ASME Code Section I Para PG-99.1

$$H = 1.5 \times P = 1.5 \times 2500 = 3750 \text{ PSIG}$$

Where P= Design Pressure, psig

H= Hydrotest pressure, psig

100410-1				
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100715
(0047-

BYIS MANUFACTURING

318 CEDAR LANE WINFIELD, KS 67156

Phone 620-221-4603

ORDER NO.

CUSTOMER ORDER NO.

ASME B31.1 CODE CALCULATIONS

for

2", 1¼", ¾" & ½" PIPING

DESIGN CONDITIONS

150 psig @ 90°F with 0.03" Corros.

CUSTOMER

PLANT LOCATION:

PROJECT NAME/ID NO.

EQUIPMENT ID NO.

REV.	DATE	PREPARED BY	REVISION
0	20-Jun-12	DLCarlson	ORIGINAL ISSUE PGS 1 THROUGH 8

BYIS MANUFACTURING

SA-106-B PIPING @ 150 PSI, 90°F & 0.03" CORROSION

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½" SCH 40 PIPE	6
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OPENINGS NOT REQUIRING REINFORCEMENT	

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STRAIGHT PIPE UNDER INTERNAL PRESSURE

2"SCH 40 PIPE W/ 0 03" CORROSION

Design Pressure	150 p s i g	ASME Code B31 1b-2009	
Design Temperature	90 ° F		
c	0 0300 inches	E =	1 00
Material	SA-106 GR B	Inside Dia. Uncorr (d).	n/a inches
Allowable Stress (S)	20,000 p s i	Outside Dia Corr (D)	2 3750 inches
y =	0 40		

Per Paragraph 304 1 2

(*) Thickness limited to D/6

(*) $t = (PD / 2 (SE + yP)) + c =$ 0 0389 inches

use T = 0.1540 inches

2"SCH40 (2 375"O D x0 154"WL)

MIN WL CK = 0 154" -12½% - 0 03" = 0 1047" > REQ'D t = 0.0389"

Where t = Minimum Required Thickness, inches

T = Actual Thickness, inches

P = Design Pressure, p s i g

D = Outside Diameter Corr , inches

E = Weld Joint Efficiency

SE = Allowable Design Stress at Design Temp., p s i

A = The Sum of the Mechanical Allowances (Thread or Groove Depth) plus

Corrosion and/or erosion per 104 1 2 (A6), Inches

y = Temperature Coefficient = 0.4 for all materials below 900°F (See Table 104 1 2(A))

	6/20/2012 DLC		3	0
ORDER NO	DATE - PREPARED BY	DATE - CHECKED BY	PAGE	REV

STRAIGHT PIPE UNDER INTERNAL PRESSURE

1 1/4" SCH 40 PIPE W/ 0.03" CORROSION

Design Pressure	150 p s i g	ASME Code B31 1b-2009	
Design Temperature	90 ° F		
c	0.0300 inches	E =	1.00
Material	SA-106 GR B	Inside Dia Uncorr (d)	n/a inches
Allowable Stress (S)	20,000 p s i	Outside Dia Corr (D)	1.6600 inches
y =	0.40		

Per Paragraph 304.1.2

(*) Thickness limited to D/6

(*) $t = (PD / 2 (SE + yP)) + c =$ 0.0362 inches

use T = 0.0925 inches

1 1/4" SCH 40 (1.66" O D x 0.140" WL)

MIN WL CK = 0.140" - 12 1/2% - 0.03" = 0.0925" > REQ'D t = 0.0362

Where: t = Minimum Required Thickness, inches

T = Actual Thickness, inches

P = Design Pressure, p s i g

D = Outside Diameter Corr, inches

E = Weld Joint Efficiency

SE = Allowable Design Stress at Design Temp, p s i

A = The Sum of the Mechanical Allowances (Thread or Groove Depth) plus

Corrosion and/or erosion per 104.1.2 (A6), inches

y = Temperature Coefficient = 0.4 for all materials below 900°F (See Table 104.1.2(A))

	6/20/2012 DLC		4	0
ORDER NO.	DATE - PREPARED BY	DATE - CHECKED BY	PAGE	REV

STRAIGHT PIPE UNDER INTERNAL PRESSURE

¾"SCH 40 PIPE W/ 0.03" CORROSION

Design Pressure	150 p.s.i.g	ASME Code B31.1b-2009	
Design Temperature	90 °F		
c	0.0300 inches	E =	1.00
Material	SA-106 GR. B	Inside Dia. Uncorr. (d)	n/a inches
Allowable Stress (S):	20,000 p.s.i.	Outside Dia. Corr. (D)	1.0500 inches
y =	0.40		

Per Paragraph 304.1.2

(*) Thickness limited to D/6

(*) $t = (PD / 2 (SE + yP)) + c =$ 0.0339 inches

use T = 0.1130 inches

¾"SCH40 (1.050"O.D x 0.113"W.L.)

MIN WL CK = 0.113" - 12½% - 0.03" = 0.0683" > REQ'D t = 0.0339"

Where: t = Minimum Required Thickness, inches

T = Actual Thickness, inches.

P = Design Pressure, p.s.i.g

D = Outside Diameter Corr., inches

E = Weld Joint Efficiency

SE = Allowable Design Stress at Design Temp., p.s.i.

A = The Sum of the Mechanical Allowances (Thread or Groove Depth) plus

Corrosion and/or erosion per 104.1.2 (A6), inches

y = Temperature Coefficient = 0.4 for all materials below 900°F (See Table 104.1.2(A))

	6/20/2012 DLC		5	0
ORDER NO	DATE - PREPARED BY	DATE - CHECKED BY	PAGE	REV

STRAIGHT PIPE UNDER INTERNAL PRESSURE

½" SCH 40 PIPE W/ 0.03" CORROSION

Design Pressure	150 p s i g	ASME Code B31 1b-2009	
Design Temperature	90 ° F.		
c	0.0300 inches	E =	1.00
Material	SA-106 GR B	Inside Dia. Uncorr (d)	n/a inches
Allowable Stress (S)	20,000 p s i.	Outside Dia Corr (D):	0.8400 inches
y =	0.40		

Per Paragraph 304.1.2

(*) Thickness limited to D/6

(*) $t = (PD / 2 (SE + yP)) + c =$ 0.0331 inches

use T = 0.1130 inches

½" SCH40 (0.840" O D x 0.109" WL.)

MIN WL CK = 0.109" - 12½% - 0.03" = 0.0653" > REQ'D t = 0.0331"

Where t = Minimum Required Thickness, inches

T = Actual Thickness, inches

P = Design Pressure, p s i.g

D = Outside Diameter Corr., inches

E = Weld Joint Efficiency

SE = Allowable Design Stress at Design Temp., p s i

A = The Sum of the Mechanical Allowances (Thread or Groove Depth) plus

Corrosion and/or erosion per 104.1.2 (A6), inches

y = Temperature Coefficient = 0.4 for all materials below 900°F (See Table 104.1.2(A))

