

**DEVELOPMENT WORK FOR AN ADVANCED COAL GASIFICATION SYSTEM
FOR
ELECTRIC POWER GENERATION FROM COAL DIRECTED TOWARD
A COMMERCIAL GASIFICATION GENERATING PLANT
PHASE II**

DESIGN REPORT

**VOLUME 5
SECTION 300 — SULFUR REMOVAL**

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**FOSTER WHEELER ENERGY
CORPORATION**

PREPARED FOR

THE UNITED STATES ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Under Contract No. E(49-18)-1521

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REA

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SECTION 300
SULFUR REMOVAL
(SELEXOL UNIT)

TABLE OF CONTENTS

1.	INTRODUCTION	1
2.	KEY PLOT PLAN	15
	Area Plot Plan	15
	Engineering Flow Diagrams	16
3.	LINE LIST.	20
4.	EQUIPMENT SPECIFICATIONS	24
	4.1 Equipment List.	24
	4.2 Vessels	25
	4.3 Heat Transfer Equipment	37
	4.4 Compressors	45
	4.5 Refrigeration Equipment	50
	4.6 Pumps	62
	4.7 Filters	67
	4.8 Instrumentation	68

SECTION 1

INTRODUCTION

1.1 SCOPE

This portion of the Design Report covers Section 300 - Sulfur Removal of the Coal Gasification/Combined Cycle Pilot Plant.

This unit is designed for selective removal of sulfur-bearing compounds and ammonia from the low-Btu gas product before it is burned in the gas turbine.

The major components of the system are:

- Acid gas absorber
- Low-pressure flash drum
- Recycle compressor
- Solvent stripper
- Solvent heat exchanger
- Solvent chiller and refrigeration system.

1.2 DESIGN BASIS

1.2.1 Feed Gas

Composition:	<u>mol %</u>
H ₂	13.81
CO	19.48
CO ₂	9.01
CH ₄	3.96
N ₂	52.80
H ₂ S	0.54
COS	0.06
NH ₃	30 ppm (v)
H ₂ O	0.34

Battery Limit Conditions:

Pressure (lb/in ²)	368
Temperature (°F)	110
Flow Rate:	
1b/h	184,078
1b•mol/h	7,244.3

1.2.2 Product Gas

Composition:	<u>mol %</u>
H ₂	14.30
CO	20.18
CO ₂	6.69
CH ₄	4.10
N ₂	54.71
COS/H ₂ S	150 ppm (v)
NH ₃	3 ppm (v)
H ₂ O	0.01

Battery Limit Conditions:

Pressure (lb/in ²)	354
Temperature (°F)	95
Flow Rate:	
1b/h	173,971
1b•mol/h	6,992.6

1.2.3 Acid Gas

Composition:	<u>mol %</u>
CO	0.08
CO ₂	76.98
CH ₄	0.13
N ₂	0.08
H ₂ S	16.16
COS	1.37
NH ₃	0.08
H ₂ O	5.12

Battery Limit Conditions:

Pressure (lb/in ²)	11
Temperature (°F)	110
Flow Rate:	
lb/h	9,900
lb•mol/h	240.2

1.2.4 Turndown

The unit is designed for stable operation at 25 percent of the normal gas flow.

1.3 DESIGN COMMENTS

1.3.1 Selexol™ System

The Allied Chemical Corporation's Selexol™ System was chosen after consideration of a wide range of processes. Selexol™ was chosen because:

- It has high selectivity for the removal of sulfur compounds over carbon dioxide so that:
 - Maximum carbon dioxide is retained in the low-Btu gas to yield power via expansion in the gas turbine.
 - The acid gas stream to sulfur recovery will have maximum sulfur concentration to benefit Claus unit cost and efficiency.
- It will remove carbonyl sulfide and ammonia.
- It is relatively inexpensive.

In addition, Selexol™ uses a nontoxic and noncorrosive solvent, which allows the unit to be built of carbon steel. The process design for this unit is based upon a design package received from Allied Chemical that included solvent circulation rates, product streams, heat balances, and tower sizes.

1.3.2 Circulating Solution

Since ammonia and carbon dioxide are dissolved in the solution, there is a possibility of ammonium carbonate solids formation in the cold, rich solution. This should be investigated, and Allied Chemical Corporation has agreed to do so before the unit is built.

A solvent storage tank has not been included in the unit. When the solvent is originally delivered, it can be pumped directly into the system; if it necessary to empty part of the solvent circulating loop for maintenance, the solvent may be pumped into one of the towers.

1.3.3 Solvent Heat Exchanger

The extreme pressure drop of 150 lb/in^2 taken on the tube side of this exchanger was selected to reduce the size of the unit. Increased pumping costs are far outweighed by savings in exchanger costs.

1.3.4 Acid Gas Recycle

The Acid Gas Recycle Compressor (C-301) is a lubricated reciprocating compressor. Most of any lubricating oil introduced into the process system at

this point would be removed with the condensate stream from the Acid Gas Scrubber Knockout Drum (D-301). The rest can be skimmed off the top of the liquid in the solvent flash drum. This procedure is consistent with Allied Chemical's experience in operating plants, where it has been found that compressor oil has beneficial antifoam properties.

There is no spare for the acid gas recycle compressor. If the compressor is out of service, the SelexolTM unit can still operate by sending the flash gases to the Sulfur Recovery Unit. Thus the pilot plant can continue to operate, although at a reduced rate.

To proceed with overall plant design and utility balances, a Worthington compressor has been used as a design basis.

1.3.5 Refrigeration Unit

To proceed with overall plant design and utility balances, a York refrigeration package has been used as a design basis.

1.3.6 Product Composition

The SelexolTM unit is designed to produce a product gas containing a maximum of 150 ppm (v) hydrogen sulfide and carbonyl sulfide. An additional design goal is to remove minimum carbon dioxide from the gas stream.

1.4 PROCESS DESCRIPTION

Process Flow Diagram 1521-1-50-61 illustrates the flow through this section. Gas from the Water Wash Section, containing hydrogen sulfide, carbonyl sulfide, and ammonia, enters Section 300 at 368 lb/in² and 110°F and is mixed with recycle gas from the acid gas recycle compressor. This gas is then cooled in the Product Gas Heat Exchanger (E-302) to 54°F. The condensed water is removed from the gas stream in the acid gas scrubber knockout drum. Since this water is contaminated with lubricating oil from the acid gas recycle compressor, it is sent to the oily water sewer.

The cooled gas is then sent to the Acid Gas Scrubber (T-301), where it is contacted with cold Selexol™ solvent. The Selexol™ solvent is polyethylene glycol ether, in this case containing a small amount of water to provide stripping steam in the solvent stripper. The gas is scrubbed down to 150 ppm (v) sulfur and 3 ppm (v) ammonia.

The gas leaves the tower and is warmed to 95°F in the product gas heat exchanger before passing through the Product Gas Knockout Drum (D-304) and on to the gas turbine. The product gas is normally dry because the product gas knockout drum is used to guard the turbine and other downstream equipment from any liquid which might be "bumped" from the acid gas scrubber during an upset.

To increase the unit's selectivity for sulfur and ammonia removal, the solvent leaving the absorber is flashed in the Solvent Flash Drum (D-302). The gases flashed, primarily carbon dioxide, hydrogen, and carbon monoxide, are sent to the acid gas recycle compressor and then back to the inlet gas stream. This step reduces the amount of gas in the solvent going to the stripper and hence the amount of off-gas sent to the Sulfur Recovery Unit, increasing the concentration of hydrogen sulfide in the off-gas and making it easier to process.

The solvent is held in the flash drum for a minimum time to allow the solvent and gases to reach equilibrium. The flashed solvent is then sent to the Rich Solvent Pump (P-301). After leaving the pump, a slipstream is filtered in the Solvent Filter (F-301). The solvent then passes into the Solvent Heat Exchanger (E-304), where it is heated thereby cooling the stripper bottoms stream.

The hot solvent, having been further flashed in the solvent heat exchanger, is sent to the Solvent Stripper (T-302). There it is stripped with steam from the Solvent Stripper Reboiler (E-305). The stripper overhead vapor is sent to the Solvent Stripper Condenser (E-306) and then to the Solvent Stripper Reflux Drum (D-303). The acid gas at 110°F and 11 lb/in² at the Selexol™ unit battery limit then goes to the Sulfur Recovery Unit. The condensed liquid is sent by the Solvent Stripper Condensate Pumps (P-303A/B) back to the suction of the rich solvent pump.

The lean solvent goes from the bottom of the stripper to the Lean Solvent Pumps (P-302A/B), and from there through the solvent heat exchanger to the Solvent Chiller (E-303). In the solvent chiller the solvent is cooled before being sent back to the acid gas scrubber.

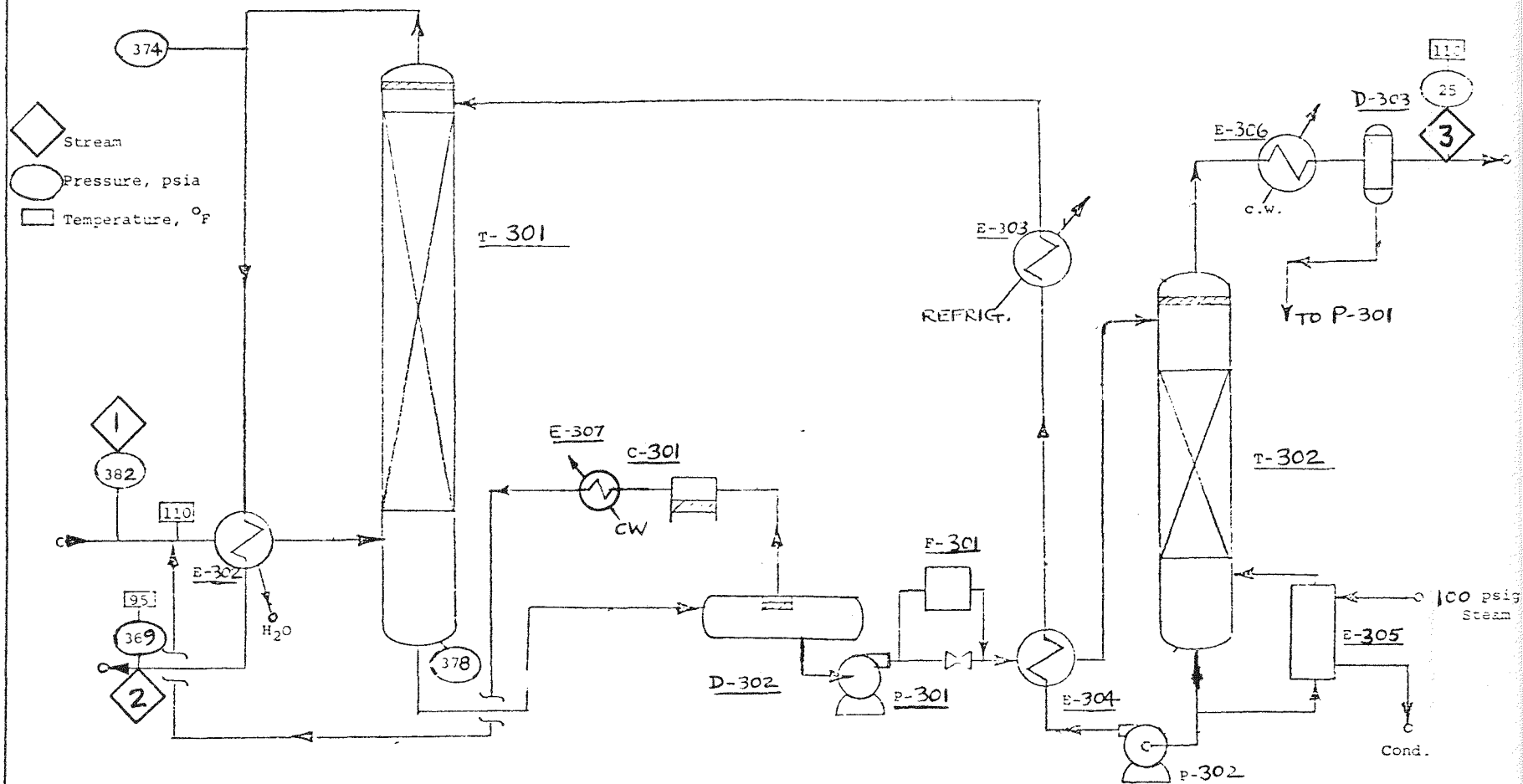
To minimize solvent loss and avoid unnecessary effluent, all solvent drains are sent to the Solvent Sump (TK-302). From there solvent can be pumped back into the circulating system by the Solvent Sump Pump (P-305).

1.5 PROCESS FLOW DIAGRAM AND MATERIAL BALANCE

Overall expected operating conditions around the Selexol™ unit are shown in Volume 1 on Process Flow Diagram 1521-1-50-61 and the material balance following it.

Conditions within the Selexol™ unit and a complete detailed material balance are presented in Figure 5.1 and the associated tables which follow.

For reference purposes, Figure 5.2 presents the basic design flow sheet and main flows as originally prepared by Allied Chemical Corporation.

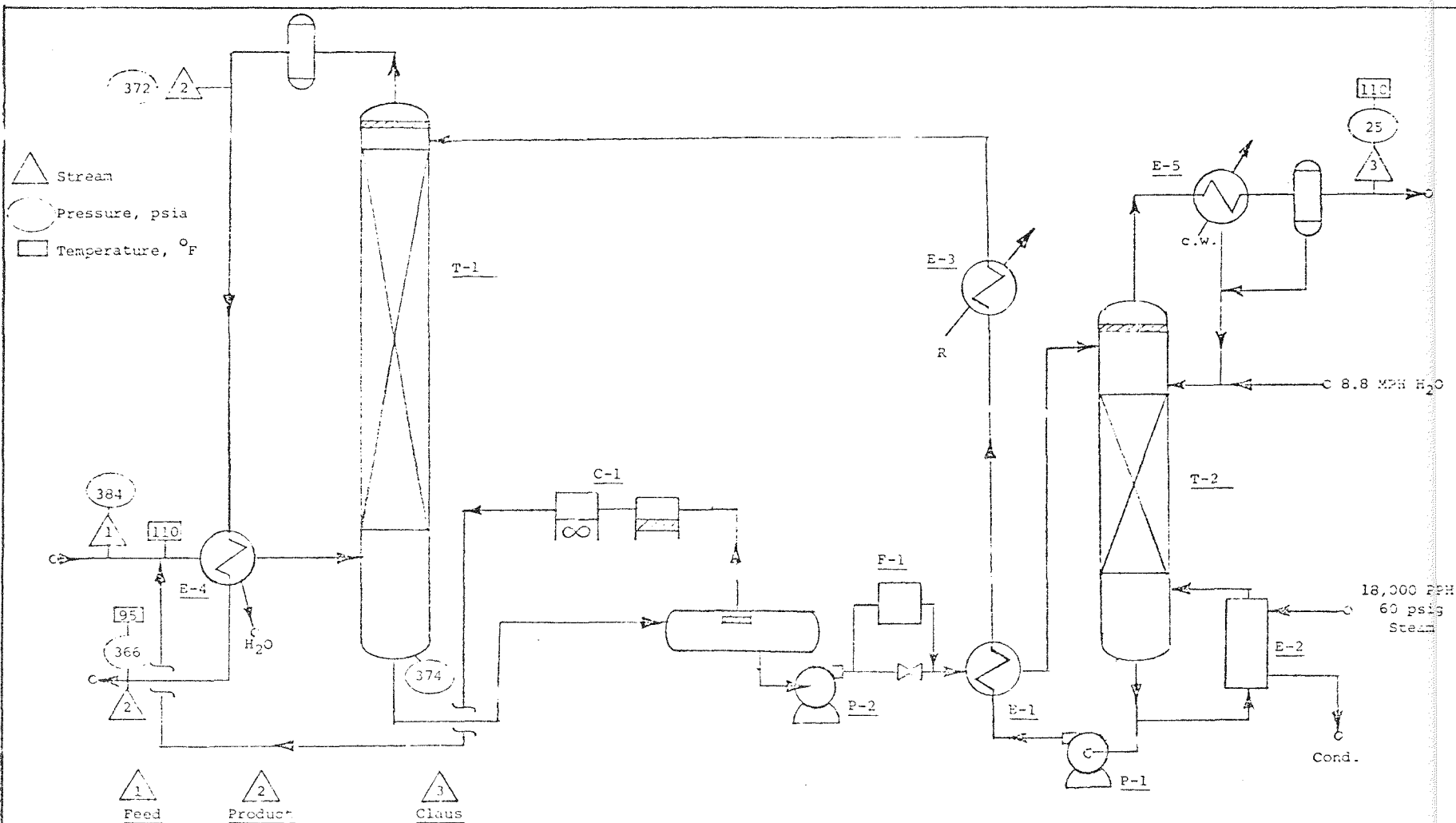


Allied
Chemical

GAS PURIFICATION DEPARTMENT
 ALLIED CHEMICAL CORPORATION
 P.O. BOX 1012R, MORRISTOWN, NEW JERSEY 07950

Figure 5.1 SELEXOL Gas Purification Flow Drawing
 C.P.C. Desulfurization

STREAM NO. & UNITS		1	2	3
STREAM DESCRIPTION		Gas From Section 200	Clean Product Gas	Acid Gas to Claus Unit
		FLOW - lb . moles/h		
COMPONENT	MOL. WT.			
H ₂	2.016	1000.1	1000.1	
CO	28.011	1411.3	1411.1	0.2
CO ₂	44.011	652.8	467.9	184.9
CH ₄	16.043	286.9	286.6	0.3
N ₂	28.016	3825.3	3825.1	0.2
O ₂	32.000			
H ₂ S	34.082	38.8	1 ppm (v)	38.8
COS	60.077	4.3	1.0	3.3
NH ₃	17.032	0.2		0.2
H ₂ O	18.016	24.6	0.8	12.3
TOTAL lb . moles/h		7244.3	6992.6	240.2
FLOW - lb/h				
FLOW lb/h				
LIQUID				
GAS		184,075	173,969	9898
TOTAL		184,075	173,969	9898
GAS	MOL. WT.	25.41	24.88	41.21



	1 Feed	2 Product	3 Claus
CO ₂	651.5	461.0	190.5
H ₂ S	41.6	(2 ppm)	41.6
COS	4.3	1.0 (148 ppm)	3.3
C ₁	289.2	289.9	0.3
H ₂	1026.6	1026.6	-
CO	1404.6	1404.4	0.2
N ₂	3574.2	3574.0	0.2
NH ₃	1.4	(3 ppm)	1.4
H ₂ O	23.1	-	12.8
TOTAL	7016.5	6755.9	250.3

*NH₃, H₂O
Free Basis



Allied
Chemical

GAS PURIFICATION DEPARTMENT
ALLIED CHEMICAL CORPORATION
P.O. BOX 1013R, MORRISTOWN, NEW JERSEY 07960

Figure 5.2 SELEXOL Gas Purification Flow Drawing
C.P.C. Desulfurization

Dwg. #210-5

July 17, 1975

1.6 UTILITIES AND CHEMICALS

The following are estimated normal utility and chemical requirements for Section 300:

1.6.1 Electric Power

<u>Item</u>	<u>Service</u>	<u>Normal kw</u>
P-301	Rich Solvent Pump	*
P-302A/B	Lean Solvent Pump	*
P-303A/B	Solvent Stripper Condensate Pump	*
P-305	Solvent Sump Pump (Intermittent)	*
C-301	Acid Gas Recycle Compressor	*
A-301	Solvent Chiller Refrigeration Unit	*
Total		1862

1.6.2 150 lb/in² Steam

E-305	Solvent Stripper Reboiler	20,430 lb/h
-------	---------------------------	-------------

1.6.3 Low-Pressure Condensate Returned

E-305	Solvent Stripper Reboiler	20,430 lb/h
-------	---------------------------	-------------

1.6.4 Boiler Feedwater

Circulating Solution Makeup	166 lb/h
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1.6.5 Cooling Water

<u>Item</u>	<u>Service</u>	<u>gal/min</u>	<u>Temp. Rise (°F)</u>
E-306	Solvent Stripper Condenser	*	25
E-307	Recycle Acid Gas Cooler	*	25
C-301	Acid Gas Recycle Compressor	*	10
A-301	Solvent Chiller Refrigeration Unit	*	10
Total		3564	13.4 (Average)

1.6.6 Start-Up Nitrogen

For Purging System	8,700 lb
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* Proprietary data

1.6.7 Chemicals Required

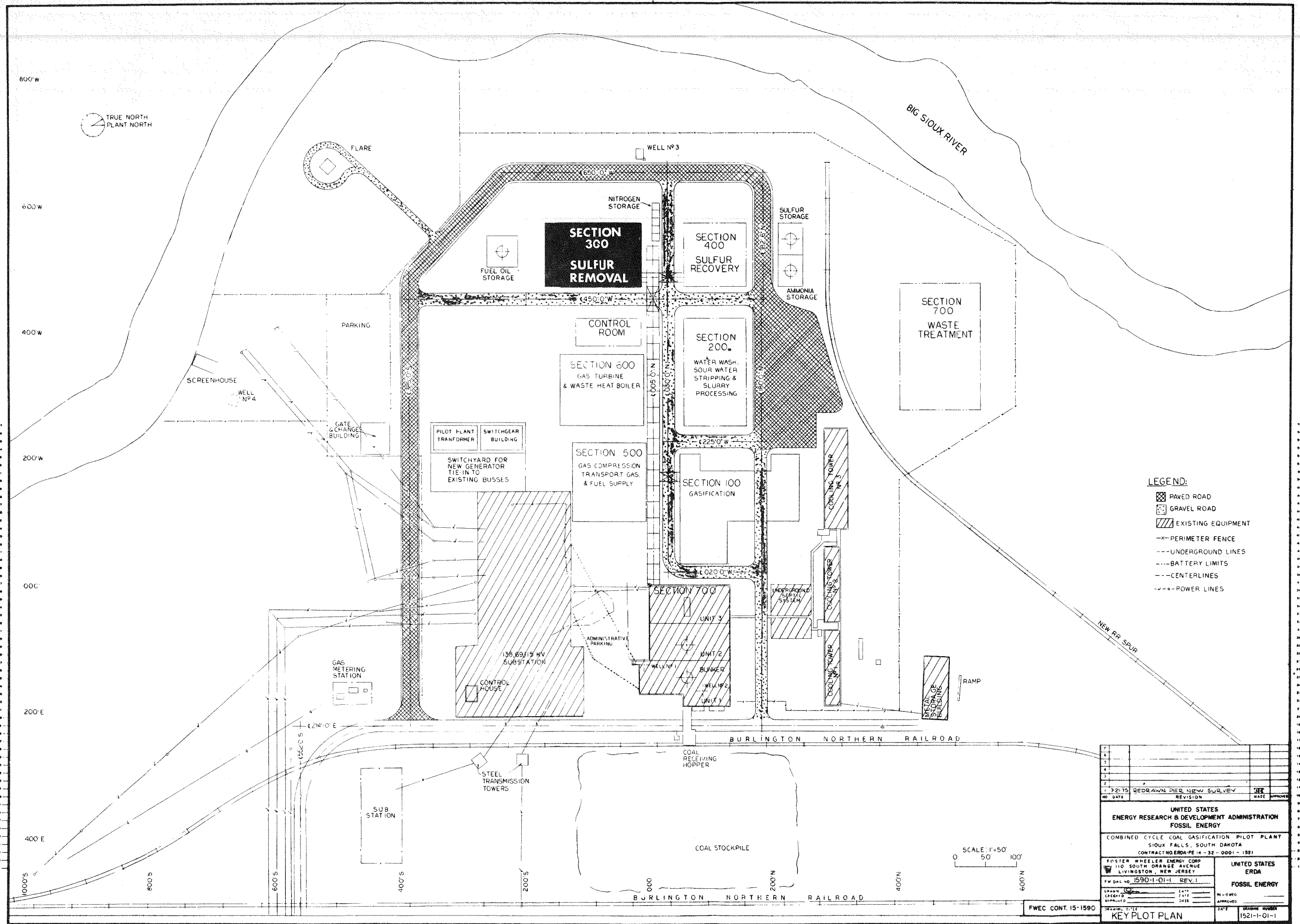
Selexol™ Solvent:

Initial Charge

250,000 lb

Consumption

10 lb/d



72175		REDRAWN PER NEW SURVEY		DATE	REVISION	MADE	APPROVED
UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY COMBINED CYCLE COAL GASIFICATION PILOT PLANT SIOUX FALLS, SOUTH DAKOTA CONTRACT NO. ERDA-PE 14-32-0001-1321							
FOSTER WHEELER ENERGY CORP. 110 SOUTH ORANGE AVENUE LIVINGSTON, NEW JERSEY				UNITED STATES ERDA FOSSIL ENERGY			
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KEY PLOT PLAN							

SECTION 2



570'-0" W B.L.

100'-0"

A-301
(20'-0" x 13'-0")E-303
(4'-0" DIA.)D-305
(8'-0" DIA.)
(ELEVATED)

E-304F

E-304E

E-304D

E-304C

E-304B

E-304A

(3'-0" DIA. x 20'-0" L)

DROP AREA
7'-0" x 7'-0"

T-301

D-301

E-302

D-304
(5'-0" DIA.)NITROGEN
STORAGE20'-0" PIPE RACK
(ELEVATED)

15'-0" PIPE RACK

C-301
(16'-0" x 16'-0")

E-307

D-302

(8'-0" DIA. x 28'-0" L)

DROP AREA
5'-0" x 5'-0"

T-302

E-305 AT GRADE
E-306 ON PLATFORMD-303
(5'-0" DIA.)TK-302
(6'-0" x 6'-0")

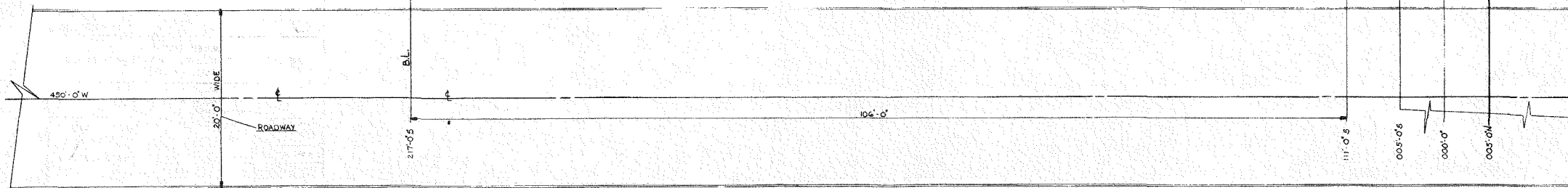
P-305

470'-0" W B.L.

SECT. 300 B.L.

PRELIMINARY
PLOT PLAN

* PROPRIETARY DATA

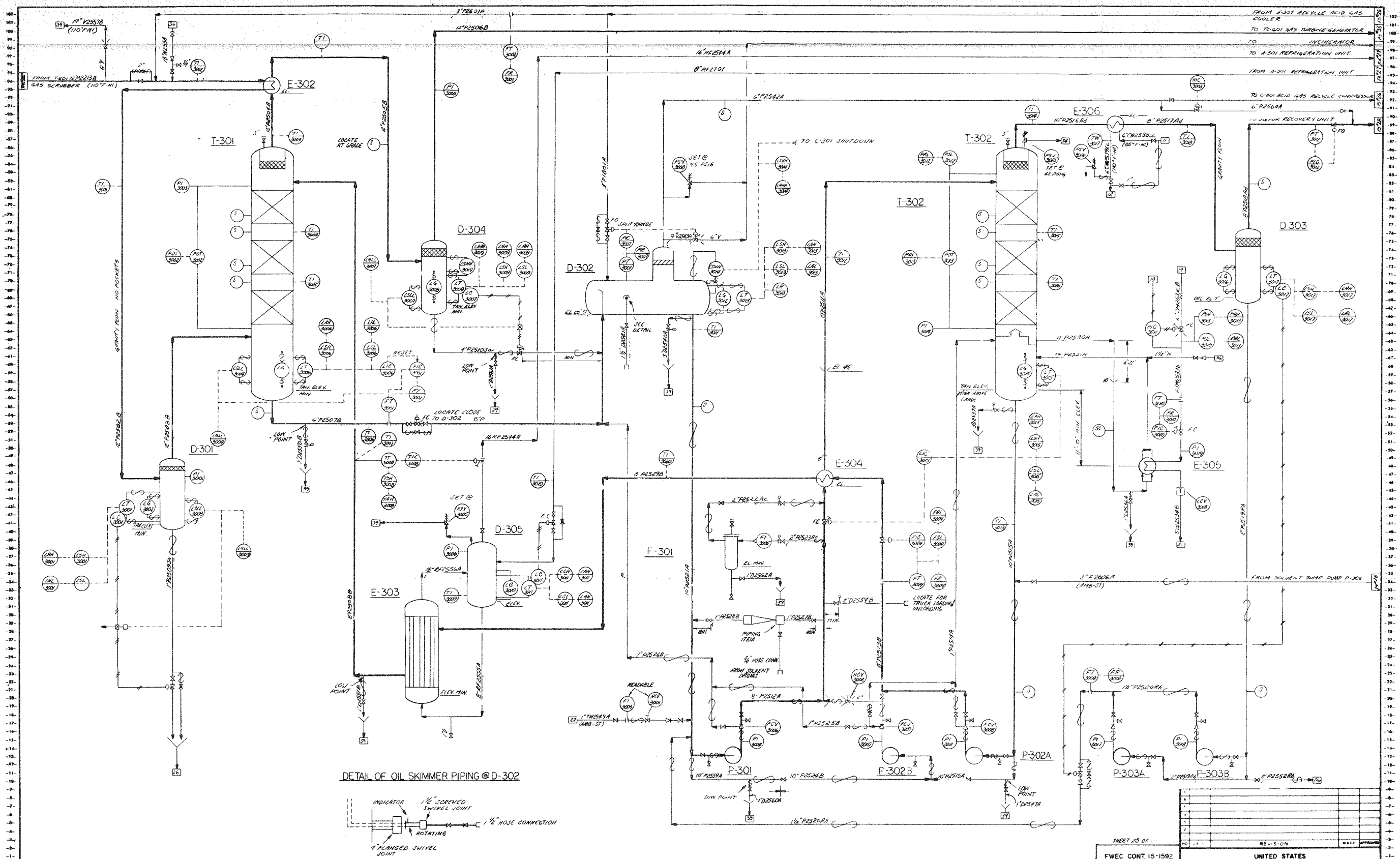


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COAL GASIFICATION COMBINED CYCLE PILOT PLANT SIOUX FALLS, SOUTH DAKOTA CONTRACT NO. ERDA-FE 14-82-0001-1521	
FOSTER WHEELER ENERGY CORP. 110 SOUTH ORANGE AVENUE LIVINGSTON, NEW JERSEY	UNITED STATES ERDA FOSSIL ENERGY
FW DGC NO. OP-751-616	DATE 3-4-80
DRAWN BY J. J. JENNINGS	CHECKED BY J. J. JENNINGS
APPROVED BY J. J. JENNINGS	DATE 3-4-80
PROJECT TITLE AREA 300 SULFUR REMOVAL PLOT PLAN	DRAWING NUMBER 1521-1-01-4

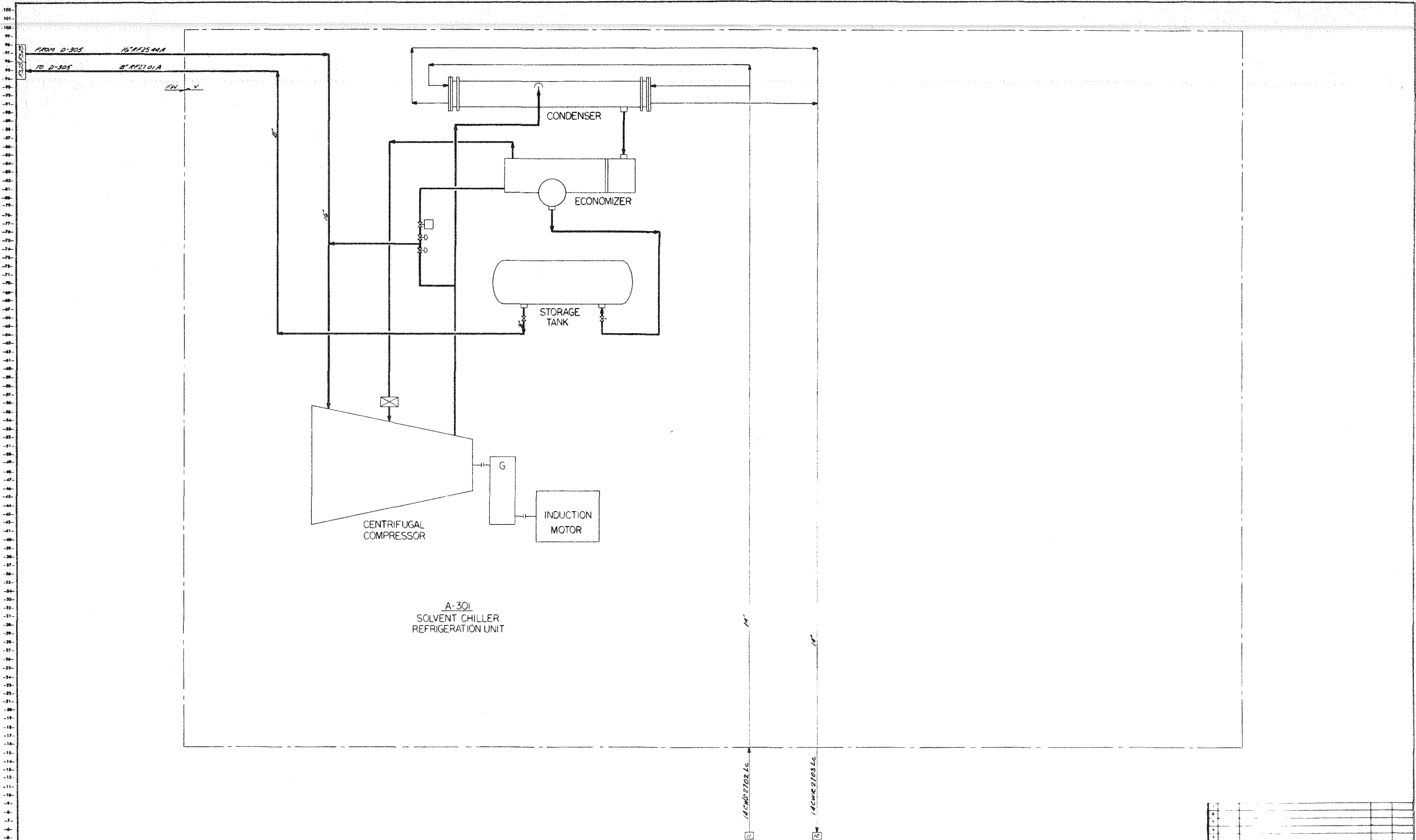
FWEC CONT. 15-1592

SCALE 3/8" = 1'-0"



* PROPRIETARY DATA									
ITEM NO.	1	2	3	4	5	6	7	8	9
DESCRIPTION	COOLING WATER SUPPLY	EXHAUST STEAM	CONDENSATE	CHILLED WATER	CHILLED WATER	CHILLED WATER	CHILLED WATER	CHILLED WATER	CHILLED WATER
UNIT	1000 GPM	1000 GPM	1000 GPM	1000 GPM	1000 GPM	1000 GPM	1000 GPM	1000 GPM	1000 GPM
TEMPERATURE	50°F	250°F	150°F	40°F	40°F	40°F	40°F	40°F	40°F
PRESSURE	100 PSI	100 PSI	100 PSI	100 PSI	100 PSI	100 PSI	100 PSI	100 PSI	100 PSI

ITEM NO.	10	11	12	13	14	15	16	17	18
DESCRIPTION	COOLING WATER RETURN	POTABLE WATER	TREATED WATER	FUEL OIL	FUEL GAS	CLEAN WATER SEWER	CHILLED WATER	CHILLED WATER	CHILLED WATER
UNIT	1000 GPM	1000 GPM	1000 GPM	1000 GPM	1000 GPM	1000 GPM	1000 GPM	1000 GPM	1000 GPM
TEMPERATURE	50°F	250°F	150°F	40°F	40°F	40°F	40°F	40°F	40°F
PRESSURE	100 PSI	100 PSI	100 PSI	100 PSI	100 PSI	100 PSI	100 PSI	100 PSI	100 PSI



SHEET 27 OF 28		FWEC CONT 15-1592		UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY	
COOLING WATER SUPPLY		EXHAUST STEAM		CONDENSATE	
COOLING WATER RETURN		POTABLE WATER		TREATED WATER	
H.P. STEAM		PLANT AIR		FUEL OIL	
STEAM (INTERMEDIATE PRESS.)		INSTRUMENT AIR		FUEL GAS	
L.P. STEAM		H.P. CONDENSATE		CLEAN WATER SEWER	
DIRTY OR DIRTY WATER SEWER		PUMP/OUT		PURGE GAS	
PROCESS SEWER		BLOWDOWN		FLARE	
SANITARY SEWER		TO ATMOSPHERE		INERT GAS	
FIRE WATER		FURNACE GAS		BOILER FEEDWATER	
FLUSHING OIL		SOLVENT BUMP SYSTEM		SOLVENT WATER	
ITEM NO.		E-301		A-301	
SERVICE		SOLVENT CHILLER		SOLVENT CHILLER	
SHEET DES. P. & T.		30/60		30/60	
TUNE DES. P. & T.		30/60		30/60	
MATERIAL		STEEL		STEEL	
INSULATION		INSULATION		INSULATION	
DRAWING NO.		SHEET 30F3		SHEET 30F3	
CHECKED		DATE		DATE	
APPROVED		DATE		DATE	
DRAWING TITLE		SULFUR REMOVAL		SULFUR REMOVAL	
REFRIGERATION UNIT		REFRIGERATION UNIT		REFRIGERATION UNIT	
SHEET 30F3		SHEET 30F3		SHEET 30F3	
DATE		DATE		DATE	
DRAWING NUMBER		DRAWING NUMBER		DRAWING NUMBER	
1521-50-27		1521-50-27		1521-50-27	

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DATE													
LINE NUMBER			LINE EXTREMITIES		OPERATING		DESIGN		INSULATION		PLAN OR ISO. DRAWING NO.	PIPE WALL TKN.	REMARKS
SIZE	SERIAL	SPEC	FROM	TO	TEMP °F	PRESS PSIG	TEMP °F	PRESS PSIG	TYPE	TKN.			
12	P 2502	B	E-302	D-301	P R O P R I E T A R Y D A T A				CC				
12	P 2503	B	D-301	T-301					CC				
12	P 2504	B	T-301	E-302					CC				
12	P 2505	B	E-302	D-304					NI				
12	P 2506	B	D-304	TC-601					NI				
12/8	P 2507	B	T-301	D-302					CC				
8	P 2508	B	E-303	T-301					CC				
1	P 2509	SA	D-301	[26]					ST				
4	P 2510	SA	D-304	D-302					ST				
8/10	P 2511	A	E-304	T-302					HC				
8	P 2512	A	P-301	E-304					ST				
6	P 2513	B	P-302/B	E-304					HC				
1	P 2514	A	P-302 A/B	T-302					ST				
10	P 2515	A	T-302	P-302A/B					ST				
10	P 2516	Ad	T-302	E-306					PP				
8	P 2517	Ad	E-306	D-303					NI				
8	P 2518	Ad	D-303	#FS-20					NI				
2	P 2519	Rh	D-303	P-303A/B					ST				
1 1/2	P 2520	Rh	P-303 A/B	10"P2521A					ST				
10	P 2521	A	D-302	P-301					ST				
2	P 2522	AL	F-301	8"P1712A					ST				
2	P 2523	AL	8"P2512A	F-301					ST				
10	P 2524	B	10"P2521A	P-302B					ST				
1	P 2525	B	8"P2513B	1"P-2526B					ST				
1	P 2526	B	8"P2512A	D-302					ST				
1	P 2527	B	8"P2512A	EJ-					NI				
1	P 2528	B	EJ-	10"P2521A					NI				
8	P 2529	B	E-304	E-303					CC				
12/10	P 2530	A	T-302	E-305					HC				
14	P 2531	A	E-305	T-302					HC				
6	SM 2532	B	[14]	FC-					HC				
8	SM 2533	B	FC-	E-305					HC				
3	CL 2534	B	E-305	[217]					HC				
1 1/2	N 2535	AK	[36]	14"P2531A					NI				

FOSTER WHEELER CORP. PROCESS PLANTS DIVISION			CONTRACT NO: 157590 SECTION: 300		LINE CLASSIFICATION LIST		FLOWSHEET NUMBER OP-751-577 FS 25		REV	BY	PAGE		
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DATE													
LINE NUMBER			LINE EXTREMITIES		OPERATING		DESIGN		INSULATION		PLAN OR ISO. DRAWING NO.	PIPE WALL TKN.	REMARKS
SIZE	SERIAL	SPEC	FROM	TO	TEMP °F	PRESS PSIG	TEMP °F	PRESS PSIG	TYPE	TKN.			
1"	D 2536	A	12/10 P2530A	[39]					ST				
3"	D 2537	A	10" P2515A	[39]					ST				
6	CW 2538	LC	[11]	E-306					NI				
6	CW 2539	LC	E-306	[12]					NI				
3	D 2540	A	10" P2521A	[39]					ST				
1 1/2"	D 2541	A	D-302	C-254106					NI				
6	P 2542	A	D-302	C-301					AS				
4/6	V 2543	A	6" P2542A	To INCINERATOR					NI				
16	RF 2544	A	D-305	A-301					CC				
4	SH 2545	E	[16]	P-302A					HC				
6	SL 2546	A	P-302A	[15]					HC				
1	D 2547	A	10" P2544A	[39]					ST				
1	D 2548	A	10" P2521A	[39]					ST				
1	ST 2549	A	[22]	10" P2521A					ST				
3	D 2550	B	6" P2507B	[39]					ST				
1	D 2551	B	8" P2508B	[39]					ST				
2	P 2552	Rh	2" P2519Rh	[26]					ST				
2	D 2553	B	4" P2510Sa	[39]					ST				
2	D 2554	B	TRK. LOADING / UNLOAD	8" P2512A					NI				
8	RF 2555	A	D-305	E-303					CC				
18	RF 2556	A	E-303	D-305					CC				
3/14	V 2557	B	12 P2213B	[34]					NI				
1 1/2	N 2558	BK	[36]	12 P2213B					HC				
10	P 2559	A	10 P2521A	10 P2524B					ST				
1	D 2560	A	10 P2559A	[39]					ST				
2	D 2561	A	4" P2510Sa	[34]					ST				
1	D 2562	A	E-301	[39]					NI				
1 1/2	N 2563	AK	[36]	14 P2531A					HC				
6	P 2564	A	6 P2542A	8 P2518A					AS				

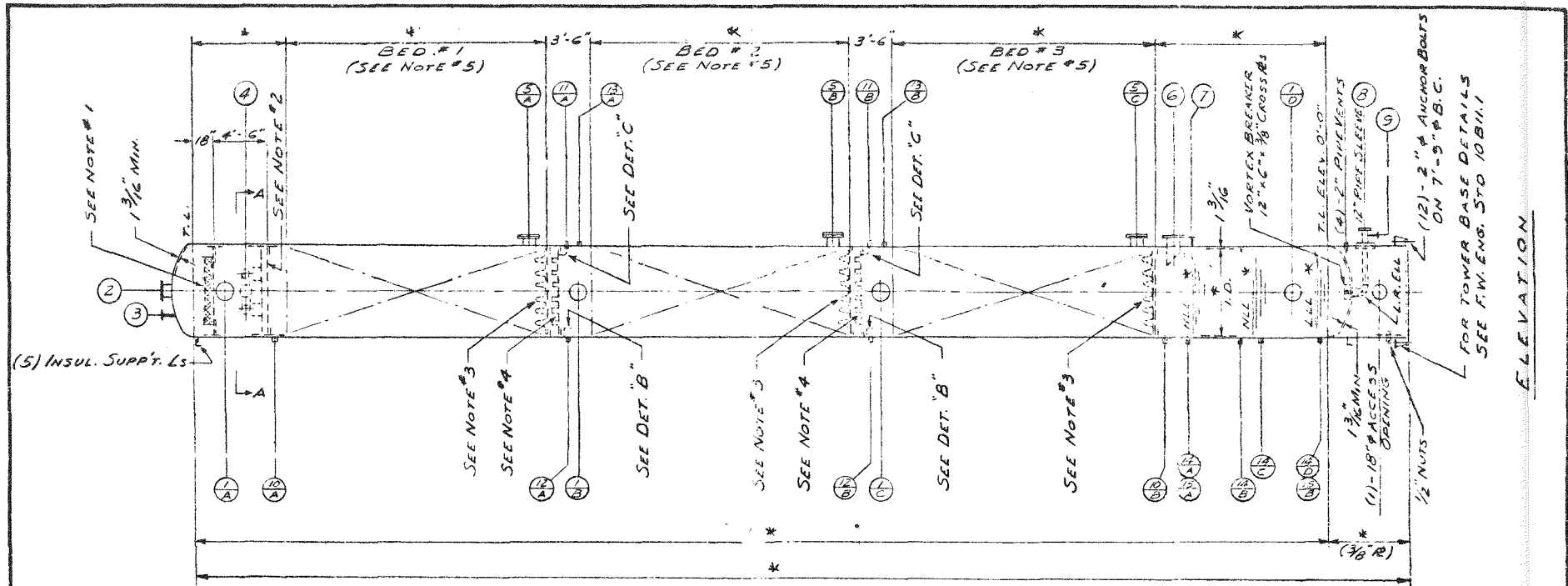
PROPRIETARY DATA

PROPRIETARY DATA

EQUIPMENT LIST

FW ENERGY CORPORATION PROCESS PLANTS DIVISION		CONTRACT 15-1592	SECTION 300	EQUIPMENT LIST		TYPE OF UNIT COAL GASIFICATION PROJECT				PAGE 1	OF 1
CUSTOMER ERDA-FE			REVISION XFX6		1	2	3	4	5		
LOCATION SIOUX FALLS, SOUTH DAKOTA			DATE 1/14/76		4/18/75	6/18/75	9/2/75	9/15/75	12/11/75		
CLASS	ITEM NO.	DESCRIPTION	FD #	REQ'N. NO.	P.O. NO.	ELEVATION					
TOWERS	T-301	Acid Gas Scrubber		1111A							
	T-302	Solvent Stripper		1112A							
DRUMS	D-301	Acid Gas Scrubber KO Drum		1131A							
	D-302	Solvent Flash Drum		1131B							
	D-303	Solvent Stripper Reflux Drum		1131C							
	D-304	Product Gas KO Drum		1131D							
	D-305 *	Refrigerant KO Drum				in Pkg. A-301					
TANKS	TK-302	Solvent Sump		1141B							
EXCHANGERS	E-302	Product Gas Heat Exchanger		1211A							
	E-303	Solvent Chiller		1211B							
	E-304	Solvent Heat Exchanger		1211C							
	E-305	Solvent Stripper Reboiler		1211D							
	E-306	Solvent Stripper Condenser		1211E							
	E-307	Recycle Acid Gas Cooler		1211F							
PUMPS	P-301	Rich Solvent Pump		1311A							
	P-302A	Lean Solvent Pump		1311B							
	P-302B	Rich & Lean Solvent Pump Spare		1311B							
	P-303A	Solvent Strip. Cond. Pump		1311C							
	P-303B	Solvent Strip. Cond. Pump Spare		1311C							
	P-305	Solvent Sump Pump		1311E							
COMPRESSORS	C-301	Acid Gas Recycle Compressor		1321A							
FILTERS	F-301	Solvent Filter		1349A							
PKG UNIT	A-301	Solvent Chiller Refrig. Unit		1281A							
	D-305	Refrigerant KO Drum									