	6/20/2012 DLC		6	0
ORDER NO.	DATE - PREPARED BY	DATE - CHECKED BY	PAGE	REV

ULTRASONIC TESTING RESULTS

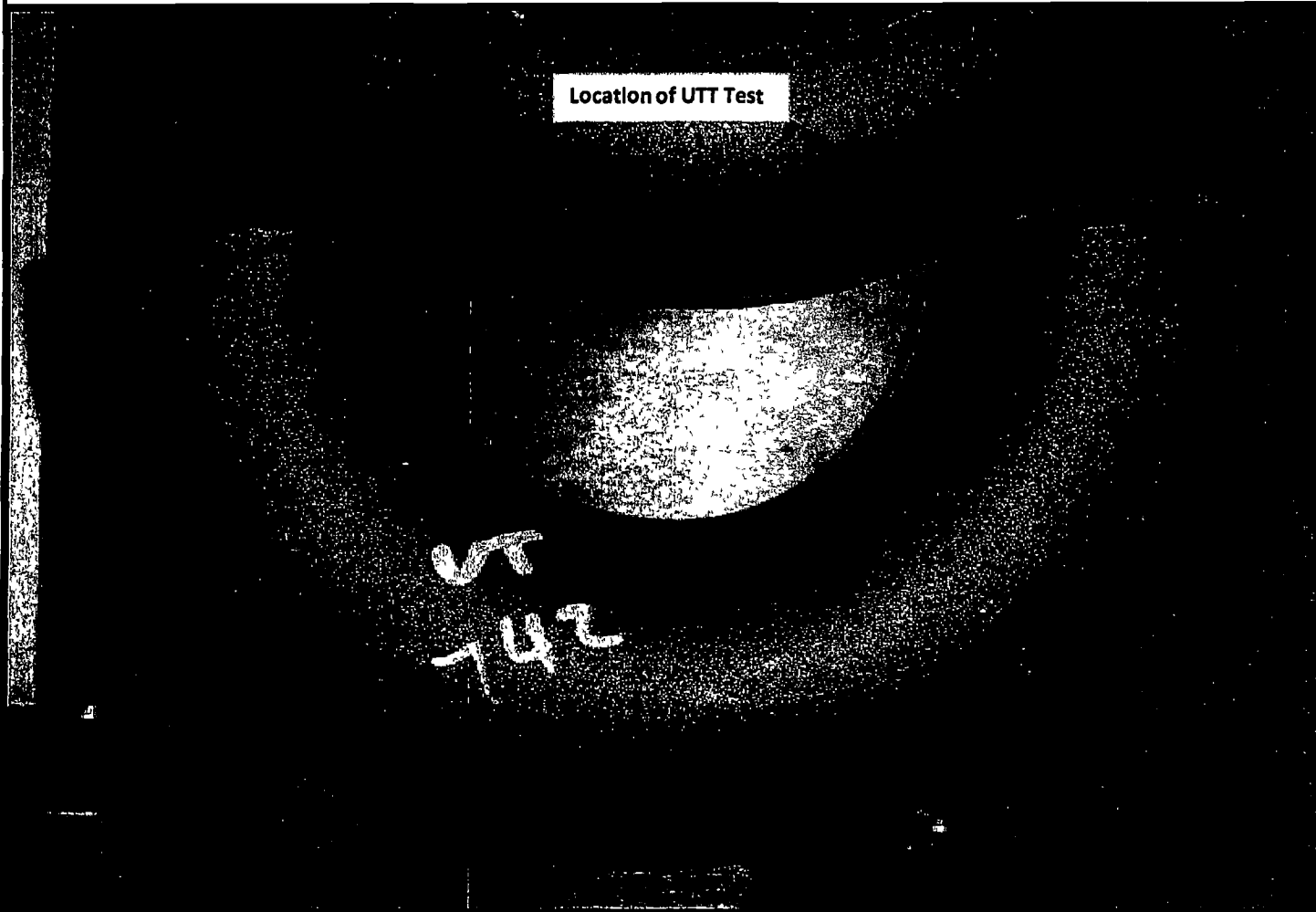
Client: BYIS
Facility: Fab shop area

Technician: Bryan Potter
Date: September 6, 2011

Client PO# _____

TGR Job# _____

Part name: 180 Degree parts; Reducers



NOTES:

714-A	0.474"
714-B	0.450"
715-A	0.451"
715-B	0.438"
716-A	0.444"
716-B	0.482"
717-A	0.453"
717-B	0.461"
718-A	0.479"
718-B	0.441"
719-A	0.460"
719-B	0.457"
720-A	0.469"
720-B	0.454"
721-A	0.482"
721-B	0.451"
722-A	0.480"
722-B	0.452"
723-A	0.453"
723-B	0.441"
724-A	0.447"
724-B	0.461"
725-A	0.479"
725-B	0.448"
726-A	0.443"
726-B	0.446"
727-A	0.443"
727-B	0.465"
728-A	0.458"
728-B	0.443"
729-A	0.490"

ULTRASONIC TESTING RESULTS

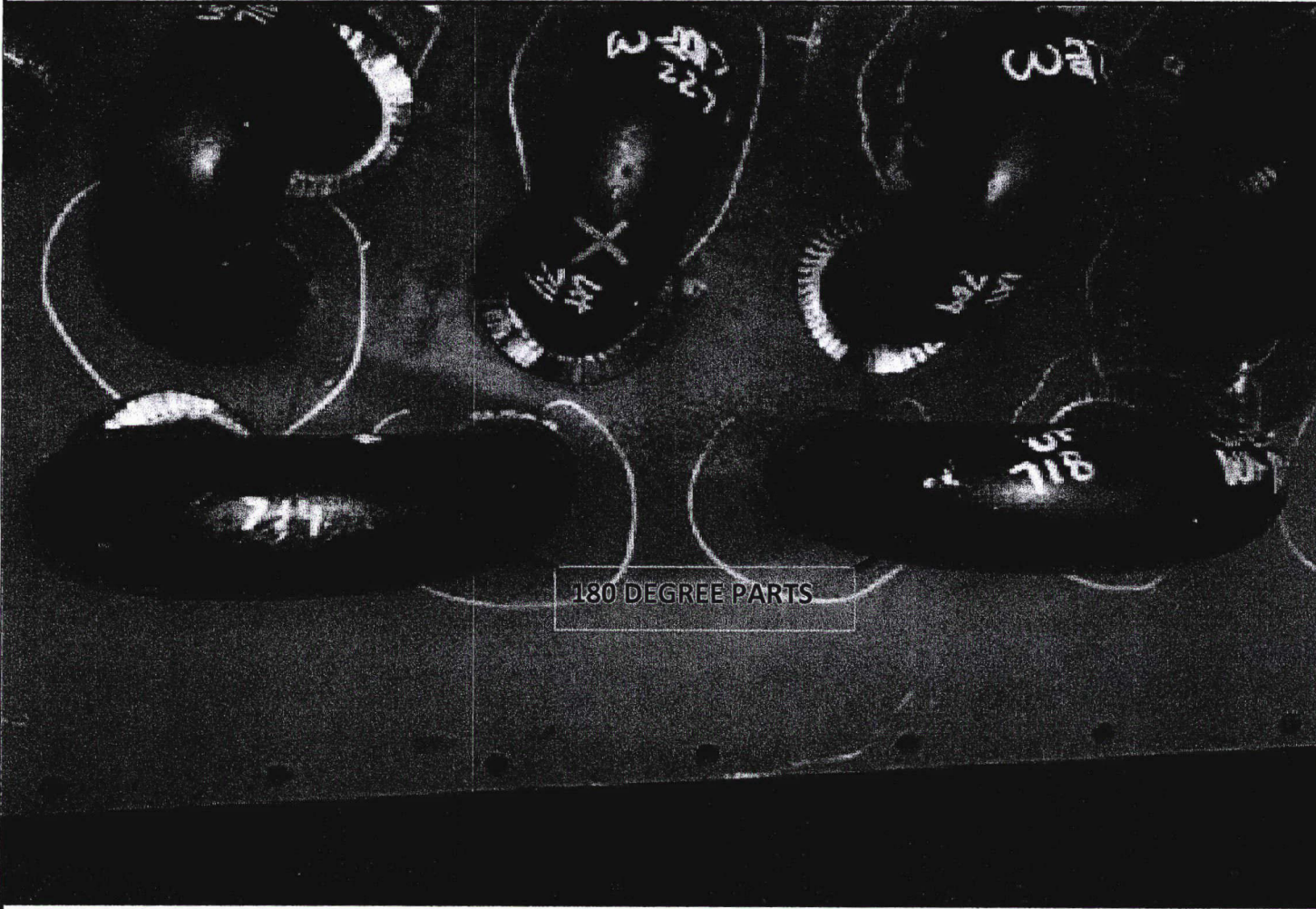
Client: BYIS
Facility: Fab shop area

Technician: Bryan Potter
Date: September 7, 2011

Client PO# _____

TGR Job# _____

Part name: 180 Degree parts; Reducers



730-A	0.490"
730-B	0.485"
731-A	0.498"
731-B	0.496"
732-A	0.483"
732-B	0.473"
733-A	0.451"
733-B	0.475"
734-A	0.476"
734-B	0.465"
735-A	0.473"
735-B	0.482"
736-A	0.474"
736-B	0.484"
737-A	0.473"
737-B	0.473"
738-A	0.476"
738-B	0.478"
739-A	0.476"
739-B	0.462"
740-A	0.486"
740-B	0.488"
741-A	0.439"
741-B	0.465"
742-A	0.449"
742-B	0.449"
743-A	0.479"
743-B	0.459"
744-A	0.482"
744-B	0.476"
745-A	0.466"
745-B	0.459"