VESSELS



NOTES:

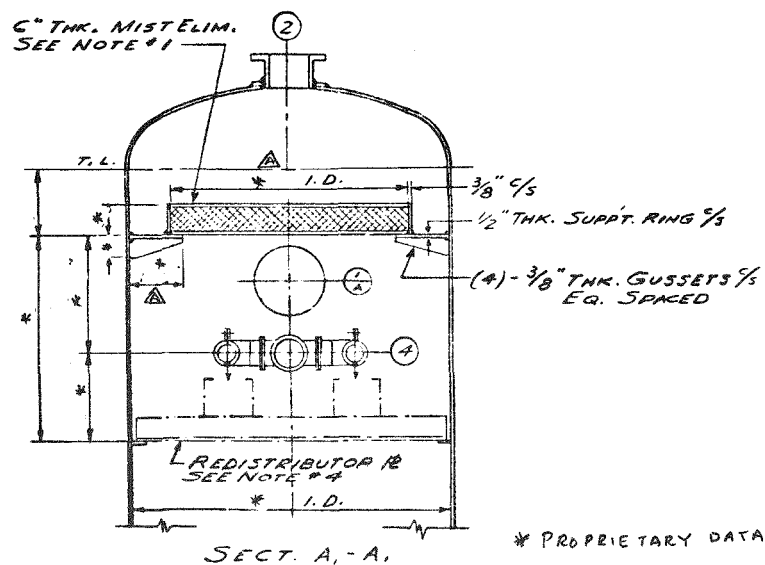
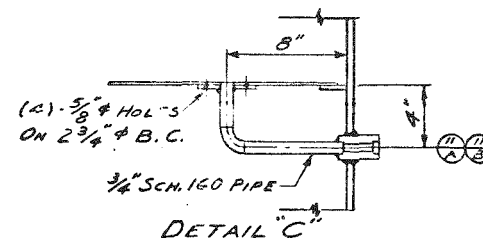
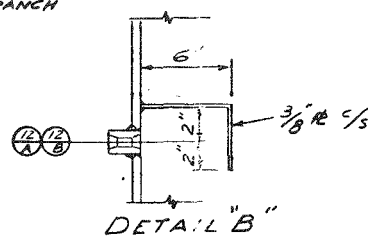
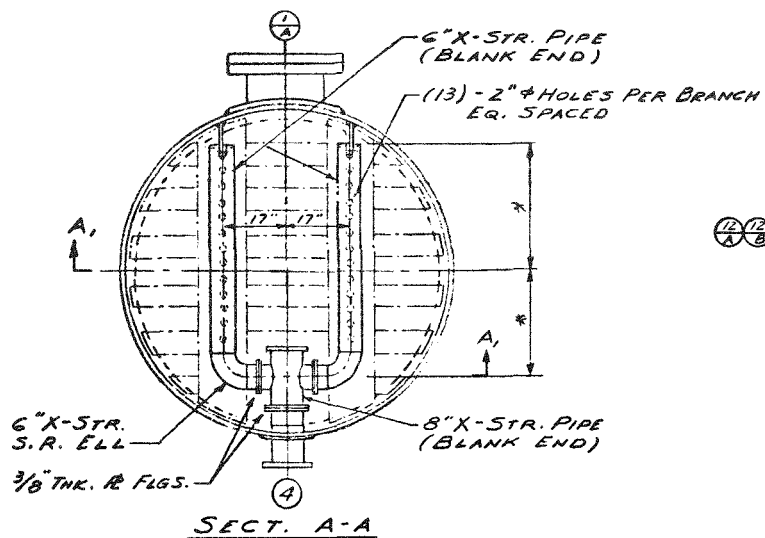
1. MIST ELIMINATOR TO BE * $\phi \times 6"$ THK. $\frac{3}{8}$ TP. 304 W/ LT. WT. GRIDS PER F.W. STD. 10 B 15.1 FURNISHED & INSTALLED BY VESSEL FABRICATOR
2. WEIR-TROUGH DISTRIBUTOR TO BE NORTON MODEL 806 OR EQUAL $\frac{3}{8}$ TP. 410 S (BY OTHERS)
3. PACKING SUPPLY PLATE TO BE NORTON MODEL 804 OR EQUAL $\frac{3}{8}$ TP. 410 S (BY OTHERS)
4. REDISTRIBUTOR PLATE TO BE NORTON MODEL 851 OR EQUAL $\frac{3}{8}$ TP. 410 S (BY OTHERS)
5. PACKING FOR BEDS #1, 2 & 3 TO BE * RINGS (BY OTHERS)
6. SUPPORT RINGS TO BE $2\frac{1}{2}" \times \frac{1}{2}"$ THK. $\frac{3}{8}$

* PROPRIETARY DATA

REFERENCE DRAWINGS, REQUISITIONS, STANDARDS		
1530-10A1	15B 11.1	OP-764-513
1530-100A1	15B 12.2	OP-764-514
1530-40A1	15B 14.3	
1530-50A2	15B 15.1	
1530-82A1	11B 11.1	
1530-83A1		

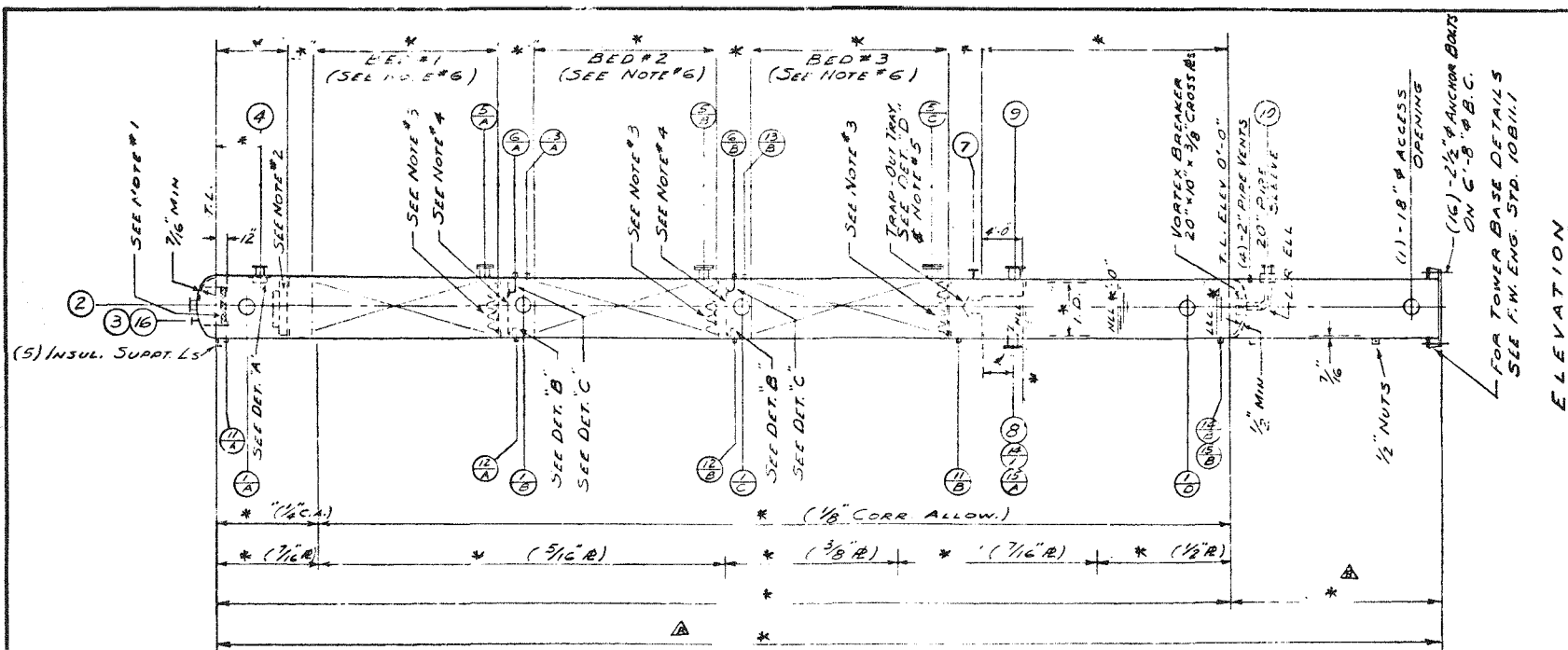
A 11/17/76 AS NOTED ON NOTE 1		DATE	11/15
UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY			
COAL GASIFICATION COMBINED CYCLE PILOT PLANT SIOUX FALLS, SOUTH DAKOTA CONTRACT NO ERDA-FE 14-32-0001-1521			
FOSTER WHEELER ENERGY CORP 110 SOUTH ORANGE AVENUE LIVINGSTON, NEW JERSEY		UNITED STATES ERDA	
FW DNG NO OP-764-512-A		FOSSIL ENERGY	
DRAWN BY A.Y.	DATE 11/17/76	REVIEWED	
CHECKED	DATE	APPROVED	
ACID GAS SCRUBBER T-301		FWEC CONT 15-1592	
REQ N 1592-1111A			

RELEASES					VESSEL DATA	
DWG. REV.	DATE	ISSUED FOR			1	ITEM NO: <u>T-301</u> NO. REQ'D: <u>ONE</u>
OP	DATE OF ORDER	(A) PURCHASE SHELL AND HEAD MATERIAL. PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.			2	SERVICE: <u>ACID GAS SCRUBBER</u>
		(B) ISSUE CHECKED FOSTER WHEELER DRAWING. PURCHASE ALL OTHER MATERIALS. FINALIZE AND SUBMIT CHECKED SHOP DETAIL DRAWING WITHIN ONE WEEK OF RELEASE DATE. PROCEED WITH COMPLETE FABRICATION.			3	
		(C) VENDOR'S DRAWING RETURNED			4	DIAMETER: *
		(D) FIELD CONSTRUCTION			5	TANGENT LENGTH: *
		(E)			6	OPER. PRESSURE: NORM.: <u>360 PSIG</u>
NOZZLE CHART					7	ABOVE LIQUID LEVEL MAX.: <u>360 PSIG</u>
CONN. NO.	SIZE	USAS. RATING	SERVICE	NO. REQ'D	8	DESIGN PRESSURE: <u>417 PSIG</u>
1	20"	300*RF	MANWAY W/DAVIT	4	9	OPER. LIQUID HOLD-UP PRESS: <u>5 PSI</u>
2	12"		GAS OUTLET	1	10	OPER. PRESS. DROP THRU VESSEL: <u>2 PSI</u>
3	3"		VENT	1	11	MAX. RELIEVING PRESS. @ TOP NO.: <u>410 PSI</u>
4	8"		LIQUID INLET	1	12	MAX. OPER. TEMPERATURE: *
5	10"		PACKING DUMP	3	13	DESIGN TEMPERATURE: *
6	12"		GAS INLET	1	14	SPECIFIC GRAVITY (PROCESS FLUID): *
7	3"		STEAMOUT	1	15	CODE: <u>ASME SECT VIII, DIV. 1</u> STAMPED: <u>YES</u>
8	6"		LIQUID OUTLET	1	16	P.W.M.T.: FOR CODE: <u>NO</u> FOR PROCESS: <u>NO</u>
9	3"		DRAIN	1	17	RADIOGRAPHED: <u>FULL</u>
10	3/4"	6000*CPIS	PI/PDI	2	18	JOINT EFFICIENCY: <u>100%</u>
11	3/4"	6000* S.W. CPIS	LIQUID SAMPLE	2	19	CORROSION ALLOWANCE SHELLS: <u>1/8" HEADS: 1/8"</u>
12	3/4"	6000*CPIS	VAPOR SAMPLE	2	20	MATL., SHELL: <u>SA-516 GR. 70</u>
13	3/4"		TI	2	21	MATL., HEADS: <u>SA-516 GR. 70</u>
14	3/4"		LG	4	22	MATL., SUPPORTS: <u>SA-516 GR. 55</u>
15	3/4"		LC	2	23	TYPE OF HEADS: <u>2:1 ELLIP.</u>
* PROPRIETARY DATA					24	EXTERNAL BOLTING: <u>SA-193-B74SA-194-2H</u>
					25	INTERNAL BOLTING: <u>5/8 TP-304</u>
					26	GASKETS: <u>PER SPEC. 1590-50A2</u>
					27	BOLT HOLES: <u>STRADDLE VESSEL CENTERLINE</u>
					28	PAINT: <u>SKIRT ONLY PER SPEC. 1590-83A</u>
					29	INSULATION: <u>3" THK. (BY OTHERS)</u>
					30	SHIPMENT: <u>ONE PIECE</u>
					31	
					32	EMPTY WGT.: <u>124 200 LBS</u>
					33	WATER WGT.: (ONLY) <u>225 950 LBS</u>
					34	TRAYS WGT.: <u>2 000 LBS</u>
					35	INSULATION WGT.: <u>4 250 LBS</u>
					36	GUNITE WGT.: <u>4 950 LBS</u>
					37	OPER. LIQUID WGT.: <u>30 670 LBS</u>
					38	PACKING WT. <u>58 100 LBS.</u>
39						
40						
41	HYDROTEST: SHOP: FIELD: PSI					
42	GAGE LOCATION:					
43	MAX. ALLOW. PRESS. (HEAT & COLD): PSI					
UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY COAL GASIFICATION COMBINED CYCLE PILOT PLANT SIOUX FALLS, SOUTH DAKOTA CONTRAC. NO. ERDA-FE 14-32-C001-1521					UNITED STATES ERDA FOSSIL ENERGY	
					FOSTER WHEELER ENERGY CORP 110 SOUTH ORANGE AVENUE LIVINGSTON, NEW JERSEY	
					FW DWG NO. <u>OP-764-513</u>	
					DRAWN <u>B.A.Y.</u> DATE <u>1/22/76</u> CHECKED _____ DATE _____ APPROVED _____ DATE _____	
					DRAWING TITLE: <u>ACID GAS SCRUBBER T-301</u>	
REFERENCE DRAWINGS, REQUISITIONS, STANDARDS <u>OP-764-512</u> <u>OP-764-514</u>					FWEC CONT. 15-1592 REQ'N NO. <u>1592-1111A</u>	



REFERENCE DRAWINGS, REQUISITIONS, STANDARDS
 OP-764-512
 OP-764-513

A 3/17/76 AS NOTED ON SECT. A-A		MS
NO. DATE	REVISION	MADE APPROVED
UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY		
COAL GASIFICATION COMBINED CYCLE PILOT PLANT SIOUX FALLS, SOUTH DAKOTA CONTRACT NO. ERDA-FE 14-32-0001-1521		
FOSTER WHEELER ENERGY CORP 110 SOUTH ORANGE AVENUE LIVINGSTON, NEW JERSEY		UNITED STATES ERDA FOSSIL ENERGY
FW Dwg No. <u>OP-764-514A</u>		
DRAWN <u>B. A. V.</u> CHECKED _____ APPROVED _____	DATE <u>12/22/76</u> DATE _____ DATE _____	REVIEWED _____ APPROVED _____
DRAWING TITLE <u>ACID GAS SCRUBBER T-301</u>		
FWEC CONT. 15-1592		REQ. NO. 1592-1111A



NOTES:

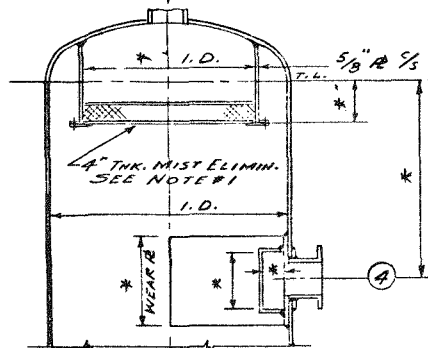
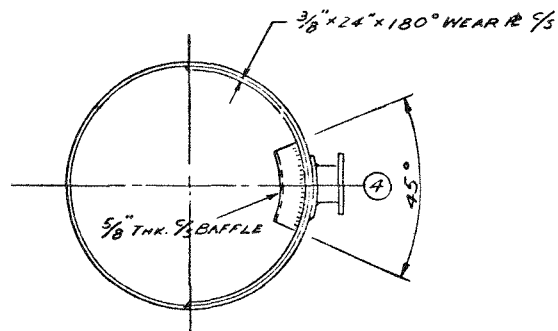
1. MIST ELIMINATOR TO BE * "4" x 4" THK. $\frac{1}{2}$ TP. 304 W/ LT. WT. GRIDS PER F.W. STD. 10B15.1 FURNISHED & INSTALLED BY VESSEL FABRICATOR.
2. REGENERATOR DISTRIBUTOR TO BE NORTON MODEL 898 OR EQUAL $\frac{1}{2}$ TP. 4105 (BY OTHERS)
3. PACKING SUPPORT PLATE TO BE NORTON MODEL 804 OR EQUAL $\frac{1}{2}$ TP. 4105 (BY OTHERS)
4. REDISTRIBUTOR TO BE NORTON MODEL 851 OR EQUAL $\frac{1}{2}$ TP. 4105 (BY OTHERS)
5. TRAP-OUT TRAY TO BE $\frac{1}{2}$ FURNISHED BY TRAY VENDOR & INSTALLED BY VESSEL FABRICATOR
6. PACKING FOR BEDS #1, 2 & 3 TO BE * (BY OTHERS)
7. SUPPORT RINGS TO BE $2\frac{1}{2}$ x $\frac{1}{16}$ THK. $\frac{1}{2}$

* PROPRIETARY DATA

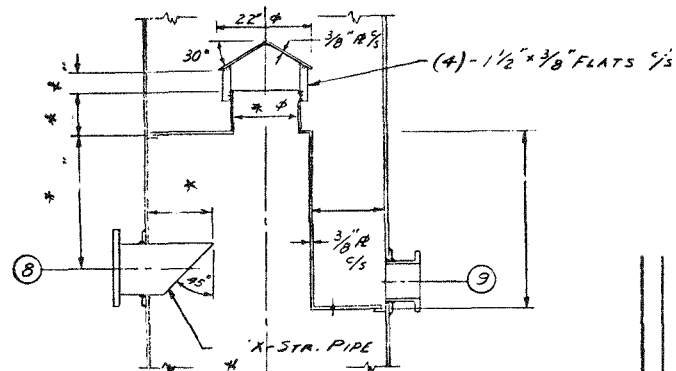
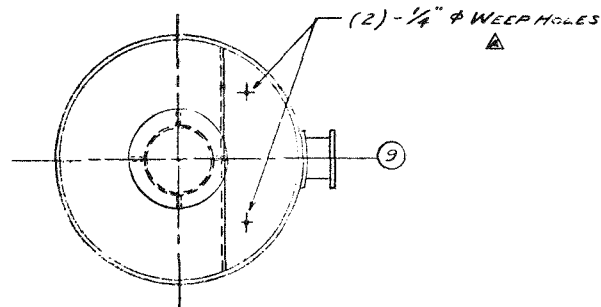
REFERENCE DRAWINGS	REQUISITIONS	STANDARDS
1590-10A1	10B 11.1	OP-754-777
1520-1100A	10B 13.2	OP-754-778
1590-13A1	10B 14.1	
1520-13A2	10B 15.1	
1520-13A1	10B 11.1	

6/9/78	SKIRT COVERALL - LENGTH INCREASED	M.S.
A/12/78	AS NOTED	B.A.Y.
NO DATE	REVISION	MADE
UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY		
COAL GASIFICATION COMBINED CYCLE PILOT PLANT SIOUX FALLS, SOUTH DAKOTA CONTRACT NO. ERDA/FE 14-32-0001-1521		
FOSTER WHEELER ENERGY CORP. 110 SOUTH ORANGE AVENUE LIVINGSTON, NEW JERSEY		UNITED STATES ERDA
FW DWE NO. OP-754-776-B DRAWN BY B.A. YOUNG CHECKED DATE 10/1/78 APPROVED DATE		FOSSIL ENERGY REVIEWED APPROVED
TRAINING TITLE SOLVENT STRIPPERS-302		
FWEC CONT. 15-1592		REQ. N. 1592-1112A