ULTRASONIC TESTING RESULTS

Client: BYIS

Technician: Bryan Potter

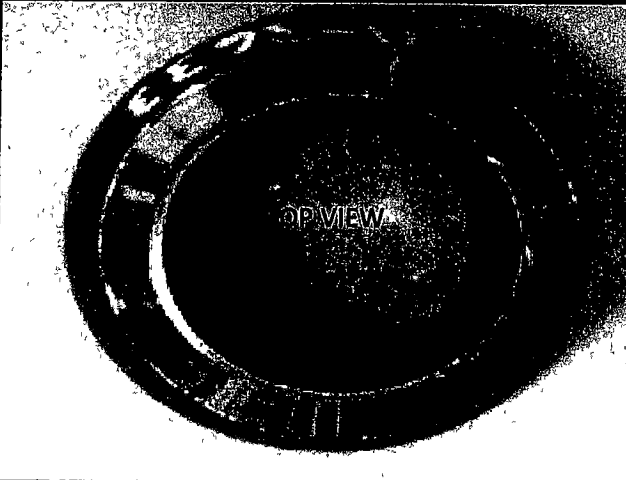
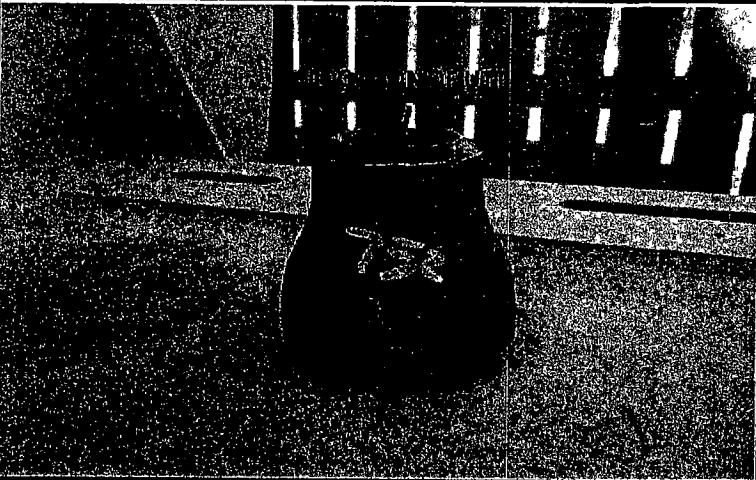
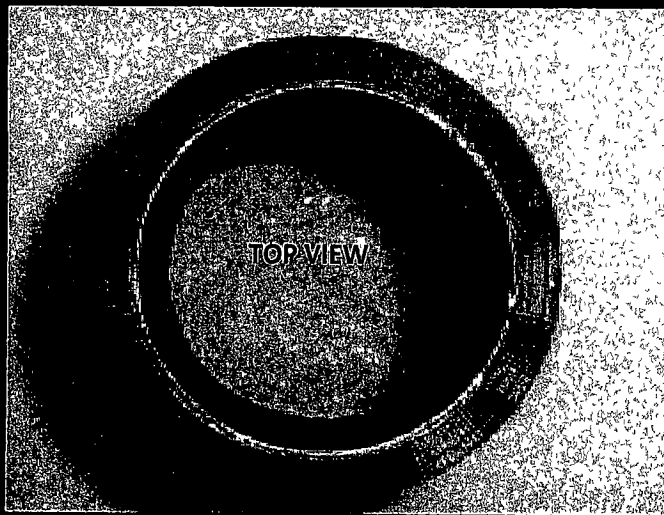
Facility: Fab shop area

Date: September 7, 2011

Client PO# _____

TGR Job# _____

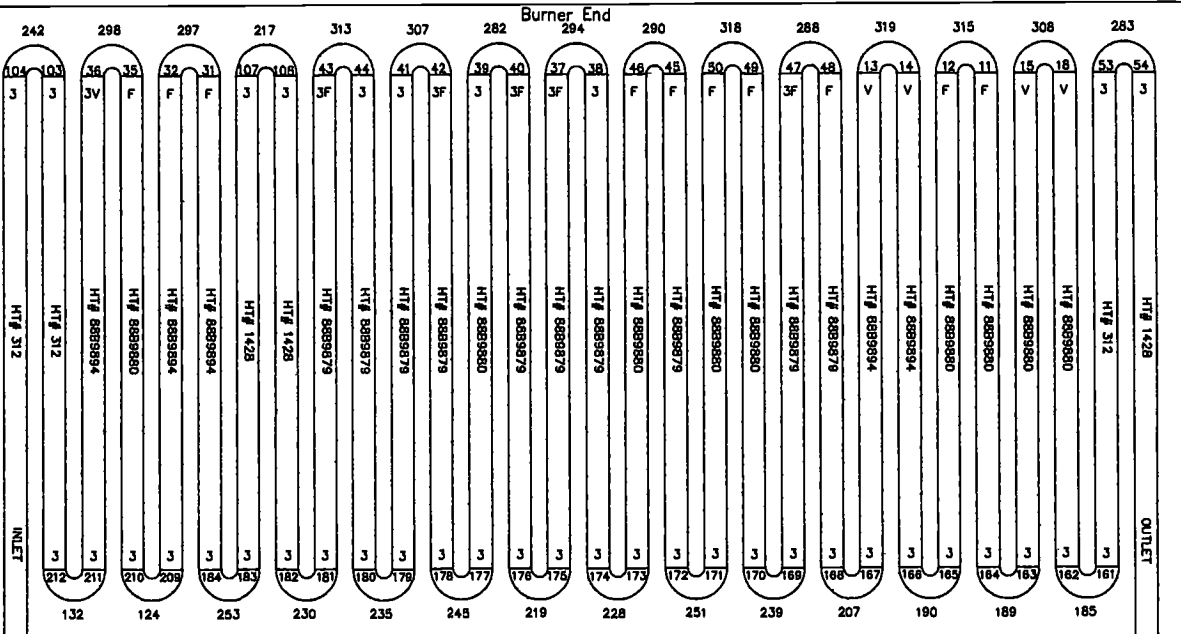
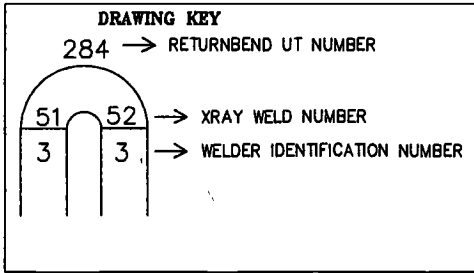
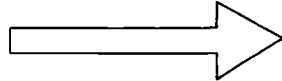
Part name: 180 Degree parts; Reducers



NOTES:

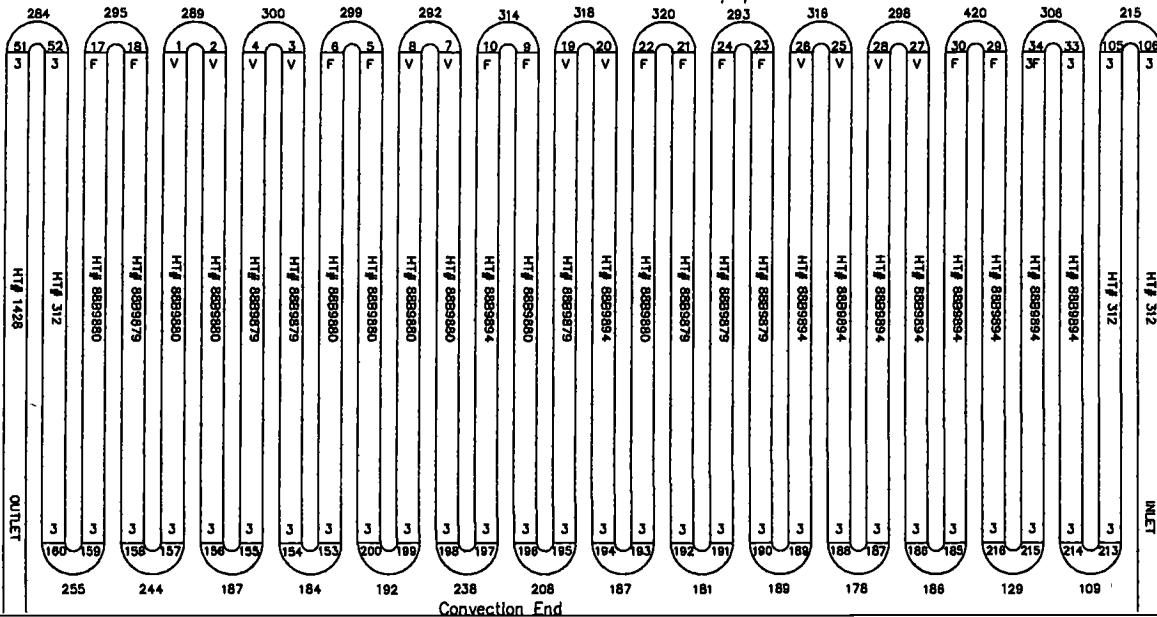
746	0.449"
747	0.491"
748	0.496"
749	0.517"
750	0.467"
751	0.449"
752	0.451"
753	0.451"
754	0.484"
755	0.448"
756	0.466"
757	0.466"
758	0.488"
759	0.487"