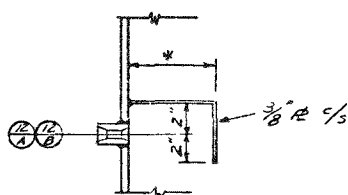
RELEASES					VESSEL DATA	
DWG. REV.	DATE	ISSUED FOR			1	ITEM NO: <u>T-302</u> NO. REQ'D: <u>ONE</u>
OP	DATE OF ORDER	(A) PURCHASE SHELL AND HEAD MATERIAL. PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.			2	SERVICE: <u>SOLVENT STRIPPER</u>
		(B) ISSUE CHECKED FOSTER WHEELER DRAWING. PURCHASE ALL OTHER MATERIALS. FINALIZE AND SUBMIT CHECKED SHOP DETAIL DRAWING WITHIN ONE WEEK OF RELEASE DATE. PROCEED WITH COMPLETE FABRICATION.			3	
		(C) VENDOR'S DRAWING RETURNED			4	DIAMETER: * <u>1.0</u>
		(D) FIELD CONSTRUCTION			5	INLET LENGTH: *
		(E)			6	OPER. PRESSURE: NORM.: * <u>PSIG</u>
NOZZLE CHART					7	LIQ. LEVEL MAX.: * <u>PSIG</u>
					8	DESIGN PRESSURE: * <u>PSIG</u>
CONN. NO.	SIZE	USAS. RATING	SERVICE	NO. REQ'D	9	OPER. LIQ. HOLD-UP PRESS: <u>PSI</u>
1	20"	150*RF	MANWAY W/DAVIT	4	10	OPER. PRESS. DROP THRU VESSEL: <u>PSI</u>
2	10"		VAPOR OUTLET	1	11	MAX. RELIEVING PRESS. @ TOP HD.: * <u>PSIG</u>
3			PSV	1	12	MAX. OPER. TEMPERATURE: * <u>°F</u>
4	10"		LIQUID FEED	1	13	DESIGN TEMPERATURE: * <u>°F</u>
5	10"		PACKING DUMP	3	14	SPECIFIC GRAVITY (PROCESS FLUID): *
6	3/4"	6000*CPG	LIQUID SAMPLE	2	15	CODE: <u>ASME SECT. VIII DIV. 1</u> STAMPED: <u>YES</u>
7	2"	150*RF	STEAMOUT	1	16	P.W.H.T.: FOR CODE: <u>NO</u> FOR PROCESS: <u>NO</u>
8	14"		VAPOR FROM REBOILER	1	17	RADIOGRAPHED: <u>SPOT</u>
9	12"		LIQUID TO REBOILER	1	18	JOINT EFFICIENCY: <u>85%</u>
10	10"		LIQUID OUTLET	1	19	CORROSION ALLOWANCE: SHELLS: <u>SEE ELEV.</u> HEADS: <u>SEE ELEV.</u>
11	3/4"	6000*CPG	PI/PDI CELL	2	20	MATL., SHELL: <u>SA-285 GR. C</u>
12	3/4"		VAPOR SAMPLE	2	21	MATL., HEADS: <u>SA-285 GR. C</u>
13	3/4"		TI	2	22	MATL., SUPPORTS: <u>SA-285 GR. C</u>
14	1 1/2"		D/P CELL	2	23	TYPE OF HEADS: <u>2:1 ELLIP.</u>
15	3/4"		LG	2	24	EXTERNAL BOLTING: <u>SA-193-B7# SA-194-2H</u>
16	3"	150*RF	VENT	1	25	INTERNAL BOLTING: <u>5/8 TP. 304</u>
* PROPRIETARY DATA					26	GASKETS: <u>PER SPEC. 1590-50A2</u>
					27	BOLT HOLES: <u>STRADDLE VESSEL CENTERLINE</u>
					28	PAINT: <u>SKIRT ONLY PER SPEC. 1590-83A1</u>
					29	INSULATION: <u>3" THK. (BY OTHERS)</u>
					30	SHIPMENT: <u>ONE PIECE</u>
					31	
					32	EMPTY WGT.: <u>52500 LBS</u>
					33	WATER WGT.: (ONLY) <u>176500 LBS</u>
					34	TRAYS WGT.: <u>2500 LBS</u>
					35	INSULATION WGT.: <u>7200 LBS</u>
36	GUMITE WGT.: <u>8950 LBS</u>					
37	OPER. LIQUID WGT.: <u>38700 LBS</u>					
38	PACKING WT. <u>39400 LBS</u>					
					39	
					40	
					41	HYDROTEST: SHOP: <u>PSI</u> FIELD: <u>PSI</u>
					42	GAGE LOCATION:
					43	MAX. ALLOW. PRESS. (INT. & CBL.): <u>PSI</u>
UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY					COAL GASIFICATION COMBINED CYCLE PILOT PLANT SIOUX FALLS, SOUTH DAKOTA CONTRACT NO ERDA-FE 14-32-0001-1521	
					FOSTER WHEELER ENERGY CORP 110 SOUTH ORANGE AVENUE LIVINGSTON, NEW JERSEY	
					UNITED STATES ERDA	
					FOSSIL ENERGY	
FW Dwg NO. <u>OP-754-777-A</u>					DRAWN <u>B.A. YOUNG</u> DATE <u>1/8/76</u>	
DESIGNED <u>DATE</u>					REVIEWED <u>DATE</u>	
APPROVED <u>DATE</u>					APPROVED <u>DATE</u>	
REFERENCE DRAWINGS, REQUISITIONS, STANDARDS					DRAWING TITLE: <u>SOLVENT STRIPPER T-302</u>	
<u>OP-754-776</u> <u>OP-754-778</u>					FWEC CONT. 15-1592. REQ'N NO <u>1592-1112A</u>	



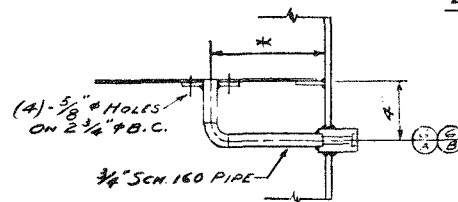
DETAIL "A"



DETAIL "D"



DETAIL "B"



DETAIL "C"

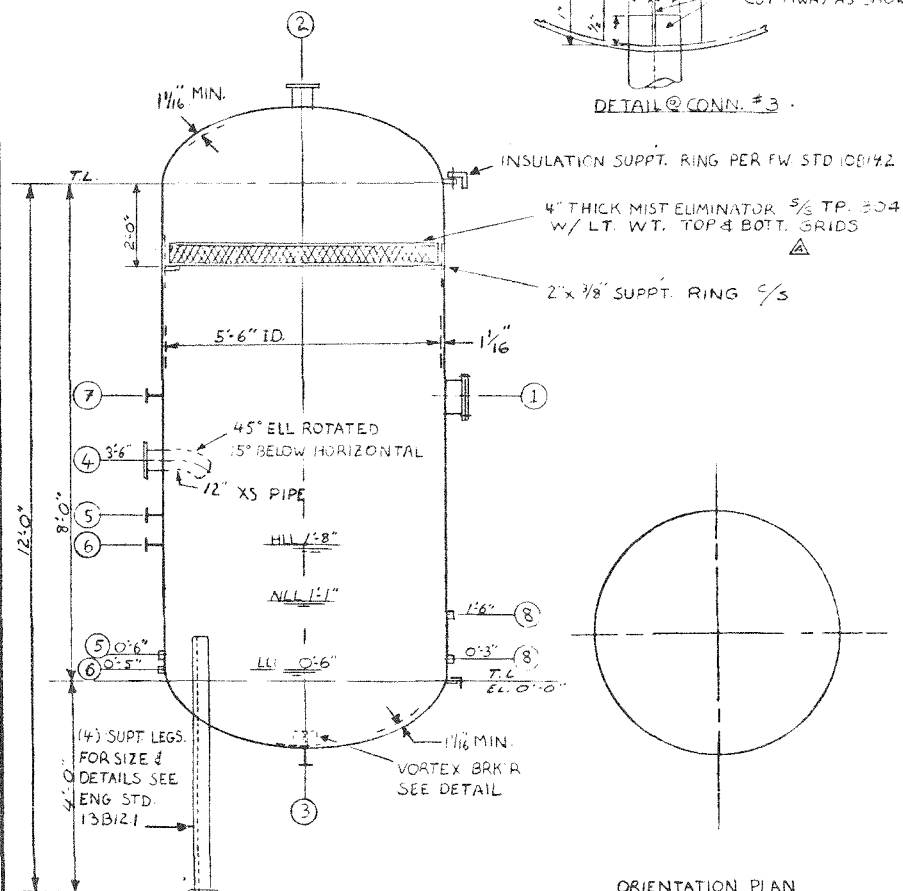
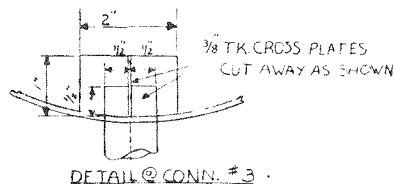
* PROPRIETARY DATA

REFERENCE DRAWINGS, REQUISITIONS, STANDARDS

OP-754-776
OP-754-777

A 1/2 X AS NOTED		B.A.Y.	
NO DATA	REVISION	DATE	APPROVED
UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY			
COAL GASIFICATION COMBINED CYCLE PILOT PLANT SIOUX FALLS, SOUTH DAKOTA CONTRACT NO ERDA-FE 14-32-0001-1521			
FOSTER WHEELER ENERGY CORP 110 SOUTH ORANGE AVENUE LIVINGSTON, NEW JERSEY		UNITED STATES ERDA	
FW DNG NO. OP-754-778-A		FOSSIL ENERGY	
DRAWN	B.A.YOUNG	DATE	1/8/76
CHECKED		DATE	
APPROVED		DATE	
DRAWING TITLE			
SOLVENT STRIPPERS-302			
FWEC CONT. 15-1592		REQ'N NO 1592-1112A	

1. INSULATION BY OTHERS-INSULATION SUPPT. RINGS BY VESSEL FABRICATOR



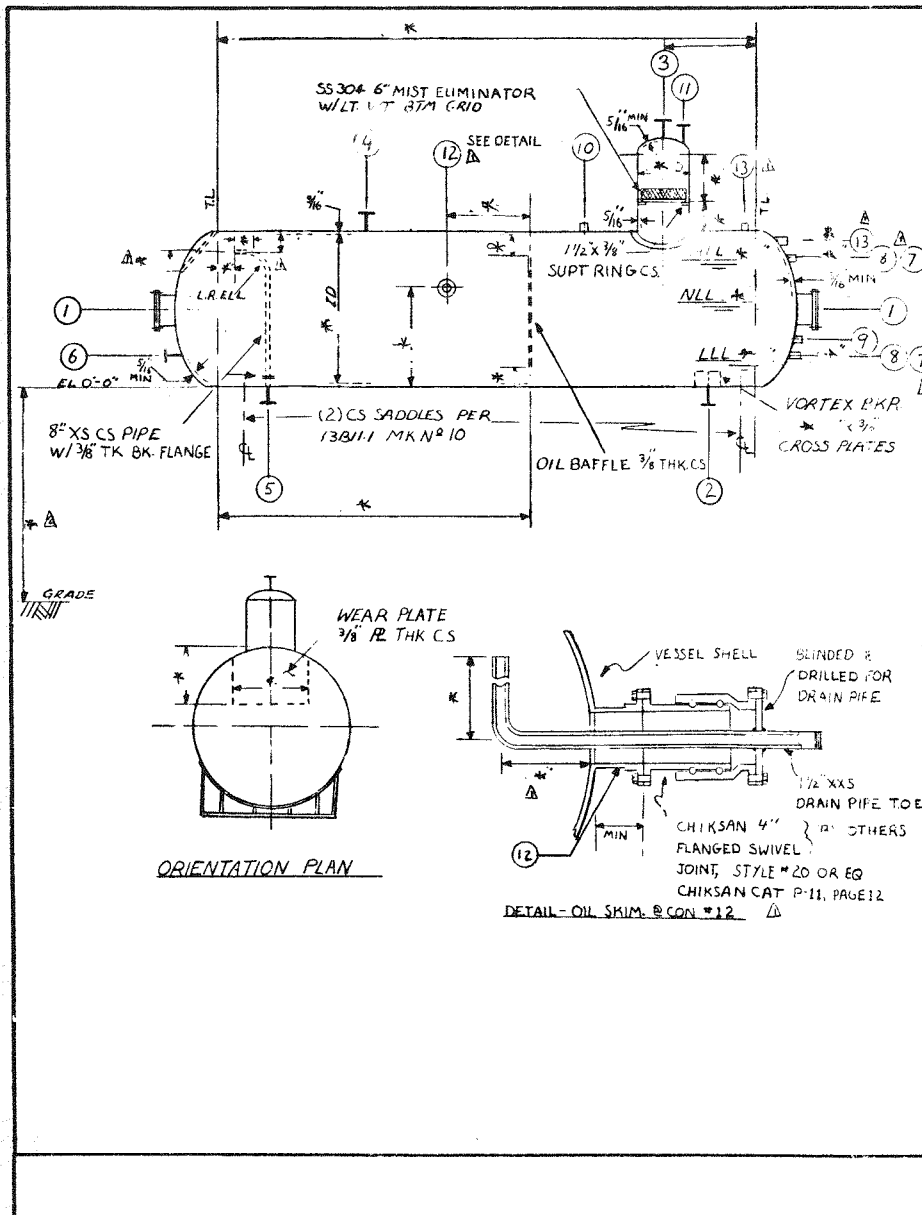
ORIENTATION PLAN

VESSEL DATA

DWG. REV.	DATE	ISSUED FOR	ITEM NO.	DESCRIPTION	QTY.	REQ'D BY
OP			1	ITEM NO. D-301		NO. REQ'D: ONE
	DATE OF ORDER	(A) PURCHASE SHELL AND HEAD MATERIAL. PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.	2	SERVICE: ACID GAS SCRUBBER KNOCK-OUT		
		(B) ISSUE CHECKED FOSTER WHEEL DRAWING. PURCHASE ALL OTHER MATERIALS. FINALIZE AND SUBMIT CHECKED SHOP DETAIL DRAWING WITHIN ONE WEEK OF RELEASE DATE. PROCEED WITH COMPLETE FABRICATION.	3	DRUM		
		(C) VENDOR'S DRAWING RETURNED	4	DIAMETER: 5'-6" I.D.		
		(D) FIELD CONSTRUCTION	5	TAILLET LENGTH: 8'-0"		
			6	OPER. PRESSURE: NORM.: 360 PSIG		
			7	ASPH. LIQUID LEVEL MAR.: 360 PSIG		
			8	STEAM PRESSURE: 411 PSIG		
			9	OPER. LIQUID HOLD-UP PRESS: 1 PSIG		
			10	OPER. PRESS. DROP THRU VESSEL: 1 PSIG		
			11	MAX. RELIEVING PRESS. @ TOP NO.: 410 PSIG		
			12	MAX. OPER. TEMPERATURE: * F		
			13	DESIGN TEMPERATURE: 150°F		
			14	SPECIFIC GRAVITY (PROCESS FLUID): 1.0		
			15	CODE: ASME SECTION VIII, STAMPED: YES		
			16	P. H. M. T.: FOR CODE: NO FOR PROCESS: NO		
			17	RADIOGRAPHED: SPOT		
			18	JOINT EFFICIENCY: 85%		
			19	CORROSION ALLOWANCE: SHELLS: 1/8 HEADS: 1/8"		
			20	MATL. SHELL: SA-516-70		
			21	MATL. HEADS: SA-516-70		
			22	MATL. SUPPORTS: SA-36		
			23	TYPE OF HEADS: 2:1 ELLIP		
			24	EXTERNAL BOLTING: SA-143-B7/5-194-2H		
			25	INTERNAL BOLTING:		
			26	GASKETS: COMPRESSED ASBESTOS 1/8" THK		
			27	BOLT HOLES: STRADDLE VESSEL CENTERLINE		
			28	PAINT: LEGS ONLY PER SPEC. 1590-83A1		
			29	INSULATION: YES, PROCESS STABILIZATION *		
			30	SHIPMENT: ONE PIECE		
			31	* SEE NOTE #1		
			32	EMPTY WT.: 13500 LBS		
			33	WATER WGT. (ONLY) 14556 LBS		
			34	TRAYS WGT.: LBS		
			35	INSULATION WGT.: LBS		
			36	GUBITE WGT.: LBS		
			37	OPER. LIQUID WGT.: LBS		
			38			
			39			
			40			
			41	HYDROTEST: SHOP: FIELD: PSIG		
			42	GAGE LOCATION:		
			43	MAX. ALLOW. PRESS. (WT. & COLOR): PSIG		

NOZZLE CHART		CORR. NO.	
SIZE	USAS. RATING	SERVICE	NO. REQ'D
1" 1/2	300# RF	MAINWY "FLAMIT"	1
2"		VAPOR OUTLET	1
3"		LIQUID OUTLET	1
4"		INLET	1
5"	WCOO RAG	LG	2
6"	1 1/2	LC	2
7"	3/4	PI	1
8"	1"	LLA	2

UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY	
COAL GASIFICATION COMBINED CYCLE PILOT PLANT	
SIOUX FALLS, SOUTH DAKOTA	
CONTRACT NO. ERDA-FE-14-32-0001-1521	
FOSTER WHEELER ENERGY CORP. 110 SOUTH ORANGE AVENUE LIVINGSTON, NEW JERSEY	UNITED STATES ERDA
FW ENG NO. OP-754-774-A	FOSSIL ENERGY
DESIGNED BY: R. L. BURK	DATE: 11/18/75
CHECKED BY: _____	DATE: _____
APPROVED BY: _____	DATE: _____
PROJECT TITLE: ACID GAS SCRUBBER KNOCK-OUT DRUM	PROJECT NUMBER: _____
PAGE CONT. 15-1592	REQ. NO. 1592-1131A



RELEASES				VESSEL DATA	
DWG. REV.	DATE	ISSUED FOR	1	ITEM NO: D-302	NO. REQ'D: ONE
OP	DATE OF ORDER	① PURCHASE SHELL AND HEAD MATERIAL. PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.	2	SERVICE: SOLVENT FLASH DRUM	
		② ISSUE CHECKED FOSTER WHEEL DRAWING. PURCHASE ALL OTHER MATERIALS. FINALIZE AND SUBMIT CHECKED SHOP DETAIL DRAWING WITHIN ONE WEEK OF RELEASE DATE. PROCEED WITH COMPLETE FABRICATION.	3		
		③ VENDOR'S DRAWING RETURNED	4	DIAMETER: 10	
		④ FIELD CONSTRUCTION	5	FLANGENT LENGTH: *	
			6	OPER. PRESSURE: NORM.: *	PSIG
			7	LARGE LIQUID LEVEL: MAX.: *	PSIG
			8	DESIGN PRESSURE: *	PSIG
			9	OPER. LIQUID HOLD-UP PRESS: 3	PSI
			10	OPER. PRESS. DROP THRU VESSEL: -	PSI
			11	MAX. RELIEVING PRESS. @ TOP NO.: *	PSIG
			12	MAX. OPER. TEMPERATURE: *	F
			13	DESIGN TEMPERATURE: *	F
			14	SPECIFIC GRAVITY (PROCESS FLUID): *	
			15	CODE: ASME SECC VIII DIV 1	STAMPED: YES
			16	P.W.M.T. FOR CODE: NO	FOR PROCESS: NO
			17	RADIOGRAPHED: SPCT	
			18	JOINT EFFICIENCY: 85%	
			19	CORROSION ALLOWANCE SHELLS: 1/8" HEADS: 1/8"	
			20	MATL. SHELL: SA-285-C	
			21	MATL. HEADS: SA-285-C	
			22	MATL. SUPPORTS: SA-285-C	
			23	TYPE OF HEADS: R/L FLIP	
			24	EXTERNAL BOLTING: SA-193 B7/SA-194-2H	
			25	INTERNAL BOLTING: -	
			26	GASKETS: COMPRESSED ASBESTOS 1/16" THK	
			27	BOLT HOLES: STRADDLE VESSEL CENTERLINE	
			28	PAINT: SADDLES ONLY PER SPEC 157C P-3A1	
			29	INSULATION: YES COLD CONSERVATION (BY OTHERS)	
			30	SHIPMENT: ONE PIECE	
			31		
			32	EMPTY WGT.: 13400	LBS
			33	WATER WGT. (ONLY) 54633	LBS
			34	TRAYS WGT.: -	LBS
			35	INSULATION WGT.: -	LBS
			36	GUNITE WGT.: -	LBS
			37	OPER. LIQUID WGT.: -	LBS
			38		
			39		
			40		
			41	HYDROTEST: SHOP: FIELD: PSI	
			42	GAGE LOCATION: -	
			43	MAX. ALLOW. PRESS. (REV & COLB): PSI	
UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY COAL GASIFICATION COMBINED CYCLE PILOT PLANT SIOUX FALLS, SOUTH DAKOTA CONTRACT NO ERDA-FE 14-32-0001-1521					
FOSTER WHEELER ENERGY CORP 10110 SOUTH ORANGE AVENUE LIVINGSTON, NEW JERSEY			UNITED STATES ERDA FOSSIL ENERGY		
FW DWS NO OP-754-775-B DRAWN: R. K. LUKS CHECKED: [blank] APPROVED: [blank]			DATE: 11/18/76 DATE: [blank] DATE: [blank]		
REFERENCE DRAWINGS, REQUISITIONS, STANDARDS 1590-10A1 1590-83A1 13B111 1590-1100B 1590-52A 10B132 1590-50A2 10B151					
SOLVENT FLASH DRUM D-302 FWEC CONT. 15-1592			REQ'N NO 1592-1131B		

* PROPRIETARY DATA

REV.		DATE	ISSUED FOR	DATE	OF	ORDER
OP						
1	ITEM NO. D-303	NO. REQ'D: ONE				
2	SERVICE SOLVENT STOPPER 354.2					
3	DRUM					
4	DIMENSION 3'-0" I.D.					
5	WEIGHT 7'-6"					
6	COIL PRESSURE: NORM.					
7	MAX. LIQUID LEVEL MAX.					
8	DESIGN PRESSURE					
9	COIL LIQUID HOLD UP PRESS.					
10	COIL PRESS. DASH TRUCK WEIGHT					
11	MAX. RELIEFING PRESS. & TOP NO.					
12	MAX. OPER. TEMPERATURE					
13	DESIGN TEMPERATURE					
14	SPECIFIC GRAVITY (REL. TO WATER)					
15	COIL ASSESSMENT: YES					
16	COIL ASSESSMENT: NO					
17	PROPOSED SPOT					
18	COIL EFFICIENCY: 0.85					
19	COMPOSITION ALLOWANCE SHELLS: 8"					
20	MATL. SHELL: SA-516 GR 55					
21	MATL. HEADS: SA-516 GR 55					
22	MATL. SUPPORTS: SA-26					
23	TYPE OF HEADS: SA-516 GR 55					
24	EXTERNAL BOLTING: SA-516 GR 55					
25	INTERNAL BOLTING					
26	GASKETS: 1/8" COIL PRESS. ASSES-05					
27	BOLT HOLES: STAINLESS STEEL CENTERS					
28	PAINT: AS PER SPEC 1590-83A1					
29	INSULATION: NONE					
30	SHIPMENT: ONE PIECE					
31	EMPTY WEIGHT: 2850 LBS					
32	WATER WEIGHT: 3970 LBS					
33	TRAYS WEIGHT: 1010 LBS					
34	INSULATION WEIGHT: 1010 LBS					
35	CURITE WEIGHT: 1010 LBS					
36	OPEN LIQUID WEIGHT: 1010 LBS					
37	MAX. ALLOW. PRESS. (WATER COLUMN)					
38	GAGE LOCATION: FIELD					
39	HYDROTEST: MOP					
40	MAX. ALLOW. PRESS. (WATER COLUMN)					

RELEASES

VESSEL DATA

REV.		DATE	ISSUED FOR	DATE	OF	ORDER
OP						
1	ITEM NO. D-303	NO. REQ'D: ONE				
2	SERVICE SOLVENT STOPPER 354.2					
3	DRUM					
4	DIMENSION 3'-0" I.D.					
5	WEIGHT 7'-6"					
6	COIL PRESSURE: NORM.					
7	MAX. LIQUID LEVEL MAX.					
8	DESIGN PRESSURE					
9	COIL LIQUID HOLD UP PRESS.					
10	COIL PRESS. DASH TRUCK WEIGHT					
11	MAX. RELIEFING PRESS. & TOP NO.					
12	MAX. OPER. TEMPERATURE					
13	DESIGN TEMPERATURE					
14	SPECIFIC GRAVITY (REL. TO WATER)					
15	COIL ASSESSMENT: YES					
16	COIL ASSESSMENT: NO					
17	PROPOSED SPOT					
18	COIL EFFICIENCY: 0.85					
19	COMPOSITION ALLOWANCE SHELLS: 8"					
20	MATL. SHELL: SA-516 GR 55					
21	MATL. HEADS: SA-516 GR 55					
22	MATL. SUPPORTS: SA-26					
23	TYPE OF HEADS: SA-516 GR 55					
24	EXTERNAL BOLTING: SA-516 GR 55					
25	INTERNAL BOLTING					
26	GASKETS: 1/8" COIL PRESS. ASSES-05					
27	BOLT HOLES: STAINLESS STEEL CENTERS					
28	PAINT: AS PER SPEC 1590-83A1					
29	INSULATION: NONE					
30	SHIPMENT: ONE PIECE					
31	EMPTY WEIGHT: 2850 LBS					
32	WATER WEIGHT: 3970 LBS					
33	TRAYS WEIGHT: 1010 LBS					
34	INSULATION WEIGHT: 1010 LBS					
35	CURITE WEIGHT: 1010 LBS					
36	OPEN LIQUID WEIGHT: 1010 LBS					
37	MAX. ALLOW. PRESS. (WATER COLUMN)					
38	GAGE LOCATION: FIELD					
39	HYDROTEST: MOP					
40	MAX. ALLOW. PRESS. (WATER COLUMN)					

MOZZLE CHART

* PROPRIETARY DATA

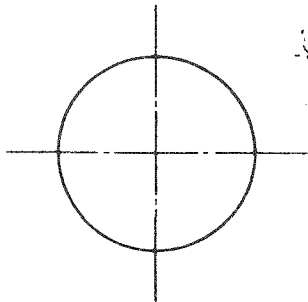
OUTLET PLATES WELDED TOGETHER.