RIGHT SIDE F/ CONVECTION END



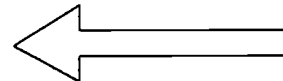
Burner End

Convection End



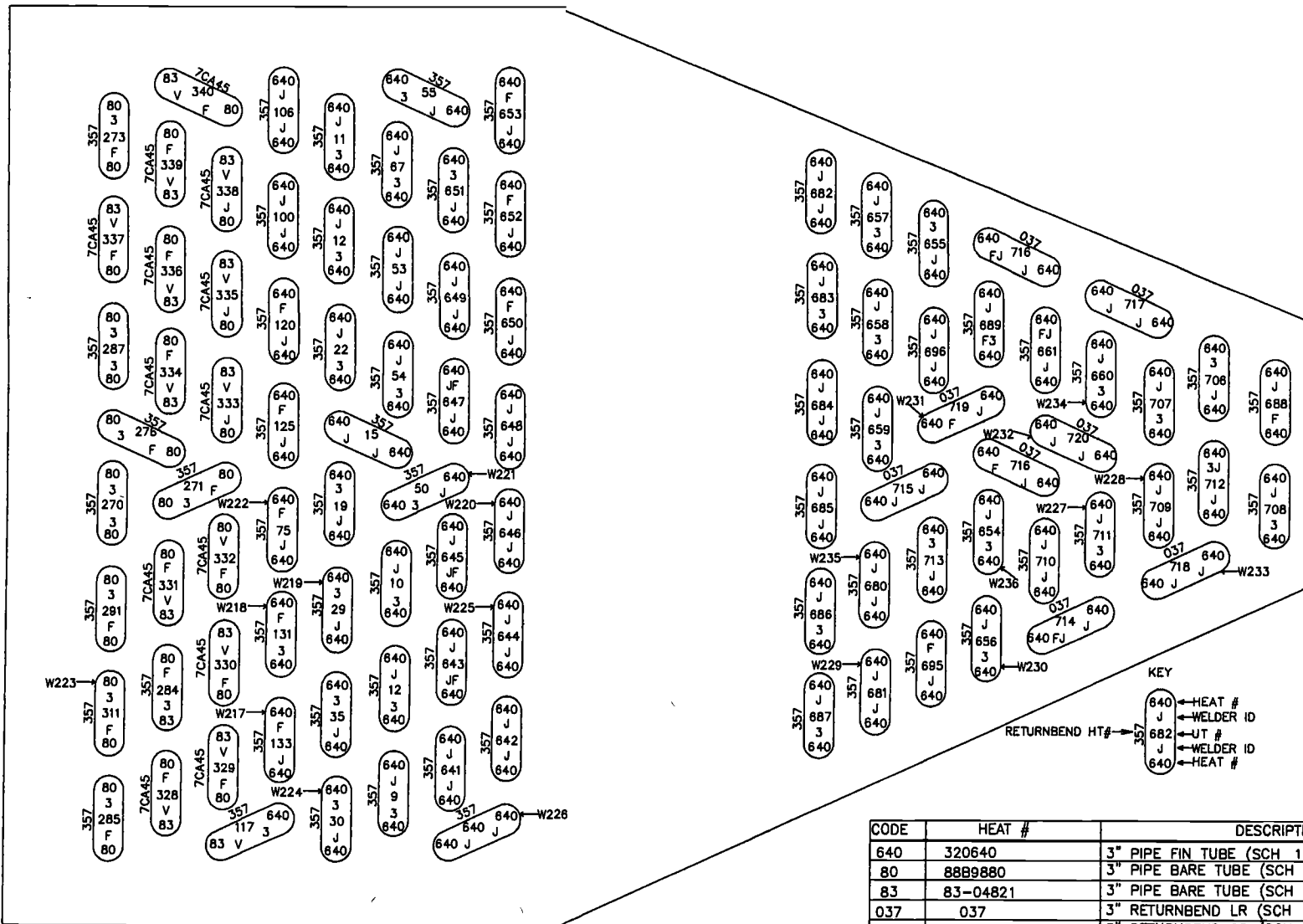
Convection End

LEFT SIDE F/ CONVECTION END



BYIS MFG., LLC	
WINFIELD, KANSAS	
RADIANT COIL WELD MAP	
DRAWN BY	DATE
CHECKED BY	DATE
APPROVED BY	DATE
SCALE	NOTE

CHANGED @ CONVECTION NO.	REV.
100410-1-D4-WELDMAP	



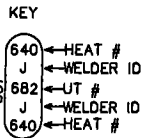
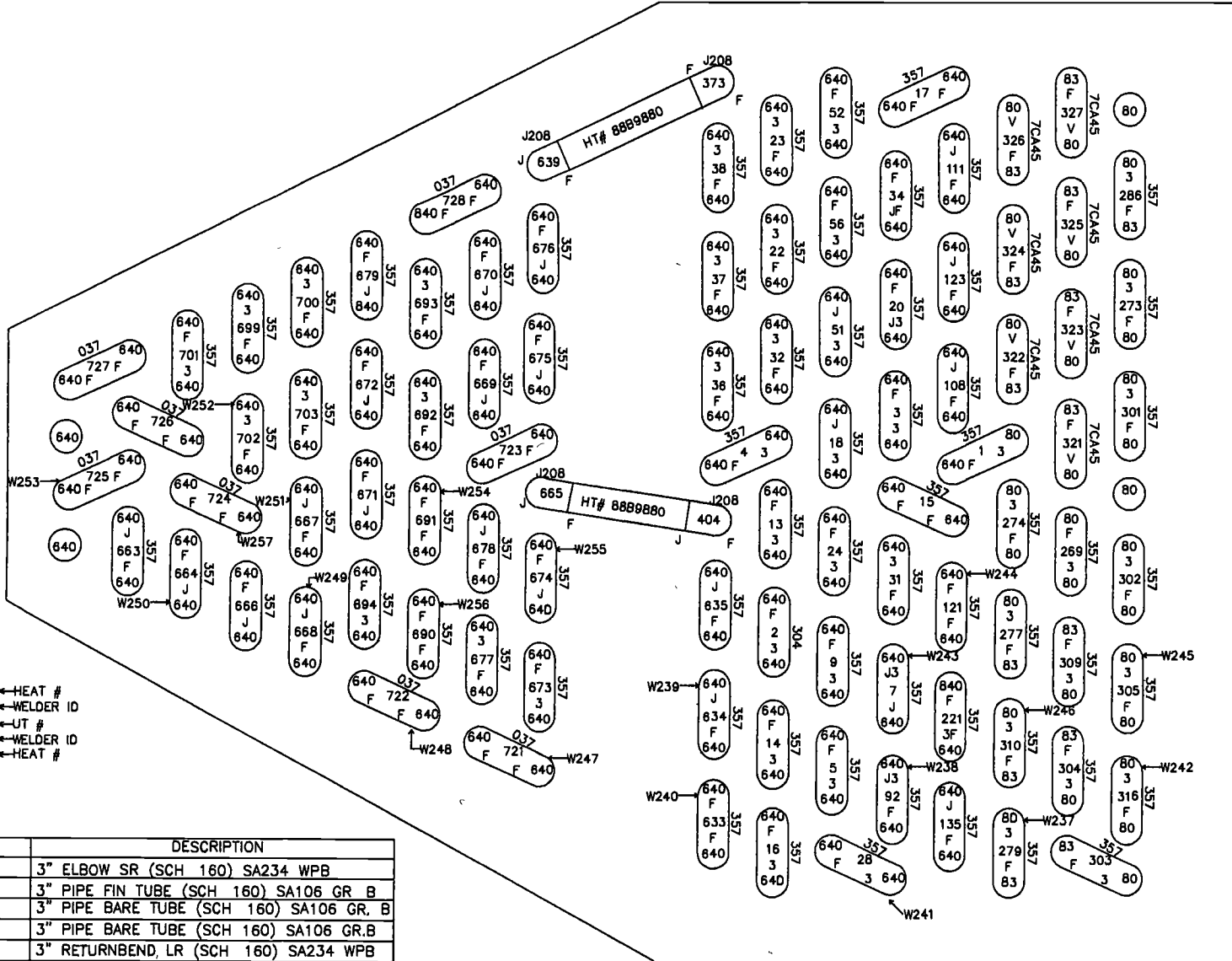
KEY

- 640 ← HEAT #
- J ← WELDER ID
- 882 ← UT #
- J ← WELDER ID
- 640 ← HEAT #

RETURNBEND HT# → 357

CODE	HEAT #	DESCRIPTION
640	320640	3" PIPE FIN TUBE (SCH 160) SA106 GR B
80	8889880	3" PIPE BARE TUBE (SCH 160) SA106 GR B
83	83-04821	3" PIPE BARE TUBE (SCH 160) SA106 GR B
037	037	3" RETURNBEND LR (SCH 160) SA234 WPB
357	357	3" RETURNBEND SR (SCH 160) SA234 WPB
7CA45	7CA45	3" RETURNBEND SR (SCH 160) SA234 WPB