DETAIL "A"

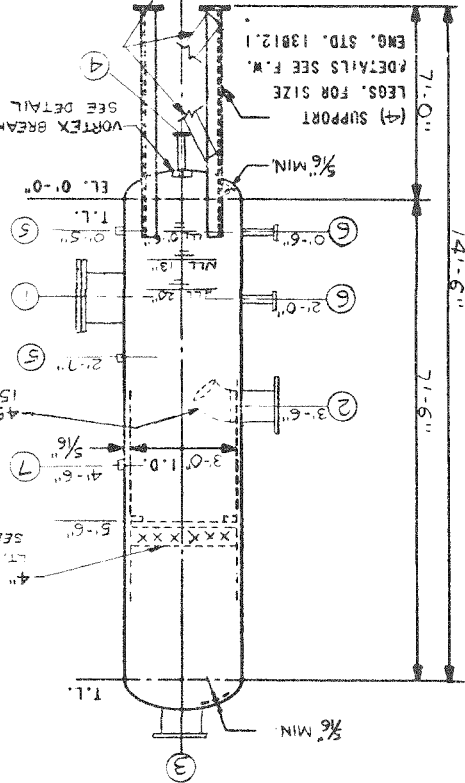
SEE F.W. STD 10315.1

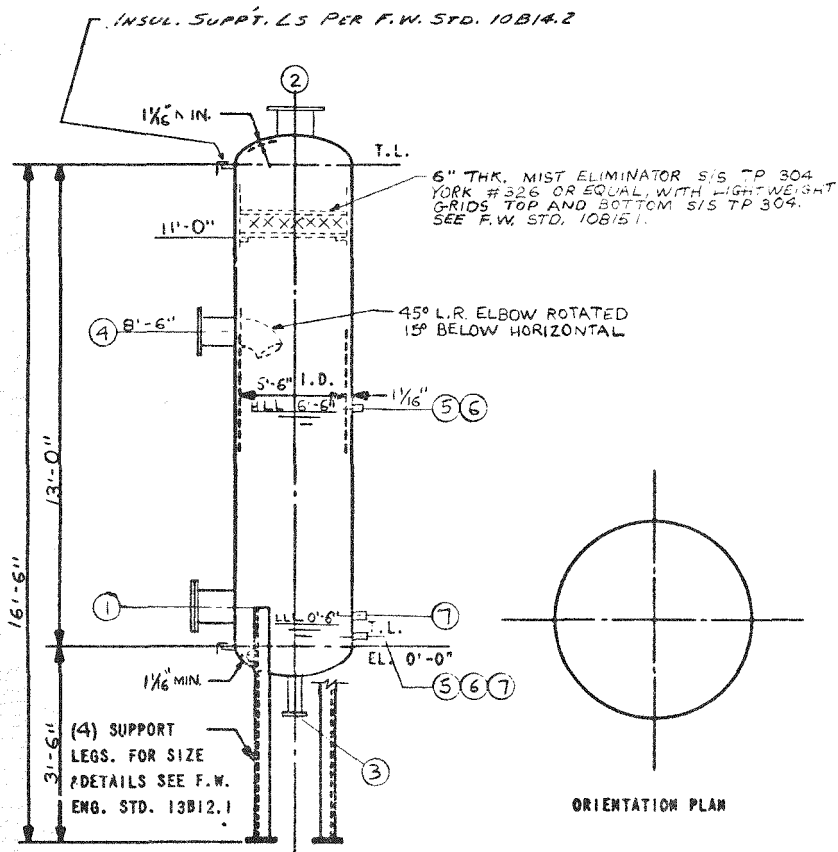
15° BELOW HORIZONTAL

ORIENTATION PLAN

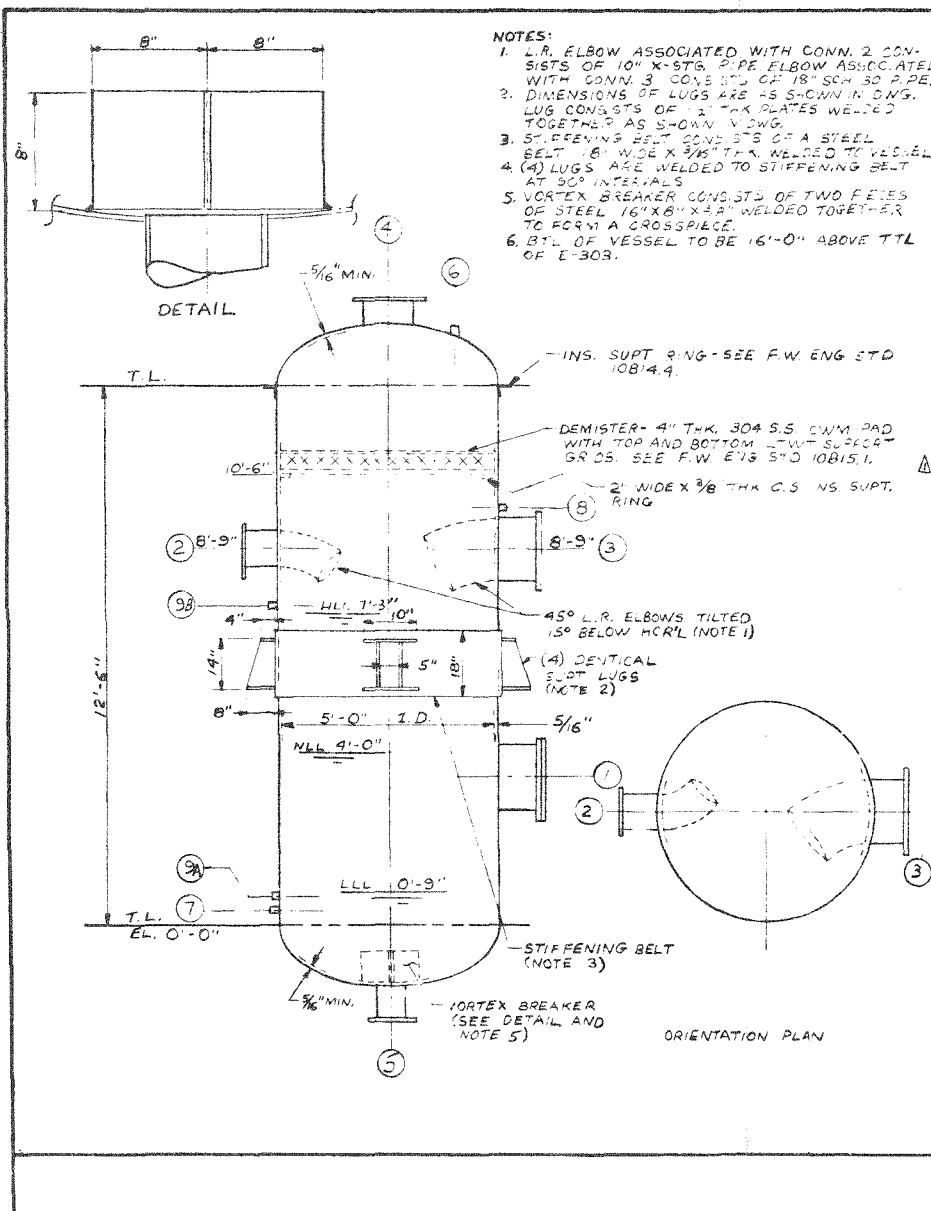


PROVIDE CROSS BRACING FOR SUPPT LEGS





RELEASES				VESSEL DATA	
DWG. REV.	DATE	ISSUED FOR	1	ITEM NO. D-304	NO. REQ'D ONE
OP	DATE OF ORDER	(A) PURCHASE SHELL AND HEAD MATERIAL. PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.	2	SERVICE: PRODUCT GAS	K.O. DRUM
		(B) ISSUE CHECKED FOSTER WHEEL DRAWING. PURCHASE ALL OTHER MATERIALS. FINALIZE AND SUBMIT CHECKED SHOP DETAIL DRAWING WITHIN ONE WEEK OF RELEASE DATE. PROCEED WITH COMPLETE FABRICATION.	3	DIAMETER: 5'-6" I.D.	
		(C) VENDOR'S DRAWING RETURNED	4	TOTAL LENGTH: 13'-0"	
		(D) FIELD CONSTRUCTION	5	OPER. PRESSURE: NORM.	354 PSIG
			6	VESSEL LIQUID LEVEL MAX.	PSI
			7	OPER. PRESSURE	4:4 PSIG
			8	OPER. LIQUID HOLD-UP PRESS.	4 PSIG
			9	OPER. PRESS. SHOP THRU VESSEL	PSI
			10	MAX. RELIEVING PRESS. @ TOP HD.	410 PSIG
			11	MAX. OPER. TEMPERATURE	150°F
			12	DESIGN TEMPERATURE	200°F
			13	SPECIFIC GRAVITY (PROCESS LIQUID)	
			14	CODE: ASME SECT VII DIV. 1 STAMPED: YES	
			15	P.W.N.T. FOR CRACK: NO	FOR PROCESS: NO
			16	RADIOGRAPHED: SPOT	
			17	JOINT EFFICIENCY: 0.85	
			18	CORROSION ALLOWANCE SHELLS: 1/8" HEADS: 1/8"	
			19	MAT'L. SHELL: SA-516 GR 70	
			20	MAT'L. HEADS: SA-516 GR 70	
			21	MAT'L. SUPPORTS: SA-36	
			22	TYPE OF HEADS: 2:1 ELLIPSOIDAL	
			23	EXTERNAL BOLTING: SA-193-B7/SA-194-2H	
			24	INTERNAL BOLTING:	
			25	GASKETS: 1/2" COMPRESSED ASBESTOS	
			26	SOFT HOLES: STRADDLE VESSEL CENTERLINE	
			27	PAINT: LEGS ONLY - PER SPEC 1590-B3A1	
			28	INSULATION: YES (BY OTHERS) PER 1590-B3A1	
			29	SHIPMENT: ONE PIECE	
			30		
			31		
			32	EMPTY WGT.: 18000	LBS
			33	WATER WGT.: 23300	LBS
			34	TRAYS WGT.:	LBS
			35	INSULATION WGT.:	LBS
			36	GRUNITE WGT.:	LBS
			37	OPER. LIQUID WGT.: 12200	LBS
			38		
			39		
			40		
			41	HYDROTEST: SHOP: FIELD: PSI	
			42	GAGE LOCATION:	
			43	MAX. ALLOW. PRESS. (HEAT & COLD): PSI	
UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY					
COAL GASIFICATION COMBINED CYCLE PILOT PLANT SIOUX FALLS, SOUTH DAKOTA CONTRACT NO. EPCA-FE 14-32-0001-1521					
FOSTER WHEELER ENERGY CORP. 110 SOUTH ORANGE AVENUE LIVINGSTON, NEW JERSEY				UNITED STATES ERDA FOSSIL ENERGY	
FW Dwg. NO. OP-754-781					
DESIGN: MS DATE: 2/2/78				REVIEW: DATE:	
APPROVED: DATE:				APPROVED: DATE:	
REFERENCE DRAWINGS, REQUISITIONS, STANDARDS					
1590-10A1; 1590-1100A; 1590-B3A1; 1590-50A1					
1590-520A; 10B15.1; 13B12.1; 10B13.2; 1590-82A 10B14.2					
DRAWING TITLE: PRODUCT GAS K.O. DRUM D-304				FWEC CONT. 15-1592 REQ'N NO. 1592-11B1D	



RELEASES

DWG. REV.	DATE	ISSUED FOR
0/P	DATE OF ORDER	(A) PURCHASE SHELL AND HEAD MATERIAL. PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.
		(B) ISSUE CHECKED FOSTER WHEEL DRAWING. PURCHASE ALL OTHER MATERIALS. FINALIZE AND SUBMIT CHECKED SHOP DETAIL DRAWING WITHIN ONE WEEK OF RELEASE DATE. PROCEED WITH COMPLETE FABRICATION.
		(C) VENDOR'S DRAWING RETURNED
		(D) FIELD CONSTRUCTION
		(E)

NOZZLE CHART

CONN. NO.	SIZE	USAS. RATING	SERVICE	NO. RE.
1	18"	1500 R.F.	WATERWAY/H.D. IT	1
2	10"		VAPOR LIQ. INLET	1
3	18"		VAPOR LIQ. RETURN	1
4	10"		VAPOR OUTLET	1
5	2"		LIQ. OUTLET	1
6	1/2"		PSI	1
7	3/4"	6000# 1.6	TI	1
8	3/4"		PI	1
9	2"		LG/LC	2

VESSEL DATA

1	ITEM NO.: D-305	NO. REQ'D:
2	SERVICE: REFRIGERANT	NO. DRUM: A
3		
4	DIAMETER: 5'-0" (1)	
5	TAGENT LENGTH: 12'-6" (1)	
6	OPER. PRESSURE: NORM.: 30 (1) PSIG	
7	ABOVE LIQ. LEVEL MAX.: 30 (1) PSIG	
8	DESIGN PRESS. RE: 59 PSIG	
9	OPER. LIQUID HOLD-UP PRESS: 36 PSIG	
10	OPER. PRESS. DROP THRU VESSEL: PSI	
11	MAX. RELIEVING PRESS. @ TOP NO.: 55 PSIG	
12	MAX. OPER. TEMPERATURE: 4	
13	DESIGN TEMPERATURE: 4	
14	SPECIFIC GRAVITY: PROCESS LIQ.:	
15	CODE: ALVE. SECT. D.U.S. STAMPED: YES	
16	P.W.M.T. FOR CODE: NO FOR PROCESS: NO	
17	RADIOGRAPHED: SA	
18	JOINT EFFICIENCY: C.H.S.	
19	CORROSION ALLOWANCE SHELLS: 2" HEADS: 1/8"	
20	MATL. SHELL: SA-285 GR C	
21	MATL. HEADS: SA-285 GR C	
22	MATL. SUPPORTS: SA-285 GR C	
23	TYPE OF HEADS: 2 1/2" E-F-S: 2 1/2"	
24	EXTERNAL BOLTING: SA-285 GR C, SA-94-2H	
25	INTERNAL BOLTING:	
26	GASKETS: 1/2" COMPRESSED ASBESTOS	
27	BOLT HOLES: STRADDLE VESSEL CENTERLINE	
28	PAINT: PER SPEC 530-631-1 LUGS ONLY	
29	INSULATION: YES (EX. CT.ERS)	
30	SHIPMENT: ONE PIECE	
31		
32	EMPTY WGT.: 6960 LBS	
33	WATER WGT.: 17700 LBS	
34	TRAYS WGT.: LBS	
35	INSULATION WGT.: LBS	
36	GUNITE WGT.: LBS	
37	OPER. LIQUID WGT.: 11300 LBS	
38		
39	YES. FAB. TO SUPPLY INS. SUPT. RING	
40		
41	HYDROTEST: SHOP: FIELD: PSI	
42	GAGE LOCATION:	
43	MAX. ALLOW. PRESS. (REG. & COLOR): PSI	

* PROPRIETARY DATA

UNITED STATES
ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION
FOSSIL ENERGYCOAL GASIFICATION COMBINED CYCLE PILOT PLANT
SIOUX FALLS, SOUTH DAKOTA
CONTRACT NO. ERDA-FE 14-32-0001-1521FOSTER WHEELER ENERGY CORP
110 SOUTH ORANGE AVENUE
LIVINGSTON, NEW JERSEYUNITED STATES
ERCA

FW DNG NO. OP-764-568-A

FOSSIL ENERGY

DRAWN: MS

DATE: 3/2/76

CHECKED: MS

DATE: 3/2/76

APPROVED: MS

DATE: 3/2/76

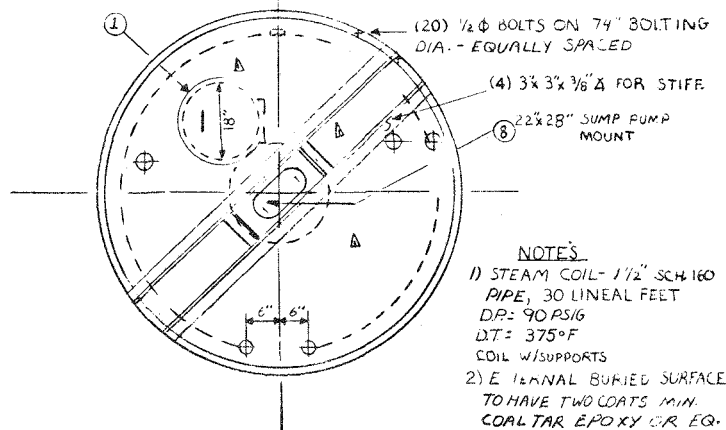
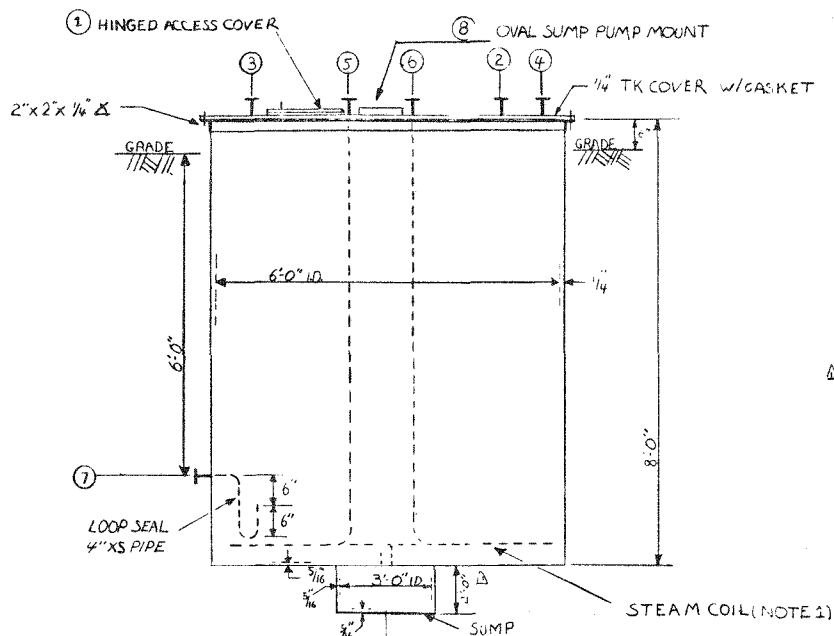
REFRIGERANT K.O. DRUM D-305

FWEC CONT 15-1592

REQ. N. NO. 1592

REFERENCE DRAWINGS, REQUISITIONS, STANDARDS

F.W. SPECS
530-631 50-11
530-632 52-4
530-633 52-4
F.W. ENG. STDs
10815.1
10814.4



- NOTES**
- 1) STEAM COIL- 1 1/2" SCH 160 PIPE, 30 LINEAL FEET DP: 90 PSIG DT: 375°F COIL W/SUPPORTS
 - 2) EXTERNAL BURIED SURFACE TO HAVE TWO COATS MIN. COAL TAR EPOXY U/R EQ.
 - 3) WELDING IN ACCORDANCE WITH SEC. IX OF ASME CODE

RELEASES				VESSEL DATA	
DWG. REV.	DATE	ISSUED FOR	ITEM NO.	DESCRIPTION	REMARKS
OP		1 PURCHASE SHELL AND HEAD MATERIAL. PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.	1	ITEM NO. TK-302	CO. REQ'D: ONE
		2 ISSUE CHECKED FOSTER WHEEL DRAWING. PURCHASE ALL OTHER MATERIALS. FINALIZE AND SUBMIT CHECKED SHOP DETAIL DRAWING WITHIN ONE WEEK OF RELEASE DATE. PROCEED WITH COMPLETE FABRICATION.	2	SERVICE: SOLVENT SUMP	
		3 VENDOR'S DRAWING RETURNED	3	DIAMETER: 6'-0"	ID
		4 FIELD CONSTRUCTION	4	HEIGHT: 8'-0"	
			5	DESIGN PRESSURE: ATM	PSI
			6	OPER. LIQUID HOLD-UP PRESS: 3	PSI
			7	OPER. PRESS. DROP: -	PSI
			8	MAX. RELIEVING PRESS. @ TOP NO.: ATM	PSI
			9	MAX. OPER. TEMPERATURE: 250°F	
			10	DESIGN TEMPERATURE: 300°F	
			11	SPECIFIC GRAVITY (PROCESS FLUID): 1.05	
			12	CODE: GOOD COMMERCIAL PRAC. STAMPED: NO	
			13	P.W.M.T.: FOR CODE: NO FOR PROCESS: NO	
			14	RADIOGRAPHED: SPOT	
			15	JOINT EFFICIENCY: 85%	
			16	CORROSION ALLOWANCE SHELLS: 1/16" HEADS: 1/16"	
			17	MATL. SHELL: SA-283-C	
			18	MATL. HEADS: SA-283-C	
			19	MATL. SUPPORTS: -	
			20	TYPE OF HEADS: FLAT PLATE	
			21	EXTERNAL BOLTING: SA-307-A	
			22	INTERNAL BOLTING: -	
			23	GASKETS: COMPRESSED ASBE 105 1/16" THK.	
			24	BOLT HOLES: STRAIGHT VESSEL CENTERLINE	
			25	PAINT: PER SPEC 1592-83A1	
			26	INSULATION: NONE	
			27	SHIPMENT: ONE PIECE	
			28	EMPTY WGT.: 4300	LBS
			29	WATER WGT. (ONLY) 14114	LBS
			30	TRAYS WGT.: -	LBS
			31	INSULATION WGT.: -	LBS
			32	GUNITE WGT.: -	LBS
			33	OPER. LIQUID WGT.: -	LBS
			34	HYDROTEST: SHOP: FIELD: PSI	
			35	GAGE LOCATION: -	
			36	MAX. ALLOW. PRESS. (HOT & COLD): PSI	
UNITED STATES ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION FOSSIL ENERGY COAL GASIFICATION COMBINED CYCLE PILOT PLANT SIOUX FALLS, SOUTH DAKOTA CONTRACT NO. EROD-FE 14-32-0001-1521 FOSTER WHEELER ENERGY CORP 2210 SOUTH ORANGE AVENUE NEW LIVINGSTON, NEW JERSEY UNITED STATES ERDA FOSSIL ENERGY FW Dwg. NO. 00-754-782-A DRAWN: RIK CHECKED: DATE: 10/15/76 REVIEWED: DATE: 10/15/76 SOLVENT SUMP TK-302 FWC CONT. 15-1592 REQ'N NO. 1592-1141B					

REFERENCE DRAWINGS, REQUIREMENTS, STANDARDS
1590-1042, 1590-1100B, 1590-1042, SEC 4
1590-83A1

HEAT TRANSFER EQUIPMENT

FORM NO. 135-128A

MATERIAL REQUISITION

POWER WORKING METHOD CORPORATION
110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.SHELL & TUBE
EXCHANGERS

PAGE 1 OF 1

CONTRACT NO. 15-1592		REQ'N. NO. 1592-1211-A		DATE JAN. 28/76	
CUSTOMER'S NAME UNITED STATES - ERDA - FOSSIL ENERGY		LOCATION SIOUX FALLS, S. DAKOTA			
SUPERSEDED BY					
CHANGE NO.	C-1	C-2	C-3	C-4	C-5
DATE	4-13-76				
SERVICE OF UNIT PRODUCT GAS HEAT EXCHANGER		ITEM NO. E-302			
SIZE *		TYPE BFU	(HORIZ)	CONNECTED IN	-
SQ. FT. SURF./UNIT (EFF)	*	SHELLS/UNIT ONE		SQ. FT. SURF./SHELL (EFF)	*
PERFORMANCE OF ONE UNIT					
FLUID CIRCULATED		SHELL SIDE		TUBE SIDE	
TOTAL FLUID ENTERING		PRODUCT GAS (3)		FEED GAS	
VAPOR		173,970 LB/HR		* LB/HR	
LIQUID		LB/HR		LB/HR	
STEAM		10 LB/HR		* LB/HR	
NON-CONDENSABLES		173,960 LB/HR		* LB/HR	
FLUID (VAPORIZED)(CONDENSED)		LB/HR		* LB/HR	
STEAM CONDENSED		LB/HR		* LB/HR	
GRAVITY (LBS/FT ³)		1.65		1.67	
VISCOSITY (Cps)				*	
MOLECULAR WEIGHT		24.65		*	
SPECIFIC HEAT		0.29 BTU/LB-°F		0.28 BTU/LB-°F	
THERMAL CONDUCTIVITY		BTU/HR-FT-°F		BTU/HR-FT-°F	
LATENT HEAT		BTU/LB		BTU/LB	
TEMPERATURE IN		* °F		110 °F	
TEMPERATURE OUT		95 °F		* °F	
OPERATING PRESSURE, INLET		357 (PSIG)		368 (PSIG)	
NO. PASSES PER SHELL		Two		Two	
VELOCITIES		FT/SEC		FT/SEC	
PRESSURE DROP - ALLOW. CALC'D.		5.0 PSI		3.0 PSI	
FOULING RESISTANCE, MIN.		0.001		0.001	
HEAT EXCHANGED - BTU/HR.		* MTD CORRECTED-°F		*	
TRANSFER RATE - SERVICE		40.1 CLEAN			
CONSTRUCTION OF ONE SHELL					
DESIGN PRESSURE		410 PSIG		410 PSIG	
TEST PRESSURE		PER CODE PSIG		PER CODE PSIG	
DESIGN TEMPERATURE		150 °F		160 °F	
TUBES C.S.	NO.	U's	O.D. 0.75"	BWG 14 (MIN)	LENGTH
SHELL C.S.	*	I.D.		SHELL COVER	STR. PITCH 15/16" Δ
CHANNEL OR BONNET	C.S.	*		CHANNEL COVER	(INTG)(REMOV)
TUBESHEET - STATIONARY	C.S.			TUBESHEET - FLOATING	
BAFFLES - CROSS	C.S.	TYPE	DOUBLE SEGM.	FLOATING HEAD COVER	
BAFFLES - LONG		TYPE		IMPINGMENT PROTECTION	C.S.
TUBE SUPPORTS					
TUBE TO TUBESHEET JOINT					
GASKETS					
CONNECTIONS - SHELL SIDE		IN	12"	OUT	12"
CONNECTIONS - TUBE SIDE		IN	12"	OUT	12"
CORROSION ALLOWANCE - SHELL SIDE		1/8	IN.	TUBE SIDE	1/8 IN.
CODE REQUIREMENTS ASME VIII		TEMA CLASS R			
REMARKS: (1) NOZZLE & SUPPORT LOCATION TO BE AS NOTED ON F.W. STD. 21B11.1					
(2) FOR GENERAL NOTES REFER TO REQ'N. 1590-1200 A WHICH IS AN INTEGRAL PART OF THIS REQ'N					
(3) INLET COMP. (MOLE %): 6.69 CO ₂ , 2 PPMV H ₂ S, 0.01 COS, 4.10 CH ₄ , 14.30 H ₂ , 20.18 CO, 54.71 N ₂ , 5 PPMV NH ₃ .					

* PROPRIETARY DATA

MATERIAL REQUISITION

PROCESSING AND REFINING CORPORATION
110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

SHELL & TUBE
EXCHANGERS

PAGE 1 OF 1

CONTRACT NO. 15-1592		REQ'N. NO. 1592-1211-B		DATE 22/OCT/75	
CUSTOMER'S NAME ERDA. FE		LOCATION SIOUX FALLS SOUTH DAKOTA			
SUPERSEDED BY					
CHANGE NO.	C-1	C-2	C-3	C-4	C-5
DATE					
SERVICE OF UNIT SOLVENT CHILLER			ITEM NO. E-303		
SIZE *	TYPE BEM (FTS)		CONNECTED IN —		
SQ. FT. SURF./UNIT 0	*	SHELLS/UNIT ONE	SQ. FT. SURF./SHELL (175) *		
PERFORMANCE OF ONE UNIT					
FLUID CIRCULATED		SHELL SIDE		TUBE SIDE	
LEAN SOLVENT		REFRIGERANT R-22			
TOTAL FLUID ENTERING	*	LB/HR	*	LB/HR	
VAPOR	—	LB/HR		LB/HR	
LIQUID	*	LB/HR	*	LB/HR	
STEAM		LB/HR		LB/HR	
FLUID CONDENSABLES		LB/HR		LB/HR	
FLUID (VAPORIZED - CONDENSED)		LB/HR	*	LB/HR	
STEAM CONDENSED		LB/HR		LB/HR	
GRAVITY 4.85 / FT³	*		82.72 LIQ / .8 VAP		
VISCOSITY	—	*	≈ .5		
MOLECULAR WEIGHT			80.47		
SPECIFIC HEAT	*	BTU/LB-°F		BTU/LB-°F	
THERMAL CONDUCTIVITY	*	BTU/HR-FT-°F		BTU/HR-FT-°F	
LATENT HEAT		BTU/LB	92	BTU/LB	
TEMPERATURE IN	*	°F	*	°F	
TEMPERATURE OUT	*	°F	*	°F	
OPERATING PRESSURE INLET	407	(PSIG)	*	(PSIA)	
NO. PASSES PER SHELL	ONE		ONE		
VELOCITY		FT/SEC		FT/SEC	
PRESSURE DROP - ALLOW. CALC'D.	30.	PSI	1.2	PSI	
FOULING RESISTANCE, MIN.	.001		.001		
HEAT EXCHANGED - BTU/HR.	*	MTD CORRECTED-°F	*		
TRANSFER RATE - SERVICE	85	CLEAN			
CONSTRUCTION OF ONE SHELL					
DESIGN PRESSURE	565	PSIG		PSIG	
TEST PRESSURE	ASME CODE	PSIG	ASME CODE	PSIG	
DESIGN TEMPERATURE	150	°F		°F	
TUBES C-STL	NO. *	O.D. .75	BWG 14	LENGTH *	PITCH 15/16 TRI
SHELL C-STL		I.D. *	SHELL COVER NONE	(INTEG)(REMOV)	
BONNET C-STL		CHANNEL COVER NONE			
TUBESHEET - STATIONARY C-STL		TUBESHEET - FLOATING NONE			
BAFFLES - CROSS C-STL TYPE SEGS.		FLOATING HEAD COVER NONE			
BAFFLES - LONG TYPE		IMPINGMENT PROTECTION YES.			
TUBE SUPPORTS					
TUBE TO TUBESHEET JOINT					
GASKETS					
CONNECTIONS - SHELL SIDE	IN 1 x 8"	OUT 1 x 8"	RATING 300# RF		
CONNECTIONS - TUBE SIDE	IN 1 x 8"	OUT 1 x 8"	RATING 150# RF		
CORROSION ALLOWANCE - SHELL SIDE	1/8 IN.	TUBE SIDE	1/8 IN.		
CODE REQUIREMENTS ASME VIII DIV I & 1500-21A1			TEMA CLASS R		
REMARKS: (1) NOZZLE & SUPPORT LOCATION TO BE AS NOTED ON F.W. STD. 21B11.1					
(2) FOR GENERAL NOTES REFER TO REQ'N. 1500-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N					
* PROPRIETARY DATA					

MATERIAL REQUISITION

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

SHELL & TUBE
EXCHANGERS

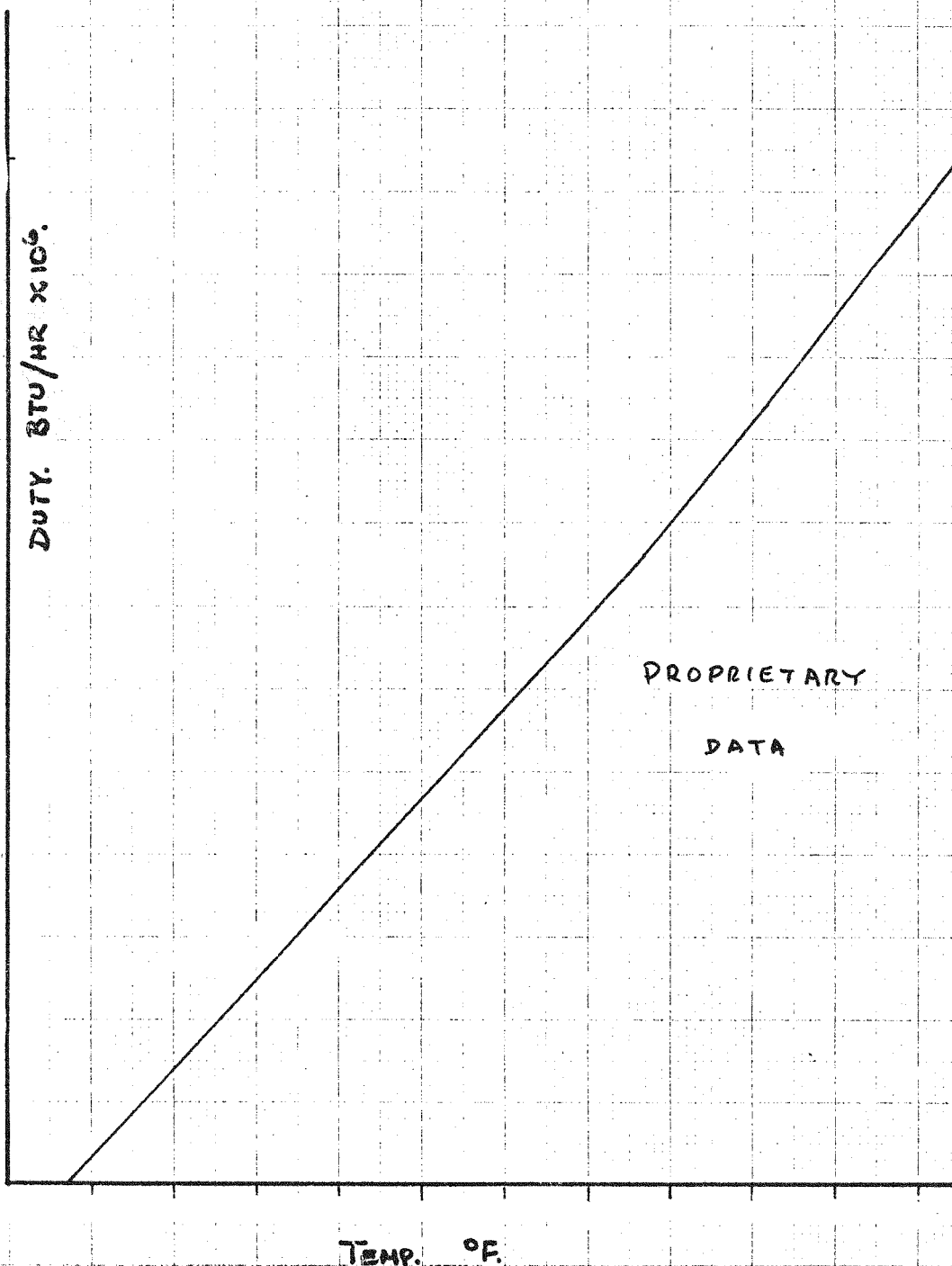
PAGE 1 OF

2

CONTRACT NO. 15-1592		REQ'N. NO. 1592-1211-C		DATE 28/JAN/76	
CUSTOMER'S NAME ERDA-FE		LOCATION SIOUX FALLS S. DAKOTA			
SUPERSEDED BY					
CHANGE NO.	C-1	C-2	C-3	C-4	C-5
DATE	4-9-76				
SERVICE OF UNIT SOLVENT HEAT EXCHANGER				ITEM NO. E-304	
SIZE *	X 30'	TYPE BFM (FTS)	CONNECTED IN SERIES		
SQ. FT. SURF./UNIT	10	* SHELLS/UNIT	*	SQ. FT. SURF./SHELL	10 *
PERFORMANCE OF ONE UNIT					
	SHELL SIDE		TUBE SIDE		
	RICH SOLVENT		LEAN SOLVENT		
FLUID CIRCULATED					
TOTAL FLUID ENTERING	*	LB/HR	*	LB/HR	
VAPOR	*	LB/HR	*	LB/HR	
LIQUID	*	LB/HR	*	LB/HR	
STEAM	*	LB/HR	*	LB/HR	
NON-CONDENSABLES	*	LB/HR	*	LB/HR	
FLUID (VAPORIZED) (CONDENSED)	*	LB/HR	*	LB/HR	
STEAM CONDENSED	*	LB/HR	*	LB/HR	
GRAVITY IN / OUT	* / *		* / *		
VISCOSITY CP. IN / OUT	* / *		* / *		
MOLECULAR WEIGHT	*		*		
SPECIFIC HEAT	*	BTU/LB-°F	*	BTU/LB-°F	
THERMAL CONDUCTIVITY IN / OUT	* / *	BTU/HR-FT-°F	* / *	BTU/HR-FT-°F	
LATENT HEAT	*	BTU/LB	*	BTU/LB	
TEMPERATURE IN	*	°F	*	°F	
TEMPERATURE OUT	*	°F	*	°F	
OPERATING PRESSURE. IN OUT.	*	(PSI) (PSIG)	*	(PSI) (PSIG)	
NO. PASSELS PER SHELL	*		*		
VELOCITY	*	FT/SEC	*	FT/SEC	
PRESSURE DROP - ALLOW. CALC'D.	*	PSI	*	PSI	
FOULING RESISTANCE, MIN.	*	0.001	*	0.001	
HEAT EXCHANGED - BTU/HR.	*		*		
TRANSFER RATE - SERVICE	49.2	CLEAN			
CONSTRUCTION OF ONE SHELL					
DESIGN PRESSURE	*	PSIG	*	PSIG	
TEST PRESSURE	ASME CODE	PSIG	ASME CODE	PSIG	
DESIGN TEMPERATURE	*	°F	*	°F	
TUBES C-STL NO. *	O.D. 0.75" BWG 14 (15)	LENGTH *	PITCH 5/16 IN.		
SHELL C-STL	I.D. *	SHELL COVER NONE	(INTEG) (REMOV)		
CHANNEL OR BONNET C-STL		CHANNEL COVER NONE			
TUBESHEET - STATIONARY C-STL		TUBESHEET - FLOATING NONE			
BAFFLES - CROSS C-STL TYPE VERT SEGS		FLOATING HEAD COVER NONE			
BAFFLES - LONG C-STL TYPE WELDED TO SHELL		IMPINGMENT PROTECTION REQD - C.S.			
TUBE SUPPORTS					
TUBE TO TUBESHEET JOINT ROLLED					
GASKETS					
CONNECTIONS - SHELL SIDE	IN 8	OUT 8	RATING 150 #RF		
CONNECTIONS - TUBE SIDE	IN 8	OUT 8	RATING 300 #RF		
CORROSION ALLOWANCE - SHELL SIDE	1/8 IN.	TUBE SIDE	1/8 IN.		
CODE REQUIREMENTS ASME VIII DIV 3			TMA CLASS R		
REMARKS: (1) NOZZLE & SUPPORT LOCATION TO BE AS NOTED ON F.W. STD. 21B11.1					
(2) FOR GENERAL NOTES REFER TO REQ'N. 1590-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N					
* PROPRIETARY DATA					

ERDA-FE
COAL GASIFICATION
VAPORIZATION CURVE
FOR RICH SOLN.

PAGE 2 OF 2
FW JOB No 15-1592
REQ'N No 1592-1211-C
DATE 28/JAN/76
ITEM No E-304.



MATERIAL REQUISITION

SHELL & TUBE
EXCHANGERS

FOSTER WHEELER CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

PAGE 1 OF

CONTRACT NO. 15-1592		REQ'N. NO. 1592-1211-D		DATE 2/Oct/75	
CUSTOMERS NAME ERDA FE.		LOCATION SIOUX FALLS, S. DAKOTA			
SUPERSEDED BY					
CHANGE NO.	C-1	C-2	C-3	C-4	C-5
DATE	4-9-76				
SERVICE OF UNIT SOLVENT STRIPPER REBOILER			ITEM NO. E-305		
SIZE *	TYPE BHU		CONNECTED IN		
SQ. FT. SURF. / UNIT (GROSS)	* SHELLS / UNIT ONE		SQ. FT. SURF. / SHELL (GROSS) *		
* BEAD SURF IS EFF. PERFORMANCE OF ONE UNIT					
		SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED		SOLVENT SOLUTION		STEAM	
Δ TOTAL FLUID ENTERING	*	LB/HR	*	LB/HR	
VAPOR		LB/HR		LB/HR	
LIQUID	*	LB/HR		LB/HR	
Δ STEAM		LB/HR	*	LB/HR	
NON-CONDENSABLES		LB/HR		LB/HR	
FLUID (VAPORIZED) (CONDENSED)	*	LB/HR		LB/HR	
Δ STEAM CONDENSED		LB/HR	*	LB/HR	
Δ GRAVITY	LIQ.	*			
VISCOSITY	CP LIQ	*			
MOLECULAR WEIGHT		*			
SPECIFIC HEAT		LIQ: * BTU/LB-°F		BTU/LB-°F	
THERMAL CONDUCTIVITY		LIQ: * BTU/HR-FT-°F		BTU/HR-FT-°F	
Δ LATENT HEAT		* BTU/LB	*	BTU/LB	
TEMPERATURE IN		°F	*	°F	
TEMPERATURE OUT		°F	*	°F	
OPERATING PRESSURE, INLET	18 (4) (PSIG)		100 (PSIG)		
NO. PASSES PER SHELL	DOUBLE SPLIT FLOW		TWO		
VELOCITY		FT/SEC		FT/SEC	
PRESSURE DROP - ALLOW. CALC'D.	1.0 PSI	PSI	3.0 PSI	PSI	
FOULING RESISTANCE, MIN.	.001		.0005		
HEAT EXCHANGED - BTU/HR.	*	MTD CORRECTED-°F	*		
TRANSFER RATE - SERVICE	169	CLEAN			
CONSTRUCTION OF ONE SHELL					
DESIGN PRESSURE	*	PSIG	*	PSIG	
TEST PRESSURE	ASME CODE	PSIG	ASME CODE	PSIG	
DESIGN TEMPERATURE	*	°F	*	°F	
TUBES C-STL NO. *	O.D. .75" BWG 14	MIN	LENGTH * SEL PITCH 15/16 Tri		
SHELL C-STL	I.D. *"		SHELL COVER C-STL	(INTEG) (REMOV)	
CHANNEL BONNET C-STL			CHANNEL COVER NONE		
TUBESHEET - STATIONARY C-STL			TUBESHEET - FLOATING NONE		
BAFFLES - CROSS TYPE			FLOATING HEAD COVER NONE *		
BAFFLES - LONG C-STL TYPE			IMPINGMENT PROTECTION YES		
TUBE SUPPORTS C-STL					
TUBE TO TUBESHEET JOINT ROLLED ONLY					
GASKETS					
CONNECTIONS - SHELL SIDE IN 2 X 8"	OUT 2 X 14"	RATING 150#RF			
CONNECTIONS - TUBE SIDE IN 1 X 8"	OUT 1 X 3"	RATING 300#RF			
CORROSION ALLOWANCE - SHELL SIDE 1/8" IN	TUBE SIDE 1/8" IN				
CODE REQUIREMENTS ASME VIII Div I § 1590-21A1	TEMA CLASS R				
REMARKS: (1) NOZZLE & SUPPORT LOCATION TO BE AS NOTED ON F.W. STD. 21B11.1					
(2) FOR GENERAL NOTES REFER TO REQ'N. 1590-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N					
(4) ATMOSPHERIC PRESSURE = 14 PSIA.					
* PROPRIETARY DATA					

MATERIAL REQUISITION

FOSTER WHEELER ENERGY CORPORATION
110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