100410-1 Convection Box



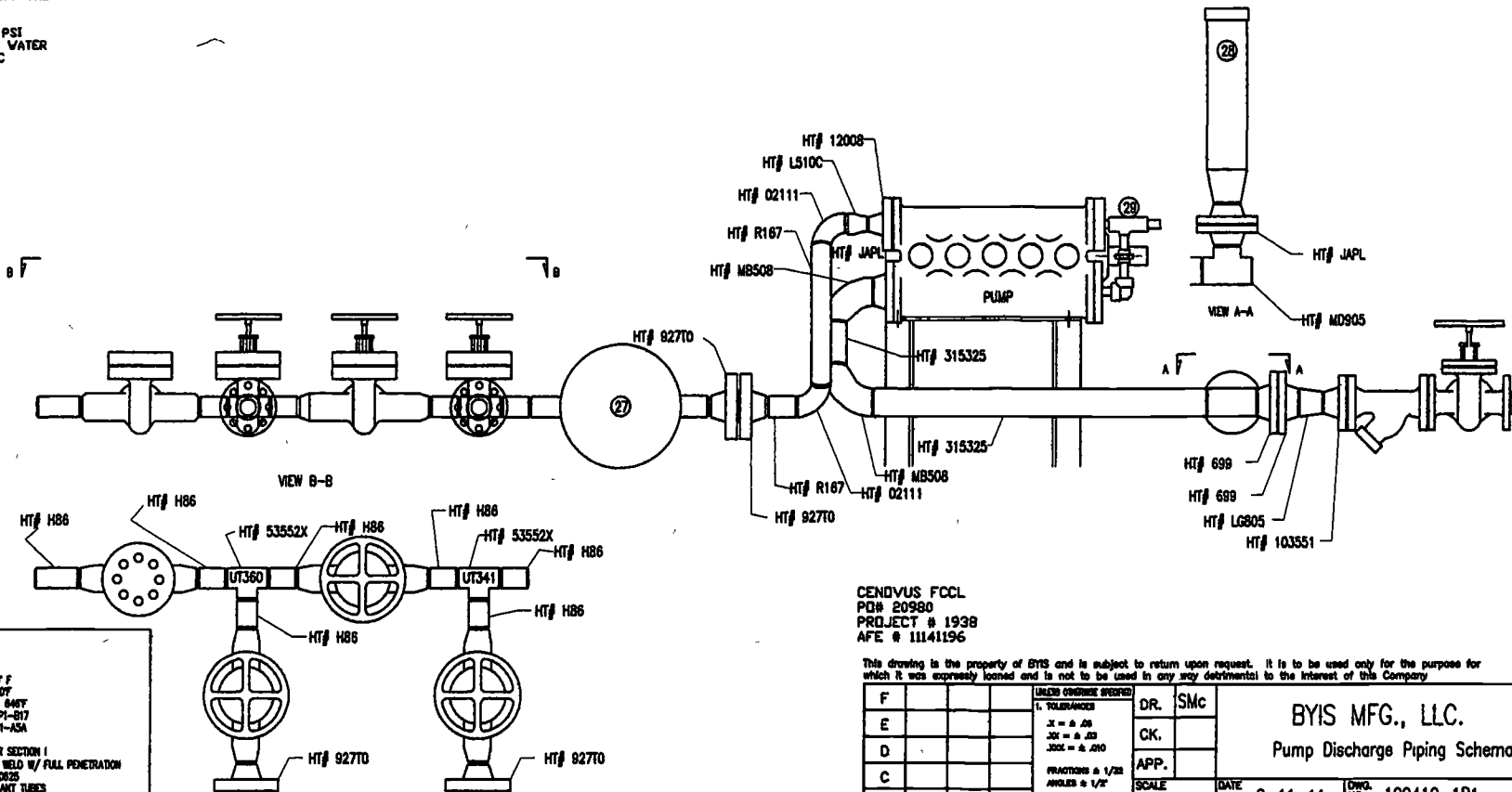
CODE	HEAT #	DESCRIPTION
J208	J208	3" ELBOW SR (SCH 160) SA234 WPB
640	320640	3" PIPE FIN TUBE (SCH 160) SA106 GR B
80	8889880	3" PIPE BARE TUBE (SCH 160) SA106 GR. B
83	83-04821	3" PIPE BARE TUBE (SCH 160) SA106 GR.B
037	037	3" RETURNBEND, LR (SCH 160) SA234 WPB
357	357	3" RETURNBEND SR (SCH 160) SA234 WPB
7CA45	7CA45	3" RETURNBEND SR (SCH 160) SA234 WPB

NOTE: THE DESCRIPTION OF ITEM 27, 28 AND 29 ARE AS FOLLOWS:

27- CORDS TECHNICAL CERAMICS
 MODEL C-2M163-3018-BEV
 SERIAL NUMBER-F1114108A
 MAX. OPER. PRESS.-3000 PSI
 CRN # -L36792

28- CORDS TECHNICAL CERAMICS
 MODEL S7004F
 SERIAL NUMBER-G1114156A
 MAX. OPER. PRESS.-150 PSI
 CRN # -D40971523

29- KUKULE SAFETY VALVE
 MODEL
 SERIAL NUMBER-
 SET PRESS.-2500 PSI
 CAPACITY-89 GPM WATER
 CRN # - D68547.5C

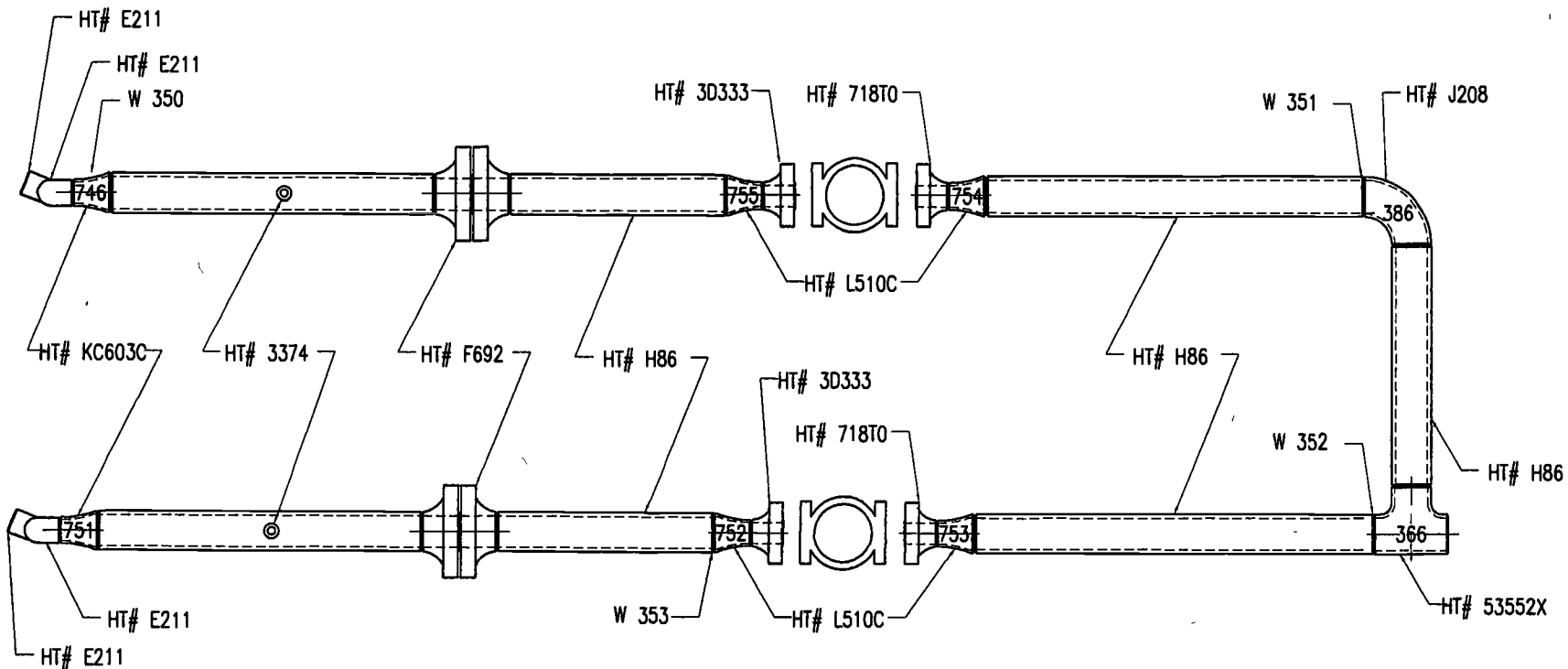


CODE ASME SECTION I
 2010 ADDITION
 MAX: 2500 PSI
 TEMPERATURE: NIGHT -20° F
 DESIGN TEMPERATURE: 700° F
 OPERATING TEMPERATURE: 640° F
 WELDING PROCEDURE: Q4-P1-B17
 Q4-P1-ASA
 HEAT TREATMENT: NONE
 HYDROTEST: 3750 PSI PER SECTION I
 WELDING: SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE: .0625
 RADIOGRAPHIC: 100% RADIANT TUBES
 FOR CONNECTION TUBES,
 USE EXT. PIPING

CENDVUS FCCL
 PDR # 20980
 PROJECT # 1938
 AFE # 11141196

This drawing is the property of BYIS and is subject to return upon request. It is to be used only for the purpose for which it was expressly loaned and is not to be used in any way detrimental to the interest of this Company

F				UNLESS OTHERWISE SPECIFIED: 1. TOLERANCES .125 = ± .05 .125 = ± .03 .125 = ± .010 FRACTIONS & 1/2" ANGLES & 1/2"	DR.	SMC	BYIS MFG., LLC. Pump Discharge Piping Schematic
E					CK.		
D				APP.			
C				SCALE	NS	DATE	8-11-11
B						DRG. NO.	100410-1D1
A				2. REMOVE ALL BURRS & SHARP EDGES 3. CHAMFER HOLES .25 4. ALL GRIND OR FINISH 5. MACHINE ✓			
REV.	DATE	ECN. NO	CHK.				