SHELL & TUBE
EXCHANGERS

PAGE 1 OF 2

CONTRACT NO. 15-1592		REQ'N. NO. 1592-1211-E		DATE 29/JAN/76	
CUSTOMER'S NAME USERDA - FE		LOCATION SIOUX FALLS S. DAKOTA			
SUPERSEDED BY					
CHANGE NO.	C-1	C-2	C-3	C-4	C-5
DATE					
SERVICE OF UNIT SOLVENT STRIPPER CONDENSER				ITEM NO. E-306	
SIZE	* SEL TYPE BEU.		CONNECTED IN —		
SQ. FT. SURF./UNIT EFF. (*)	* SHELLS/UNIT ONE.		SQ. FT. SURF./SHELL EFF. (*)		
* BEND SURF IS EFF.					
PERFORMANCE OF ONE UNIT					
		SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED		COOLING WATER		ACID GAS & H₂O VAP	
TOTAL FLUID ENTERING		396,000 LB/HR		* LB/HR	
VAPOR		LB/HR		* LB/HR	
LIQUID		396,000 LB/HR		LB/HR	
STEAM		LB/HR		* LB/HR	
NON-CONDENSABLES		LB/HR		10,040 LB/HR	
FLUID (VAPORIZED)(CONDENSED)		LB/HR		LB/HR	
STEAM CONDENSED		LB/HR		* LB/HR	
GRAVITY					
VISCOSITY					
MOLECULAR WEIGHT				25.67	
SPECIFIC HEAT		BTU/LB-°F		BTU/LB-°F	
THERMAL CONDUCTIVITY		BTU/HR-FT-°F		BTU/HR-FT-°F	
LATENT HEAT		BTU/LB		957.4 BTU/LB	
TEMPERATURE IN		85 °F		* °F	
TEMPERATURE OUT		110 °F		* °F	
OPERATING PRESSURE, INLET		55 (PSIA) (PSIG)		16 (PSIA) (PSIG)	
NO. PASSES PER SHELL		ONE		TWO	
VELOCITY		FT/SEC		FT/SEC	
PRESSURE DROP - ALLOW. CALC'D.		15. PSI		2. PSI	
FOULING RESISTANCE, MIN.		.002		.002	
HEAT EXCHANGED - BTU/HR.		* 93.6.		MTD CORRECTED-°F 77.2	
TRANSFER RATE - SERVICE		CLEAN			
CONSTRUCTION OF ONE SHELL					
DESIGN PRESSURE		90 PSIG		75 PSIG	
TEST PRESSURE		ASME CODE PSIG		ASME CODE PSIG	
DESIGN TEMPERATURE		160 °F		325 °F	
TUBES 430 SS NO. * O.D.		+ BWG 16 (5) LENGTH		* PITCH 1"30	
SHELL C-STL * I.D.		SHELL COVER C-STL (INTEG) (REMOV)			
BONNET C-STL @ 5/8" 410S CLAD		CHANNEL COVER NONE.			
TUBESHEET - C-STL @ 410S CLAD FOR TEHAR.		TUBESHEET - FLOATING NONE.			
BAFFLES - CROSS C-STL TYPE HORZEGS		FLOATING HEAD COVER 170 VERT U-BENDS.			
BAFFLES - LONG TYPE		IMPINGMENT PROTECTION REQD.			
TUBE SUPPORTS					
TUBE TO TUBESHEET JOINT ROLLED.					
GASKETS					
CONNECTIONS - SHELL SIDE		IN 6" OUT 6"		RATING 150#RF	
CONNECTIONS - TUBE SIDE		IN 10" OUT 8"		RATING 150#RF.	
CORROSION ALLOWANCE - SHELL SIDE		1/8" IN.		TUBE SIDE IN.	
CODE REQUIREMENTS ASME VIII DIV I § 1590 - 21A1		TEMA CLASS R			
REMARKS: (1) NOZZLE & SUPPORT LOCATION TO BE AS NOTED ON F.W. STD. 21B11.1					
(2) FOR GENERAL NOTES REFER TO REQ'N. 1590-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N					
* PROPRIETARY DATA					

HEAT CONTENT
OF
STRIPPER OVERHEAD
15-1592
E-306
SOLVENT STRIPPER CONDENSER
7/23/75

STREAM HEAT CONTENT
MMBTU/HR

PROPRIETARY
DATA

STREAM TEMPERATURE OF

FW Job 15-1592
PAGE 2 OF 2
REQN. 1592-121-E
ITEM E-306

MATERIAL REQUISITION

FOSTER WHEELER CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

DOUBLE PIPE
EXCHANGERS

PAGE 1 OF 1

CONTRACT NO. 15-1592		REQ'N. NO. 1592-1221-A		DATE 1/OCT/75	
CUSTOMERS NAME ERDA - FE		LOCATION SIOUX FALLS SOUTH DAKOTA			
SUPERSEDED BY					
CHANGE NO.	C-1	C-2	C-3	C-4	C-5
DATE	4-9-76				
SERVICE OF UNIT RECYCLE ACID GAS COOLER				ITEM NO. E-307	
SIZE	TYPE - BARE TUBE ☐		FINNED TUBE ☐		MULTITUBE ☐
SQ. FT. SURF./UNIT (BARE) (EXT'D)	SECTIONS/UNIT		SQ. FT. SURF./SECTION (BARE) (EXT'D)		
SECTION ARRANGEMENT -		SHELL SIDE	PAR. BY	SER.	TUBE SIDE
PERFORMANCE OF ONE UNIT					
		SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED		COOLING WATER		RECYCLE GAS	
△ TOTAL FLUID ENTERING	*	LB/HR	*	LB/HR	
VAPOR		LB/HR		LB/HR	
LIQUID	*	LB/HR		LB/HR	
STEAM		LB/HR		LB/HR	
△ NON-CONDENSABLES		LB/HR	*	LB/HR	
FLUID (VAPORIZED)(CONDENSED)		LB/HR		LB/HR	
STEAM CONDENSED		LB/HR		LB/HR	
GRAVITY			*	8/FT³ @	*
VISCOSITY CP.				.02	
MOLECULAR WEIGHT				*	
SPECIFIC HEAT		BTU/LB-°F	.23	BTU/LB-°F	
THERMAL CONDUCTIVITY		BTU/HR-FT-°F	.013	BTU/HR-FT-°F	
LATENT HEAT		BTU/LB		BTU/LB	
TEMPERATURE IN	85	°F	*	°F	
TEMPERATURE OUT	110	°F	120	°F	
OPERATING PRESSURE, INLET	50	(PSI) (PSIG)	373	(PSI) (PSIG)	
NO. PASSES PER SHELL					
VELOCITY		FT/SEC		FT/SEC	
PRESSURE DROP - ALLOW. CALC'D.	15	PSI	5	PSI	
FOULING RESISTANCE, MIN.	.002		.001		
△ HEAT EXCHANGED - BTU/HR.	* (note 3)		MTD CORRECTED-°F		
TRANSFER RATE - SERVICE		CLEAN			
CONSTRUCTION OF ONE SECTION					
DESIGN PRESSURE	90	PSIG	420	PSIG	
TEST PRESSURE	ASME CODE	PSIG	ASME CODE	PSIG	
△ DESIGN TEMPERATURE	160	°F	345	°F	
DIA	TKNS	NOM. LENGTH	O.D. SCH.	Max = 25'	O.D. SCH.
MATERIAL	C-STL		C-STL		
CORROSION ALLOWANCE	1/8"	IN.		IN.	
SECTION: NOZZLE SIZE, IN OUT					
NOZZLE RATING	150# RF		300# RF		
MANIFOLDS: BY VENDOR IF REQ'D	YES ☒	NO ☐	YES ☒	NO ☐	
SIZE, IN OUT					
NOZZLE RATING					
LINE SIZES IN / OUT	2" / 2"		3" / 3"		
NO. OF TUBES/SECT.	NO. OF FINS/TUBE		FIN MATERIAL		
CODE REQUIREMENTS ASME VIII	WEIGHT OF UNIT, EMPTY		FULL OF WATER		
REMARKS: (1) PROVIDE COMPANION FLANGES FOR ALL NOZZLES IF NOT ASA STANDARD					
(2) FOR GENERAL NOTES REFER TO REQ'N. 1590-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N.					
(3) TO BE ADJUSTED - PENDING C-301 SPECIFICATION.					
* PROPRIETARY DATA					

COMPRESSORS

FOSTER WHEELER CORPORATION
110 SOUTH ORANGE AVENUE, LIVINGSTON, NEW JERSEY

RECIPROCATING COMPRESSOR DATA SHEET
MATERIAL REQUISITION PAGE 1 OF 5

FOR <u>ERDA-FE-14-32-0001-1521</u> F.W. REF. <u>15-1592</u>		REQUISITION NO.		DATE	
SITE <u>NSP LAWRENCE STATION, SIOUX FALLS, SOUTH DAKOTA</u>		<u>1592-1322-A</u>		<u>10-13-75</u>	
SERVICE <u>ACID GAS RECYCLE COMPRESSOR</u> ITEM NO. <u>C-301</u>		SUPERSEDED BY			
MANUFACTURER		CHG.	DATE	CHG.	DATE
SIZE AND TYPE		C1	<u>3-8-76</u>	C4	
DRIVER ☒ MOTOR ☐ GAS ENGINE ☐		C2		C5	
NO. REQ'D. <u>1</u>		C3		C6	

APPLICABLE SPECIFICATIONS	INSTALLATION DATA
RECIPROCATING COMPRESSORS AND ATTENDANT EQUIPMENT COVERED IN THIS REQUISITION SHALL BE FURNISHED IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS: <u>1590-50A4</u> <u>1590-1300A</u> <u>1590-96A2</u> <u>1590-92A1</u> <u>1590-32A3</u> <u>1590-38A1</u> <u>API-618 (JULY 74)</u> <u>1590-50A2</u>	COMPRESSOR UNIT WILL BE INSTALLED IN AN: ☒ OUTDOOR UNPROTECTED LOCATION ☐ ENCLOSED BUILDING BAROMETER <u>14.0</u> PSIA ALTITUDE <u>1315</u> FT. AMBIENT TEMPERATURES: <u>+93</u> °F MAX, <u>-25</u> °F MIN.

CONDITIONS OF SERVICE (EACH MACHINE)

SERVICE STAGE	DESIGN		START-UP	
	1	2	1	2
RELATIVE HUMIDITY	0		0	
MOL. WEIGHT	*		*	
Cp/Cv @ SUCTION	1.30		1.30	
Cp/Cv @ DISCHARGE				
COMP. @ SUCTION, Z				
COMP. @ DISCHARGE, Z				
* SUCTION PRESSURE, PSIA <u>LINE/CYL</u>	* /		* /	
SUCTION TEMPERATURE, °F	*		*	
① DISCHARGE PRESSURE, PSIA <u>CYL/LINE</u>		<u>1390</u>		<u>1340</u>
DISCHARGE TEMPERATURE, °F				
SCFM @ 14.7 PSIA & 60°F (DRY) <u>± 3%</u>	*			
INLET CFM (CORRECTED)				
BRAKE HORSEPOWER/STAGE				
TOTAL BHP <u>± 3%</u>				
* VENDOR TO ADVISE LOWEST SUCTION PRESSURE FOR CONTINUOUS OPERATION				

GAS ANALYSIS

COMPOSITION	MOL. WGT.	MOL%	MOL%	MOL%	MOL%	MOL%
CO ₂		*				
H ₂ S		*				
COS		*				
CH ₄		*				
H ₂		*				
CO		*				
N ₂		*				
NH ₃		*				
TOTAL		100%				

REMARKS: NOTES: ① ALLOWABLE DISCHARGE TEMPERATURE: PREFERRED = 300 °F
ACCEPTABLE = 325 °F MAX
* PROPRIETARY DATA

FOR ERDA-FE-14-32-0001-1521 F.W. REF. 15-1592
SITE NSP LAWRENCE STATION, SIOUX FALLS, SOUTH DAKOTA
SERVICE ACID GAS RECYCLE COMPRESSOR ITEM NO. C-301
MANUFACTURER
SIZE AND TYPE NO. REQ'D. 1
DRIVER ☐ MOTOR ☐ GAS ENGINE ☐
GENERAL NOTES REQUISITION IS AN
INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO. 1592-1322-A		DATE 10-13-75	
SUPERSEDED BY			
CHG.	DATE	CHG.	
C1	3-8-76	C4	
C2		C5	
C3		C6	

SPEED, RPM	NOTE ②	RATED	MAX. ALLOWABLE	MIN. ALLOWABLE
SERVICE				
STAGE		1	2	
NO. OF CYLINDERS/STAGE		1	1	
SINGLE/DOUBLE ACTING		DA	DA	
BORE, INCHES				
STROKE, INCHES				
RATED PISTON SPEED, FPM	750 MAX			
PISTON DISPLACEMENT, CFM				
VOLUMETRIC EFFICIENCY, %				
AVG. VALVE VELOCITY, FPM				
ROD DIAMETER, INCHES				
MAX. ALLOW. ROD LOAD, T/C				
RATED ROD LOAD, T/C				
CYL. MAX. ALLOW. WORKING PRESS., PSIG				
CYL. MAX. ALLOW. WORKING TEMP., °F				
HYDROSTATIC TEST PRESS. PSIG				
RELIEF VALVE SETTING				
SUCTION SIZE/RATING/FACING				
DISCHARGE SIZE/RATING/FACING				

COMPRESSOR MATERIALS ③

CYLINDER	CI	CI		
CYLINDER LINER	CI	CI		
PISTON				
PISTON RINGS				
PISTON ROD				
VALVE SEATS				
VALVE STOPS				
VALVE PLATES				
VALVE SPRINGS				

DISTANCE PIECE	LUBRICATION	
☐ STANDARD ☐ EXTRA LONG SINGLE COMPARTMENT ☒ TWO COMPARTMENT	FRAME AND RUNNING GEAR ☐ SPLASH SYSTEM ☒ PRESSURE SYSTEM INCLUDING ☒ SHAFT ☐ MOTOR DRIVEN OIL PUMP ☐ HAND OPERATED OIL PUMP FOR STARTING ☐ STEAM COIL ☒ ELECT. HEATER WITH THERMOSTAT KW	CYLINDERS AND ROD PACKING DRIVEN BY ☒ COMPRESSOR SHAFT ☐ ELECTRIC MOTOR ☐ STEAM COIL ☒ ELECT. HEATER WITH THERMOSTAT KW ☐ NON LUBE DESIGN
COMPRESSOR PACKING		
☐ STANDARD FIBRONS ☒ FULL FLOATING VENTED METALLIC ☒ FORCE FEED LUBRICATED ☐ NON LUBRICATED TYPE		

REMARKS: ② MAX SPECIFIED RPM - 514
③ NO COPPER OR COPPER CONTAINING ALLOYS

FOSTER WHEELER CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, NEW JERSEY

RECIPROCATING COMPRESSOR DATA SHEET

MATERIAL REQUISITION

PAGE 3 OF 5

FOR ERDA-FE-14-32-0001-1521 F.W. REF. 15-1592
 SITE NSP LAWRENCE STATION, SIOUX FALLS, SOUTH DAKOTA
 SERVICE ACID GAS RECYCLE COMPRESSOR ITEM NO. C-301

REQUISITION NO.

DATE

1592-1322-A10-13-75

MANUFACTURER

SIZE AND TYPE

NO. REQ'D. 1DRIVER ☐ MOTOR ☐ GAS ENGINE ☐

GENERAL NOTES REQUISITION

IS AN

INTEGRAL PART OF THIS REQUISITION.

SUPERSEDED BY

CHG.

DATE

CHG.

DATE

C1

3-8-76

C4

C2

C5

C3

C6

ACCESSORIES

COMPRESSOR MFR SHALL FURNISH:

- ☒ DRIVER AS DEFINED ON DRIVER DATA SHEET P. 5
☒ PULSATION (DAMPERS) (VOLUME BOTTLES)
☐ ANALOG STUDY
☒ INTERSTAGE PIPING
☒ INTERCOOLERS, MACHINE MOUNTED
☒ MOISTURE SEPARATORS WITH TRAPS NOTE (4)
☐ AFTERCOOLERS
☐ AIR INLET FILTER
☐ RECEIVER
☒ COOLING WATER PIPING FOR EACH CYLINDER
☐ PACKING AND PLUNGER COOLING OIL SYSTEM
☒ MANIFOLD WATER PIPING (SINGLE IN-OUT CONN.)
☒ SIGHT FLOW, T.I. & GLOBE VALVE EACH PARALLEL WATER BRANCH
☐
☐
☐

COMPRESSOR CONTROL

START UP UNLOADING

BY-PASS BY PURCHASER

OPERATING CONTROL

BY-PASS BY PURCHASER

ALARMS AND SHUTDOWNS

COMPR. MFR. SHALL FURNISH CONTACTS FOR:

- | | ALARM | SHUTDOWN |
|-----------------------------|--|-------------------------------------|
| LOW LUBE OIL PRESSURE | ☒ | ☒ |
| LOW LUBRICATOR OIL LEVEL | ☐ | ☐ |
| HIGH ENGINE JKT WATER TEMP. | ☐ | ☐ |
| LOW SUCTION PRESSURE | ☒ | ☒ |
| CYL. LUBRICATOR FAILURE | ☒ | ☐ |
| HIGH GAS DISCHARGE TEMP | ☒ (EACH CYL) | ☐ |
| REMOTE SHUTDOWN | ☒ ELECTRONIC | ☐ PNEUMATIC |
| ALARM CONTACTS SHALL: | ☒ OPEN TO SOUND ALARM
☐ CLOSE TO SOUND ALARM | |
| SHUTDOWN CONTACT SHALL: | ☒ OPEN TO SHUTDOWN
☐ CLOSE TO SHUTDOWN | |

INSPECTION AND SHOP TESTS

- ☒ SHOP INSPECTION BY PURCHASER DURING FABRICATION
☒ MANUFACTURER'S STANDARD SHOP TESTS
☐ BARRING OVER TO CHECK CLEARANCES
☒ RUNNING TEST WITH SHOP DRIVER
☒ HYDROSTATIC TEST FOR EACH CYLINDER
☐ HELIUM LEAK TEST
☐
☐
☐
☐
 PURCHASER RESERVES RIGHT TO WITNESS ANY OR ALL SHOP TESTS AND SHALL HAVE ACCESS TO MFR'S. SHOP DURING FABRICATION.

WEIGHTS AND DIMENSIONS

- TOTAL WEIGHT INCL. COMPRESSOR, DRIVER & BASEPLATE
 MAX. ERECTION WEIGHT
 MAX. MAINTENANCE WEIGHT
 FLOOR SPACE: LENGTH WIDTH
 HEIGHT
 ROD REMOVAL DISTANCE

ADDITIONAL DATA:

NOTE (4) INLET PULSATION DAMPENERS TO HAVE MOISTURE SEPARATORS/RECEIVERS, WITH PROVISION FOR LEVEL GAUGES AND HIGH LEVEL ALARMS.

FOR <u>EROA-FE-14-32-0001-1521</u> F.W. REF. <u>15-1592</u>		REQUISITION NO.		DATE	
SITE <u>NSP LAWRENCE STATION, SIOUX FALLS, SOUTH DAKOTA</u>		<u>1592-1322A</u>		<u>10-13-75</u>	
SERVICE <u>ACID GAS RECYCLE COMPRESSOR</u> ITEM NO. <u>C-301</u>		SUPERSEDED BY			
MANUFACTURER		CHG.	DATE	CHG.	
SIZE AND TYPE		C1	<u>3-8-76</u>	C4	
DRIVER ☐ MOTOR ☐ GAS ENGINE ☐		C2		C5	
GENERAL NOTES REQUISITION		C3		C6	
INTEGRAL PART OF THIS REQUISITION.					

UTILITY DATA				UTILITY SUMMARY			
ELECTRICAL				ELECTRIC			
AREA CLASSIFICATION: <u>CLASS I, GROUP D, DIVISION 2</u>				HP	LOCKED	FULL LOAD	
					ROTOR AMPS	AMPS	
MOTORS: <u>200 HP & OVER</u> VOLTS <u>4000</u> PH. <u>3</u> CYC. <u>60</u>				MAIN DRIVER			
<u>3/4 HP - 150 HP</u> VOLTS <u>460</u> PH. <u>3</u> CYC. <u>60</u>				MAIN LUBE OIL PUMP			
<u>1/2 HP & LESS</u> VOLTS <u>115</u> PH. <u>1</u> CYC. <u>60</u>				M-G SET			
AUX. MOTOR ENCLOSURE: <u>TEFC</u>				MECH. LUBRICATOR			
INSULATION TYPE: <u>B</u> TEMP. RISE: <u>80°C</u>				STARTING AIR COMPR.			
ALARM SWITCHES: ☒ AC ☐ DC VOLTS <u>115</u> PH. <u>1</u> CYC. <u>60</u>							
TRIP SWITCHES: ☒ AC ☐ DC VOLTS <u>115</u> PH. <u>1</u> CYC. <u>60</u>							
SWITCH ENCLOSURE <u>NEMA 4X WITH 1/2" NPT PURGE CONN.</u>				LUBRICATOR HEATER			
ELECT. HEATERS: <u>115</u> VOLTS <u>1</u> PH. <u>60</u> CYC.				FRAME HEATER			
				WATTS			
COOLING WATER				STEAM			
SUPPLY: PRESSURE PSIG <u>50</u> TEMP. <u>85</u> °F				MAIN DRIVER			
RETURN: PRESSURE PSIG TEMP. <u>110</u> °F, MAX.				LUBE DRIVER			
SOURCE <u>COOLING TOWER</u> FOULING FACTOR <u>.002</u>				#/HR.			
				#/HR.			
STEAM				FUEL GAS			
MAX.	NORM.	MIN.		RATED RPM %	<u>100</u>	<u>75</u>	
INLET PRESS., PSIG				BTU/HP/HR			
INLET TEMP. °F				TOTAL BTU/HR			
EXH. PRESS.				COOLING WATER			
LOW PRESS STEAM AVAIL. @ PSIG °F				GPM	INLET °F	OUTLET °F	AP PSI
FUEL GAS				COMPR. CYLINDERS			
SEE ENGINE DATA SHEET FOR GAS ANALYSIS				LUBE OIL COOLER			
AVAIL. PRESSURE PSIG @ °F				TURB. CHG. COOLER			
HEATING VALVE, BTU/CU. FT. LHV HHV				ENGINE JACKETS			
INSTRUMENT AIR SUPPLY PSIG				ENG. JKT. COOLER			

REMARKS:

FORM 135-119

F.W.C. CONTRACT <u>15-1592</u>		REQUISITION NUMBER <u>1592-1322A</u>	DATE <u>10-13-75</u>
FOR: <u>ERDA-FE-14-32-0001-1521</u>		SUPERSEDED BY CHANGE NO.:	
SITE: <u>NSP LAWRENCE STATION, SIOUX FALLS, SOUTH DAKOTA</u>		C1 <u>3-8-76</u>	C3 <u> </u> C5 <u> </u>
MANUFACTURER: <u> </u>		C2 <u> </u>	C4 <u> </u> C6 <u> </u>

APPLICABLE DOCUMENTS:

MOTOR SPECIFICATION 1590-38A1
 PREP. FOR SHIPMENT 1590-92A1
 GENERAL NOTES 1590-1300A

SITE DATA:

ALTITUDE 1315 FT. BAROMETER 14.0 PSIA
 AMBIENT 93 °F. MAX. TO (-) 25 °F. MIN.
 ATMOSPHERE
 INSTALLED ☐ INDOOR ☒ OUTDOOR ☐
 AREA ☒ CL. I -GR. 0 -DIV. 2 ☐ NON-HAZARDOUS.