CODE ASME SECTION I
 2010 ADDITION
 MAWP: 2500 PSI
 TEMPERATURE: NDMT -20° F.
 DESIGN TEMPERATURE: 700F
 OPERATING TEMPERATURE: 646F
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-A5A
 HEAT TREATMENT- NONE
 HYDROTEST: 3750 PSI PER SECTION I
 WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE: .0625
 RADIOGRAPHIC: 100% RADIANT TUBES
 10% CONVECTION TUBES,
 10% EXT PIPING

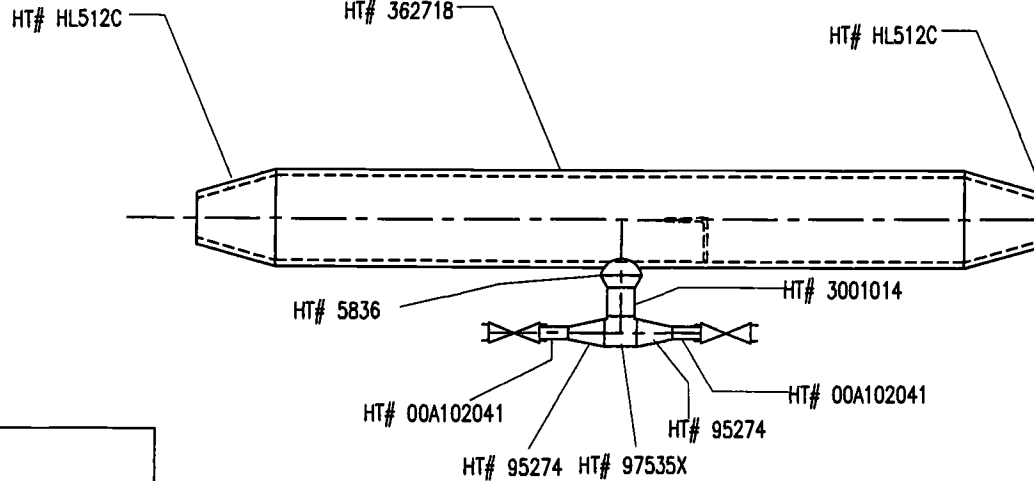
CENOVUS FCCL
 PO# 20980
 PROJECT # 1938
 AFE # 11141196

This drawing is the property of BYIS and is subject to return upon request. It is to be used only for the purpose for which it was expressly loaned and is not to be used in any way detrimental to the interest of this Company.

				UNLESS OTHERWISE SPECIFIED		FEED WATER PIPING SCHEMATIC	
F				1 TOLERANCES	DR.	SG	
E				.1	CK		
D				.1	APP.		
C				FRACTIONS ± 1/32	SCALE	DATE	CHG NO
B				ANGLES ± 1/2°	NS	08-11-11	100410-1-D47
A				2. REMOVE ALL BURRS & SHARP EDGES			
REV	DATE	ECN. NO.	CHK	3. CORNER RADIUS .03			
				4. ALL DIMS. IN INCHES			
				5. MACHINING ✓			

8 7 6 5 4 3 2 1

BILL OF MATERIAL		QTY SHOWN FOR 1 UNIT			
ITEM	QTY	DESCRIPTION	LENGTH	MATL.	WT (LBS)
1	1	PIPE 6" 100#	4'-0"	SA 1088	---
2	2	CONC. WELD RED 6 x 3 x 100#		SA234 WPB	---
3	1	WELDCLET 6 x 1 1/2 x SCH 10S		SA 105	---
4	1	WELD TEL 1 1/2 SCH 180		SA234 WPB	---
5	2	CONC. WELD RED. 1 1/2 x 1" x SCH 180		SA234 WPB	---
6	2	PIPE 1" SCH 180 x	Bx8	SA1088	---
7	1	PIPE 1 1/2" SCH 180 x	Bx8	SA1088	---
8	1	ANGLE 3 x 3 x 1/4 x	0'-8 3/4"	A36	---
9	2	1"-1800# GATE VALVE, VOGT CRN# 00080-02		F.S.	---



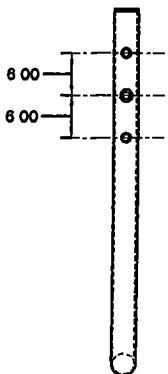
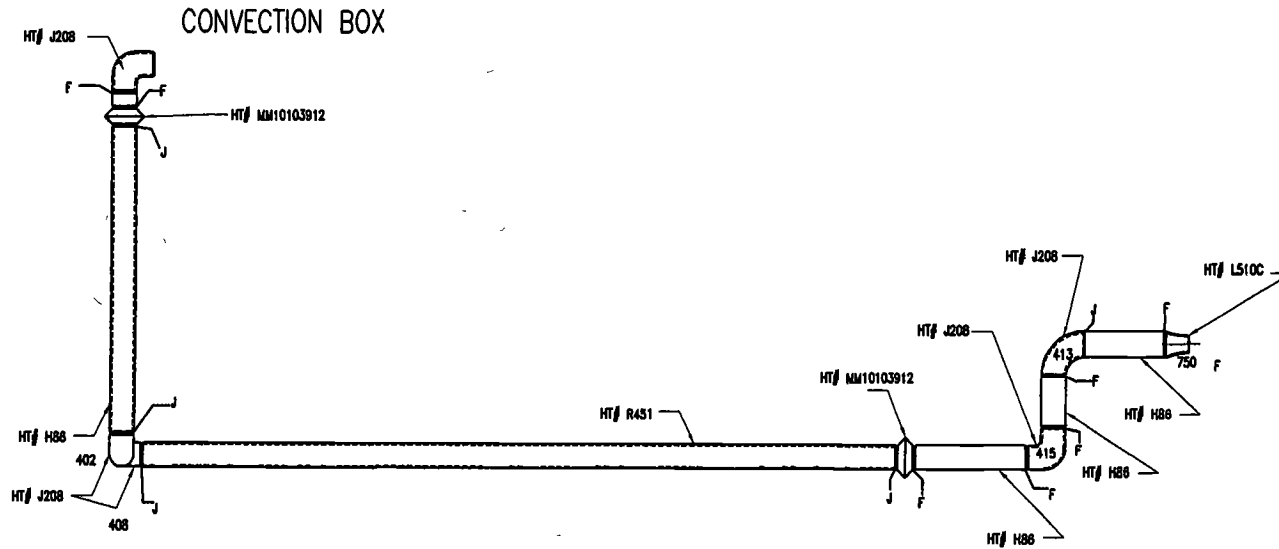
CODE ASME SECTION I
 2010 ADDITION
 MAWP. 2500 PSI
 TEMPERATURE MDMT -20° F
 DESIGN TEMPERATURE: 700° F
 OPERATING TEMPERATURE: 648° F
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-A5A
 HEAT TREATMENT- NONE
 HYDROTEST. 3750 PSI PER SECTION I
 WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE: .0625
 RADIOGRAPHIC. 100% RADIANT TUBES
 10% CONVECTION TUBES,
 10% EXT PIPING

CENOVUS FCCL
 PO# 20980
 PROJECT# 1938
 AFE# 11141198

BYIS MFG. LLC. VINNED, KANSAS			
HORIZONTAL SEPERATOR			
DESIGN	BY	DATE	REV.
CHECKED	BY	DATE	REV.
APPROVED			
SCALE		100-410-1-DS7	

8 7 6 5 4 3 2 1

ITEM	PART No.	UOM	QTY	DESCRIPTION
1			1	3" LR. WT WELD FL (SCH. 160) SA234 WPB
2			3	3" SR. WT WELD FL (SCH. 160) SA234 WPB
3			2	1/2" THREADOLET 3000# SA105
4			1	3/4" THREADOLET 3000# SA105
5			1	3" SCH. 160 PIPE 48 1/4" LG. SA106 GR. B
6			1	3" SCH. 160 PIPE 215" LG. SA106 GR. B
7			1	3" SCH. 160 PIPE 9" LG. SA106 GR.B
8			1	3" x 2 1/2" SCH 160 REDUCER SA234 WPB



CODE ASME SECTION I
 2010 ADDITION
 MAWP. 2500 PSI
 TEMPERATURE. NOMT -20° F.
 DESIGN TEMPERATURE. 700° F
 OPERATING TEMPERATURE: 648° F
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-ASA
 HEAT TREATMENT- NONE
 HYDROTEST. 3750 PSI PER SECTION I
 WELDING SINGLE "Y" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE .0825
 RADIOGRAPHIC: 100% RADIANT TUBES
 10% CONVECTION TUBES,
 10% EXT PIPING

INSIDE PIPE

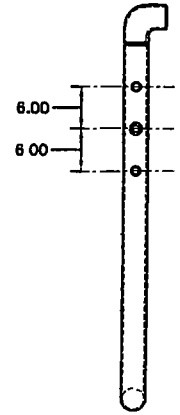
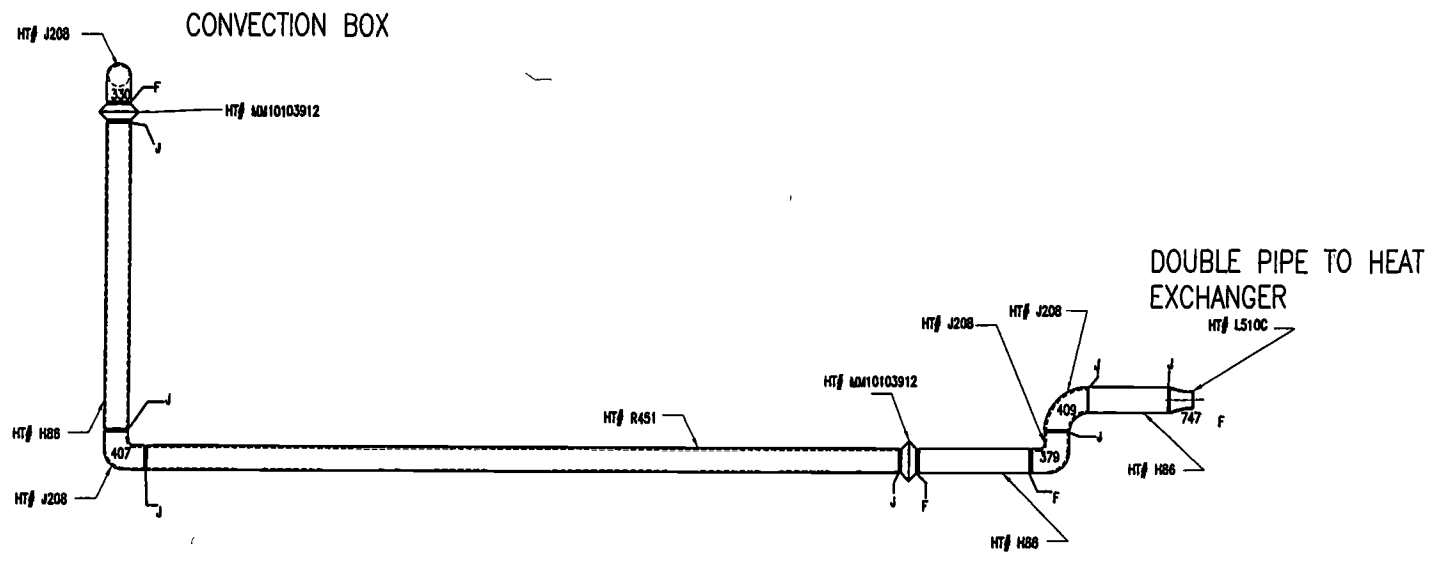
CENOVUS FCCL
 PO# 20980
 PROJECT# 1938
 AFE# 11141196

DOUBLE PIPE TO HEAT EXCHANGER

BYIS MANUFACTURING, LLC.
 CONVECTION BOX INLET PIPING

F				(UNLESS OTHERWISE SPECIFIED)	DR	SMc	BYIS MANUFACTURING, LLC. CONVECTION BOX INLET PIPING	DATE 07-31-11	DWG NO 100-410-1-D48
E				1. TOLERANCES X = ± .08 XX = ± .03 XXX = ± .010	CK	WY			
D				FRACTIONS ± 1/32 ANGLES ± 1/2°	APP				
C					SCALE	NS			
B									
A									
REV	DATE	ECN NO.	CHK	2. REMOVE ALL DIMS @ SHARP EDGES 3. CORNER RADIUS .03 4. ALL DIMS IN INCHES 5. MACHINE					

ITEM	PART No.	UOM	QTY	DESCRIPTION
1			1	3" LR. 90° WELD ELL (SCH. 160) SA334 WPB
2			3	3" SR. 90° WELD ELL (SCH. 160) SA334 WPB
3			2	1/2" THREADED 3000# SA105
4			1	3/4" THREADED 3000# SA105
5			1	3" SCH. 160 PIPE 48 1/2" LG. SA106 GR. B
6			1	3" SCH. 160 PIPE 215" LG. SA106 GR. B
7			1	3" SCH. 160 PIPE 9" LG. SA106 GR. B
8			1	3" x 2 1/2" SCH. 160 REDUCER SA334 WPB



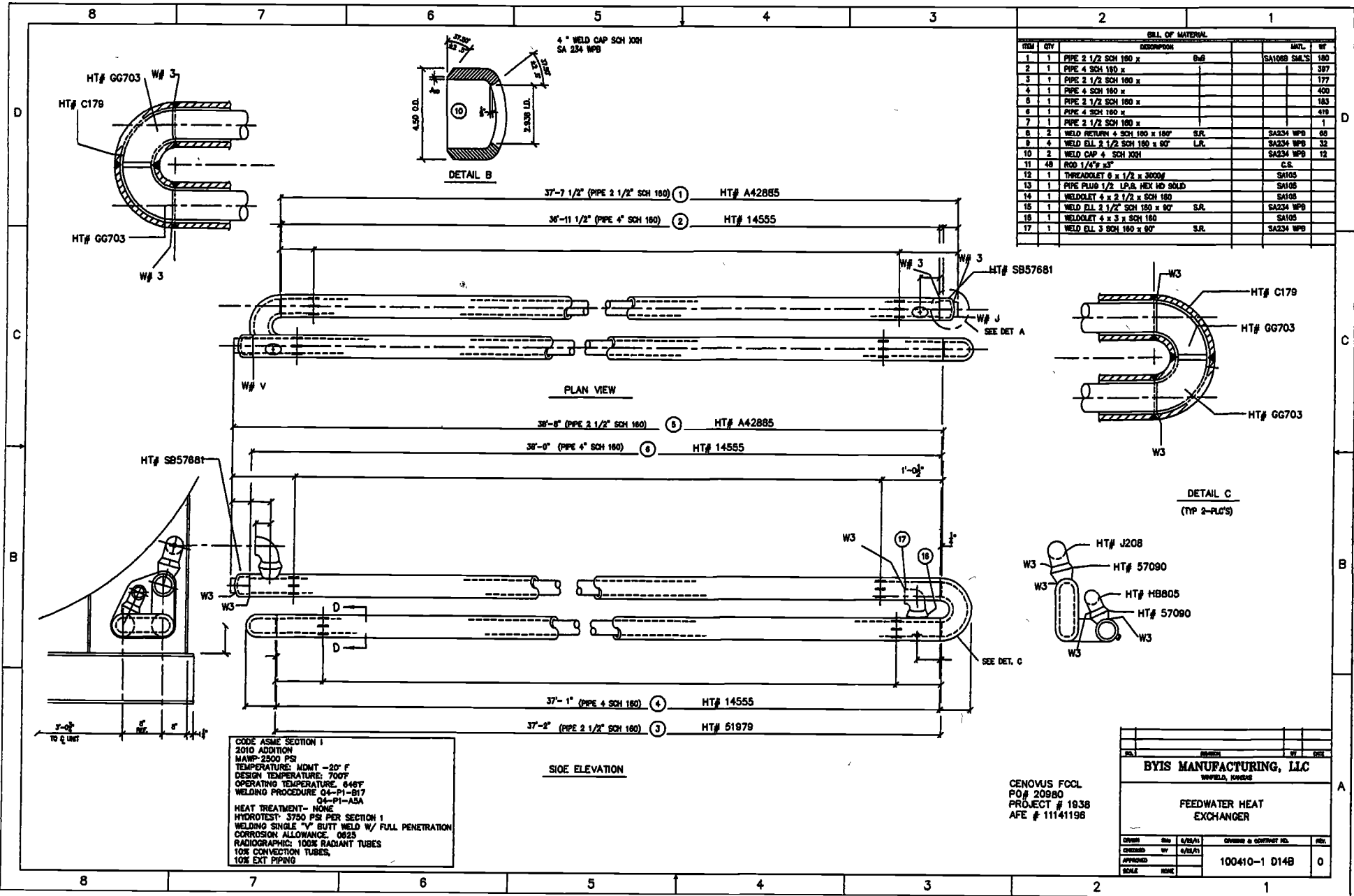
CODE ASME SECTION I
 2010 ADDITION
 MAWP 2500 PSI
 TEMPERATURE: MDMT -20° F.
 DESIGN TEMPERATURE: 700° F
 OPERATING TEMPERATURE: 648° F
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-ASA
 HEAT TREATMENT- NONE
 HYDROTEST: 3750 PSI PER SECTION I
 WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE .0625
 RADIOGRAPHIC: 100% RADIANT TUBES
 10% CONVECTION TUBES,
 10% EXT PIPING

CENOVUS FCCL
 PO# 20980
 PROJECT# 1938
 AFE# 11141196

OUTSIDE PIPE

F				UNLESS OTHERWISE SPECIFIED 1. TOLERANCES X = ± .08 Y = ± .03 Z = ± .010 FRACTIONS = 1/32 ANGLES = 1/2" 2. REMOVE ALL BURRS & SHARP EDGES 3. CORNER RADIUS .03 4. ALL DIMS. IN INCHES 5. MACHINE	DR.	SMc	BYIS MANUFACTURING, LLC. CONVECTION BOX INLET PIPING		
E					CK	WY			
D					APP.				
C					SCALE	DATE	07-31-11	DWG. NO.	100-410-1-D48
B					NS				
A									
REV.	DATE	ECN. NO.	CHK						

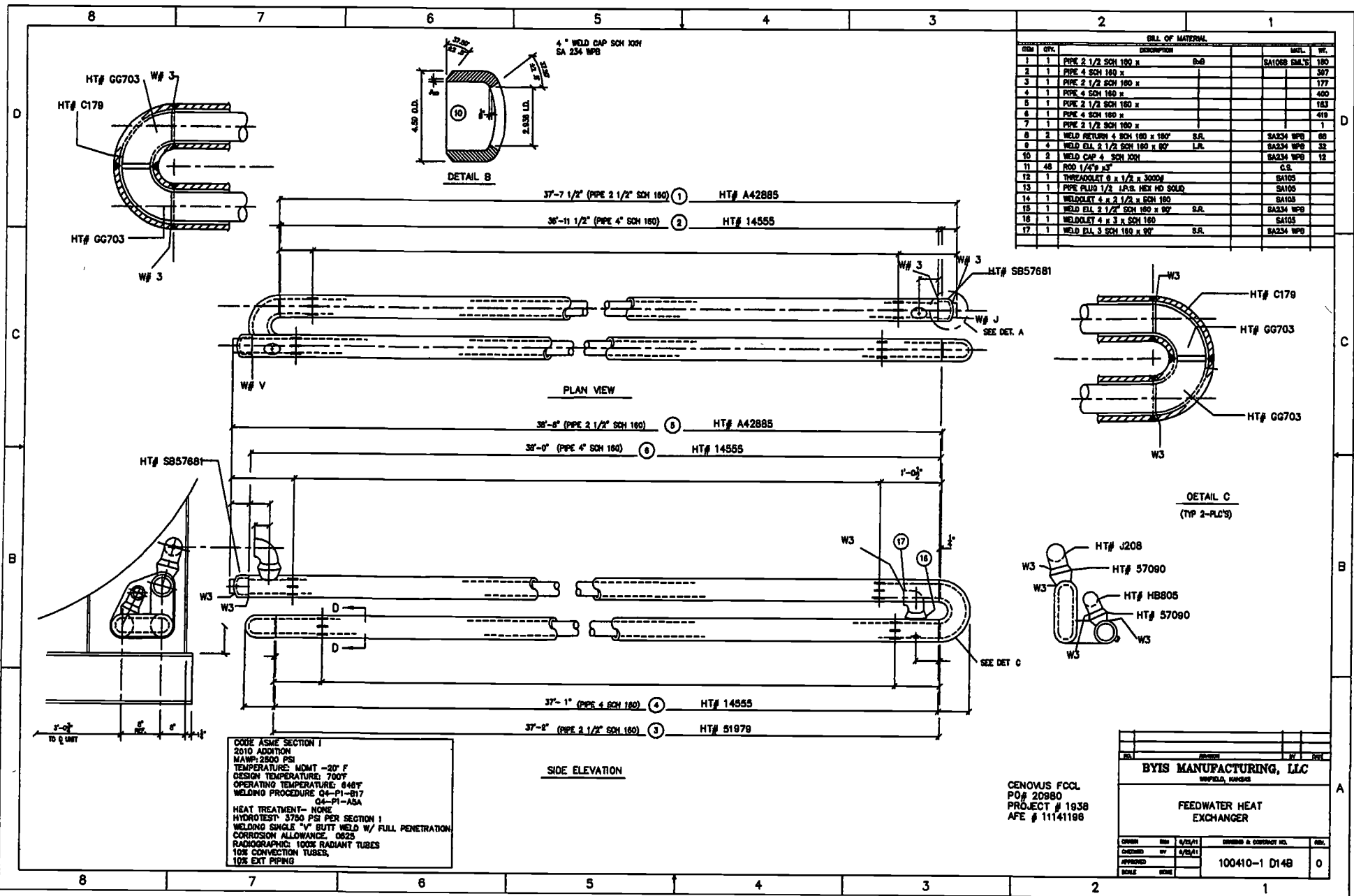
OUTSIDE DOUBLE PIPE



CENOVUS FCCL
PO# 20980
PROJECT # 1938
AFE # 11141198

BYIS MANUFACTURING, LLC <small>WHEELER, TEXAS</small>			
FEEOWATER HEAT EXCHANGER			
OWNER	DATE	DESIGNER & CONTRACT NO.	REV.
APPROVED BY	4/25/11	100410-1 014B	0
SCALE	NONE		

INSIDE PIPE



BILL OF MATERIAL			
ITEM	QTY	DESCRIPTION	UNIT
1	1	PIPE 2 1/2 SCH 160 x	180
2	1	PIPE 4 SCH 160 x	307
3	1	PIPE 2 1/2 SCH 160 x	177
4	1	PIPE 4 SCH 160 x	400
5	1	PIPE 2 1/2 SCH 160 x	163
6	1	PIPE 4 SCH 160 x	419
7	1	PIPE 2 1/2 SCH 160 x	1
8	2	WELD RETURN 4 SCH 160 x 180"	SA334 WPB 88
9	4	WELD ELL 2 1/2 SCH 160 x 90"	SA334 WPB 32
10	2	WELD CAP 4 SCH 160	SA334 WPB 12
11	48	ROD 1/4" x 3"	C.S.
12	1	THREADCOLLET 8 x 1/2 x 3000"	SA105
13	1	PIPE PLUG 1/2 1/2 B. HEX HD SOLID	SA105
14	1	WELDCOLLET 4 x 2 1/2 x SCH 160	SA105
15	1	WELD ELL 2 1/2 SCH 160 x 90"	SA334 WPB
16	1	WELDCOLLET 4 x 3 x SCH 160	SA105
17	1	WELD ELL 3 SCH 160 x W"	SA334 WPB

CODE ASME SECTION I
 2010 ADDITION
 MAWP: 2500 PSI
 TEMPERATURE: NOMT -20° F
 DESIGN TEMPERATURE: 700° F
 OPERATING TEMPERATURE: 648° F
 WELDING PROCEDURE Q4-P1-B17
 Q4-P1-ABA
 HEAT TREATMENT- NONE
 HYDROTEST: 3700 PSI PER SECTION I
 WELDING SINGLE "V" BUTT WELD W/ FULL PENETRATION
 CORROSION ALLOWANCE: 0625
 RADIOGRAPHIC: 100% RADIANT TUBES
 10% CONVECTION TUBES,
 10% EXT PIPING

CENOVUS FCCL
 PO# 20980
 PROJECT # 1838
 AFE # 11141188

BYIS MANUFACTURING, LLC			
WFIELD, KANSAS			
FEEOWATER HEAT EXCHANGER			
OWNER	DATE	DESIGNED & CONSTRUCTED BY	NO.
DESIGNED BY	DATE		
APPROVED		100410-1 D14B	0
SCALE			