ITEM NUMBERS:

TOTAL QUANTITY
 DRIVEN EQUIPMENT
 HP NAMEPLATE RATING
 SERVICE FACTOR
 RPM AT FULL LOAD/ NO. POLES
 VOLTS/PHASES/HERTZ
 ENCLOSURE
 °C. RISE AT FULL S. LOAD
 TEMP. MEASUREMENT METHOD
 INSULATION CLASS
 INSUL. SPECIAL TREATMENT
 SPECIAL HARDWARE
 FRAME NUMBER
 MOUNTING ASSEMBLY NUMBER
 ROTATE FROM END OPP. CPLG.
 BEARINGS TYPE
 LUBRICATION
 END FLOAT (IF APPL.) INS.
 N.E.M.A. DESIGN LETTER
 AMPS.: F.L./LOCKED ROTOR
 LOCKED ROTOR LIMIT, SECS.
 %EFFIC. 100%/75%/50% LOAD
 % P.F. 100%/75%/50% LOAD

ONE

COMPRESSOR

4000 3 60

WPI

87

B

BALL

ACCESSORIES:

BASE
 SPACE HEATERS: WATTS
 VOLTS/PH/HZ
 TEMP. DETECTORS: NUMBER
 TYPE
 AIR FILTERS
 MOUNTING COUPLING HALF

← VENDOR TO ADVISE

115 1 60

TESTS: (W = WITNESSED)
 N.E.M.A. STD. COMMERCIAL

YES

TEST CERTIFICATES REQ'D.

YES

WEIGHTS: (LBS.)

NET/GROSS

MAX. NORMAL MAINTENANCE

REFRIGERATION UNIT

MATERIAL REQUISITION



FOSTER WHEELER

PAGE 1 OF 12

FORM 135-20A

FOR ERDA-FE-14-32-0001-1521	F.W. REF. 15-1592	REQUISITION NUMBER	DATE
SITE NSP Lawrence Station, Sioux Falls, South Dakota		1592-1281 A	10/15/75
ITEM NO. A-301		SUPERSEDED BY CHANGE NO.:	
SERVICE: Solvent Chiller Refrigeration Unit		C1	C4
		C2	C5
		C3	C6

I. APPLICABLE SPECIFICATIONS

Furnish one (1) complete solvent chiller refrigeration package in accordance with this Requisition and the following Specifications and Standards. In the event of conflict, this requisition shall govern.

1590-1300A	General Notes
1590-32A1	Centrifugal Compressor
1590-38A1	Induction Motors
1590-38A4	Special Purpose Gears
1590-50A2	Gaskets and surface finish for flanged joints
1590-92A1	Preparation of Material for shipment
1590-96A2	Equipment Noise Control

II. BASIC DESIGN1.0 Scope

- 1.1 This refrigeration unit will be used to cool and supply refrigerant directly to an evaporator (chiller supplied by others) which cools a circulating solvent from the Selexol gas absorption system.

This requisition applies to a complete refrigeration package, with all auxiliaries and controls.

- 1.2 The following items are to be furnished by the refrigeration unit vendor:

Centrifugal refrigerant compressor with complete lubrication and sealing system.

Driver and gear increaser with complete lubrication system.

Couplings and guards.

Common fabricated steel base for all components

Refrigerant condenser

Receiver/economizer—also serves as a storage vessel

BY: PV

P.O.NO.

SUPPLIER:

II. BASIC DESIGN (Cont'd.)

1.2

Suction scrubber vessel

Capacity control

Automatic suction and bypass controls

Automatic hot gas bypass valve for startup and low load operation

One (1) complete thermal purge unit

One (1) complete pump-out and transfer unit

Refrigerant filter-dryer

Initial charge of refrigerant and lubricating oil

Control/instrument panel

All necessary instruments and controls

Instrument wiring and piping between panel and vendor supplied equipment

Power wiring to auxiliary motors

Piping systems as specified

Flow diagrams, wiring diagrams, control circuits, instrumentation drawings, layouts, elevation and foundation drawings, Pump and motor drawings and data

1.3 The items listed below are supplied by others:

Evaporator, (Solvent Chiller, Item E 305)

Refrigerant level control valve in outlet piping of this refrigeration unit

Back pressure control valve on chiller outlet (and return or inlet line to refrigeration unit.)

Main motor driver starter, controls, and power and control wiring

II. BASIC DESIGN (Cont'd.)

1.3 Foundation and anchor bolts

Insulation for all equipment

Instrument piping and wiring between panelboard
and equipment supplied by purchaser

Erection and installation of the unit

- 1.4 The refrigeration unit vendor shall be responsible
for sizing the driver and furnishing the refrigerant data
including type, flow rate, supply pressure and temperature
and any other pertinent information.

2.0 Operating Conditions

- 2.1 Design cooling duty: * BTU/HR

- 2.2 Refrigerant temperature level in chiller: * F

- 2.3 Pressure drop in returned vapor from the process chiller
to the refrigeration unit baseline: $7\frac{1}{2}\%$ of absolute
saturation pressure of refrigerant at * F.

- 2.4 Turndown requirements: Unit must be capable of operating
continuously at all levels down to 25% of design capacity.

3.0 Site Information

Outdoor Installation

Altitude: 1315 ft.

Barometer: 14.0 PSIA

Ambient Temperatures: 93°F maximum
 -25°F minimum

* PROPRIETARY DATA

FOSTER WHEELER CORPORATION

MATERIAL REQUISITION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N.J.

CENTRIFUGAL COMPRESSORS

PAGE 4

OF 12

FOR ENDA-FE-14-32-0001-1521 FW REF. 15-1592
SITE NSA LAWRENCE STATION, SIOUX FALLS, SOUTH DAK.
SERVICE SOLVENT CHILLER REFRIG. UNIT NO. A-301
MATERIAL _____
SIZE AND TYPE _____ NO. REQD. _____
DRIVER: ☒ MOTOR, ☐ STEAM TURBINE, ☐ _____
GENERAL NOTES REQUISITION SEE PG. 1 IS AN
INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO.

DATE

1592-1281AOCT. 15, 1975

SUPERSEDED BY

CHG.

DATE

CHG.

DATE

C1

C4

C2

C5

C3

C6

UTILITY DATA

ELECTRICAL:

CLASSIFICATION: ☒ CLASS 1 - GROUP D, ☐ DIV. 1, ☒ DIV. 2, ☐ _____
MOTORS 1/2 HP AND BELOW: 115 VOLTS, ONE PHASE, 60 CYCLES.
MOTORS 3/4 HP THROUGH 150 HP: 460 VOLTS, 3 PHASE, 60 CYCLES.
MOTORS 200 HP AND ABOVE: 4000 VOLTS, 3 PHASE, 60 CYCLES.
ALARM SWITCHES: ☒ AC, ☐ DC, _____ VOLTS, _____ PHASE, _____ CYCLES.
SHUTDOWN SWITCHES: ☒ AC, ☐ DC, _____ VOLTS, _____ PHASE, _____ CYCLES.
SWITCH ENCLOSURE: ☐ EXPLOSION PROOF, ☐ WEATHER PROOF, ☒ NEMA 4X WITH
1/2" NPT PURGE CONNECTION

STEAM:

	MAX.	NOR.	MIN.	MAX.	NOR.	MIN.
INLET Psig						
INLET TT OF						
EXH. Psig						
In. HG. ABS.						

(*) DENOTES CONDITIONS AT WHICH STEAM RATE IS TO BE GUARANTEED.

COOLING WATER: ☐ FRESH, ☐ SALT, ☒ COOLING TOWER
AVAILABLE AT 50 Psig AND 85 OF. FOULING FACTOR .002
ALLOW TEMP. RISE 25 MAX OF. ALLOW PRESSURE DROP 15 Psi.

INSTRUMENT AIR: AVAILABLE TO CONTROL DEVICES AT 100 Psig.

DRIVER AND UTILITY SUMMARY

MOTORS:

- ☒ COMPRESSOR DRIVE
☒ LUBE PUMP DRIVE
☐ SEAL PUMP DRIVE
☐ _____

QUAN.	MFR.	TYPE	ENCL.	HP	SF	RPM
<u>1</u>		<u>IND.</u>	<u>WPII</u>			
<u>1</u>		<u>IND.</u>	<u>TEFC</u>			

STEAM TURBINES:

- ☐ COMPRESSOR DRIVE
☐ LUBE PUMP DRIVE
☐ SEAL PUMP DRIVE
☐ _____

QUAN.	MFR.	TYPE	STAGES	HP	RPM	WR

DRIVERS MARKED ☒ SHALL BE FURNISHED BY THE COMP. VENDOR. SEE PAGE 10 OF THIS REQ'N. FOR COMPLETE DETAILS OF THE MAIN COMPRESSOR DRIVE UNIT.

COOLING WATER CONSUMPTION:

LUBE OIL COOLERS _____ GPM _____ OF. RISE.
SEAL OIL COOLERS _____ GPM _____ OF. RTSE.
INTER COOLERS _____ GPM _____ OF. RISE.
_____ GPM _____ OF. RISE.
_____ GPM _____ OF. RISE.

STEAM CONSUMPTION:

N.A.

COMPRESSOR DRIVE _____ Lb/Hr.
EACH LUBE PUMP DRIVE _____ Lb/Hr.
EACH SEAL PUMP DRIVE _____ Lb/Hr.
_____ Lb/Hr.
_____ Lb/Hr.

COMMENTS REGARDING UTILITIES:

Date: Oct. 14, 1975

PAGE 5 OF 12

REQUIREMENT

VENDOR DATA

Refrigeration unit:

Type

Manufacturer & model

Capacity, ton max./min.

Refrigerant type/charge lbs.

Compressor:

Type

Model

No. of stages

Shaft type (rigid or flexible)

Input KW

RPM

Capacity control

CENTRIFUGAL

INLET GUIDE VANE
HOT GAS BYPASS

Suction pressure, psig

Discharge pressure, psig

Suction temp. °F

Condensing temp., °F

Lube Oil system

Lube Oil pump, main/aux.

Weight. lbs

FORCED FEED

BY: P.V. P.O. NO.

SUPPLIER;

FOSTER WHEELER ENERGY CORP.

110 SOUTH ORANGE AVENUE, LIVINGSTON, N.J.

CENTRIFUGAL COMPRESSORS

PAGE 6 OF 12

FOR ERDA-FE-14-32-0001-1521 FW REF. 15-1592
 SITE NJP LAWRENCE STATION, SIOUX FALLS, SOUTH DAK.
 SERVICE SOLVENT CHILLER REFRIG. UNIT ITEM NO. A-301
 MATERIAL _____
 SIZE AND TYPE _____ NO. REQD. ONE
 DRIVER: ☒ MOTOR, ☐ STEAM TURBINE, ☐ _____
 GENERAL NOTES REQUISITION SEE PAGE 1 IS AN
 INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO.

DATE

1592-1281 A OCT. 15, 1975

SUPERSEDED BY

CHG.	DATE	CHG.	DATE
C1		C4	
C2		C5	
C3		C6	

CONSTRUCTION DETAILS

MANUFACTURERS DATA: MODEL _____ CASING SPLIT: ☐ HORIZ., ☐ VERT. NO. STAGES _____IMPELLERS: TYPE: ☐ ENCLOSED - BACKWARD LEANING, ☐ _____ DIA. _____ IN.CONSTRUCTION: ☐ CAST, ☐ RIVETED, ☐ WELDED, ☐ MILLED, ☐ _____ TIP SPEED _____ FPS

SPEED DATA: MAX. CONT. _____ RPM. FIRST CRITICAL _____ RPM. SECOND CRITICAL _____ RPM.

COMPRESSOR ROTATION: VIEWED FROM DRIVER END OF UNIT: ☐ CW, ☐ CCW.

MATERIALS OF CONSTRUCTION:

CASING: ☐ CAST STEEL, ☐ FORGED STEEL, ☐ CAST IRON, ☐ _____

DIAPHRAGMS: _____ INTERSTAGE LABYRINTHS: _____

IMPELLERS: _____ SHAFT: _____ SLEEVES: _____

OTHER: _____

TEMPERATURE AND PRESSURE LIMITATIONS:

MAX. WORKING TEMP: SUCTION END _____ OF. DISCH. END. _____ OF.

MIN. WORKING TEMP: SUCTION END. _____ OF. DISCH. END. _____ OF.

MAX. WORKING PRESS: SUCTION END _____ Psig. DISCH. END _____ Psig.

HYDRO. TEST PRESS: SUCTION END _____ Psig. DISCH. END _____ Psig.

FLANGE RATINGS:

CONNECTION	SIZE (IN.)	ASA RATING	FACING	UP	DN	RT	LF	OTHER
MAIN SUCTION				☐	☐	☐	☐	
MAIN DISCHARGE				☐	☐	☐	☐	
				☐	☐	☐	☐	
				☐	☐	☐	☐	

ALL FLANGE ORIENTATIONS ARE VIEWED FROM THE DRIVER END OF THE UNIT. ALLOWABLE FLANGE LOADINGS SHALL
 BE INDICATED ON THE VENDORS CERTIFIED DRAWINGS.

SHAFT SEAL: ☐ LABYRINTH, ☐ RESTRICTIVE RING, ☐ LIQUID FILM, ☒ MECHANICAL (CONTACT).SEALING MEDIUM: ☒ OIL, ☐ AIR, ☐ INERT GAS, ☐ _____BEARINGS: BEARING HOUSING CONSTRUCTION: ☐ INTERNAL, ☐ EXTERNAL.JOURNAL BEARING TYPE: ☐ BABBITTED SLEEVE, ☐ _____LUBE: ☒ FORCE FEED, ☐ RING OIL, ☐ _____THRUST BEARING TYPE: ☐ SINGLE KINGSBURY, ☐ DOUBLE KINGSBURY, ☐ BALL,☐ ROLLER ☐ _____LUBE: ☒ FORCE FEED ☐ RING OIL, ☐ _____CASING DRAINS: QUANTITY ONE/STAGE SIZE _____ VENDOR SHALL FURNISH☐ VALVED, ☒ PLUGGED, ☐ BLIND FLANGE, ☐ _____ CONNECTIONS.BASEPLATE: SUPPLIED BY ☒ COMPRESSOR VENDOR, ☐ _____TYPE: ☒ CONTINUOUS STRUCTURAL STEEL COMMON TO COMPRESSOR AND DRIVE UNIT.PROVIDED WITH DRIP PAN ☐ YES, ☐ NO.COUPLINGS: SUPPLIED BY ☒ COMPRESSOR VENDOR, ☐ _____

LOCATION:	COMP. GEAR	MAIN MOTOR	OIL PUMP		
MFG:					
TYPE:					
LUBE:					

COUPLING GUARDS: SUPPLIED BY ☒ COMPRESSOR VENDOR, ☐ _____TYPE: ☐ SHEET METAL, ☐ NON-SPARKING, ☒ ENCLOSED, STEEL

COMMENTS REGARDING CONSTRUCTION DETAILS: _____

FOSTER WHEELER CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N.J.

CENTRIFUGAL COMPRESSORS

PAGE 7

OF 12

FOR ERDA-FE-14-32-0001-1521FW REF. 15-1592SITE N.S.P. LAWRENCE STATION, SIOUX FALLS, S.D.SERVICE SOLVENT CHILLER REFRIG. UNIT ITEM NO. A-301

MATERIAL

SIZE AND TYPE

NO. REQD. ONEDRIVER: ☒ MOTOR, ☐ STEAM TURBINE, ☐GENERAL NOTES REQUISITION SEE PG. 1 IS AN

INTEGRAL PART OF THIS REQUISITION.

LUBE AND SEAL OIL SYSTEMS: A FORCE FEED LUBE OIL SYSTEM COMMON TO THE ☒ COMPRESSOR,☒ GEAR, ☐ DRIVER, WITH ☒ A COMBINED, ☐ A SEPARATE, ☐ NO SEAL OIL SYSTEM, SHALL BE

FURNISHED BY THE COMP. MFR. IN ACCORDANCE WITH API 617 FIG.

MATERIAL REQUISITION

REQUISITION NO.

DATE

1592-1281 A OCT. 15, 1971

SUPERSEDED BY

CHG.	DATE	CHG.	DATE
C1		C4	
C2		C5	
C3		C6	

LUBE OIL SYSTEM

SYSTEM OPERATING PRESS. _____ Psig.

SYSTEM MAX. ALLOW OPER. PRESS. _____ Psig.

RESERVOIR: LOCATED ☒ IN BASE, ☐ ON CONSOLE.

CAPACITY _____ GAL. RET. TIME _____ MIN.

TO BE FURNISHED WITH ☒ ELECTRIC, ☐ STEAMHEATER, ☒ INSULATION SUPPORTS AND☐MAIN LUBE OIL PUMP: LOCATED ON ☐ BASE,☐ CONSOLE AND DRIVEN BY ☒ COMPRESSOR SHAFT,☐ INDUCTION MOTOR, ☐ STEAM TURBINE.

MFR. _____ MODEL _____

TYPE _____ CASE MATL. _____

GPM _____ RPM _____ BHP _____

AUX. LUBE OIL PUMP: LOCATED ON ☐ BASE,☒ CONSOLE AND DRIVEN BY ☐ SHAFT,☒ INDUCTION MOTOR, ☐ STEAM TURBINE.

MFR. _____ MODEL _____

TYPE _____ CASE MATL. _____

GPM _____ RPM _____ BHP _____

RELIEF VALVES: ☐ INTEGRAL, ☒ SEPARATE.COOLERS: ☒ TWIN, ☐ SINGLE, LOCATED ON☐ BASE, ☐ CONSOLE,

MFR. _____ TYPE _____

CODE: ☐ TEMA C, ☒

SHELL: OD _____ IN. DES. PRESS. _____ Psig.

TUBES: OD _____ IN. BWG _____

MATL: SHELL _____ TUBES _____

FILTERS: ☒ TWIN, ☐ SINGLE. LOCATED ON☐ BASE, ☐ CONSOLE,

MFR. _____ MODEL _____

CASE MATL. STEEL MICRON _____ELEMENT: ☒ CLEANABLE, ☐ REPLACEABLE.TRANSFER VALVES: MFR. KRAISSL

QUAN. _____ TYPE _____ MATL. _____

SOUR OIL TRAPS: REQD. ☐ YES, ☐ NO. LOCATED ON ☐ BASE, ☐ CONSOLE, ☐ BY PURCHASER.PIPING BY ☐ COMP. VENDOR, ☐ PURCHASER. SEAL OIL LOSS _____ GAL./DAY/SEAL MAX.OVHD. SEAL OIL TANK: REQD. ☐ YES, ☒ NO. LOCATED _____ FT. ABOVE COMP. CENTER LINE.MTD. BY ☐ COMP. VENDOR, ☐ PURCHASER.CLARIFIER: REQD. ☐ YES, ☒ NO. LOCATED ON ☐ BASE, ☐ CONSOLE, ☐ BY PURCHASER.PIPING BY ☐ COMP. VENDOR, ☐ PURCHASER. BYPASS _____ GPM. MFR. _____PIPING: ☒ CARBON STEEL PICKLED AND CLEANED, ☐ STAINLESS STEEL, ☐☐ STAINLESS STEEL DRAIN LINES, ☐OTHER: TOTAL WEIGHT, INSTALLED LBTOTAL WEIGHT, SHIPPED LBVOLUMETRIC DIMENSIONS (L), (W), (H), MT.

SEAL OIL SYSTEM

SYSTEM OPERATING PRESS. _____ Psig.

SYSTEM MAX. ALLOW OPER. PRESS. _____ Psig.

RESERVOIR: LOCATED ☐ IN BASE, ☐ ON CONSOLE.

CAPACITY _____ GAL. RET. TIME _____ MIN.

TO BE FURNISHED WITH ☐ ELECTRIC, ☐ STEAMHEATER, ☐ INSULATION SUPPORTS AND☐MAIN SEAL OIL PUMP: LOCATED ON ☐ BASE,☐ CONSOLE AND DRIVEN BY ☐ SHAFT,☐ INDUCTION MOTOR, ☐ STEAM TURBINE.

MFR. _____ MODEL _____

TYPE _____ CASE MATL. _____

GPM _____ RPM _____ BHP _____

AUX. SEAL OIL PUMP: LOCATED ON ☐ BASE,☐ CONSOLE AND DRIVEN BY ☐ SHAFT,☐ INDUCTION MOTOR, ☐ STEAM TURBINE.

MFR. _____ MODEL _____

TYPE _____ CASE MATL. _____

GPM _____ RPM _____ BHP _____

RELIEF VALVES: ☐ INTEGRAL, ☐ SEPARATE.COOLERS: ☐ TWIN, ☐ SINGLE. LOCATED ON☐ BASE, ☐ CONSOLE,

MFR. _____ TYPE _____

CODE: ☐ TEMA C, ☐

SHELL: OD _____ IN. DES. PRESS. _____ Psig.

TUBES: OD _____ IN. BWG _____

MATL: SHELL _____ TUBES _____

FILTERS: ☐ TWIN, ☐ SINGLE. LOCATED ON☐ TWIN, ☐ CONSOLE,

MFR. _____ MODEL _____

CASE MATL. _____ MICRON _____

ELEMENT: ☐ CLEANABLE, ☐ REPLACEABLE.

TRANSFER VALVES: MFR. _____

QUAN. _____ TYPE _____ MATL. _____

FOSTER WHEELER CORPORATION

MATERIAL REQUISITION NO.: 1592-1281A

CHANGE NO.

Date: Oct. 14, 1975

Item A 301

PAGE 8 OF 12

	REQUIREMENT	VENDOR DATA
Condenser Data:		
Type	SHELL & TUBE	
Model		
Design working pressure, tube side, psig		
Tubeside liquid	TREATED WATER	
Inlet temp., °F	85	
Temp. rise, °F	25°F (MAX.)	
Pressure drop,	15 PSI (MAX.)	
Fouling factor	0.002	
Flow rate, gpm		
Water velocity, ft/s		
No. of passes		
Total No. of tubes		
Fins per inch		
Tube length, in		
Tube diameter, in		
Tube material	COPPER	
Tube wall gauge, #BWG	20	
Tube side total surface, ft ² (outside)		
Distance between supports, ft		
Shellside refrigerant		
Fouling factor	0.0005	
Entering temp., °F		
Entering press. psig		
Leaving temp., °F		
Leaving press. psig		
Shell diameter, in.		
Shell material		
No. of passes		
Weight, lbs		
ASME code stamp	REQUIRED	
Note: Condenser to have a baffle installed near gas entrance to prevent high velocity gas impingement on tubes and to distribute gas thru condenser.		
Pump-out unit (for high pr. refrigerants)		
Storage tank capacity, lbs		
HP of pump-out compressor		
Weight, lbs.		
Pressure relief device		
Note: Unit to have compressor with motor, valves, sight glasses, relief valve, pressure gauges & controls.		
Purge Unit:		
Type (reciprocating or thermal)		
Weight lbs.		
BY: P.V. P.O. NO. SUPPLIER:		



FORM 135-114A

FOR <u>ERDA-FE-14-32-0001-1521 F.W. CONTRACT 15-1592</u>		REQUISITION NUMBER	DATE
SITE <u>NSP LAWRENCE STATION, SIOUX FALLS, S.D.</u>		<u>1592-1281A</u>	<u>OCT. 15, 1975</u>
ITEM NO. <u>A-301</u> SERVICE <u>REFRIGERATION UNIT</u>		SUPERSEDED BY CHANGE NO.:	
DRIVEN EQUIP. <u>REFRIG. COMPRESSOR DRIVER IND. MOTOR</u>		C1	C4
MFR. _____ MODEL _____ NO. REQ'D. <u>1</u>		C2	C5
		C3	C6

OPERATING CONDITIONS:

DRIVEN UNIT RATING _____ BHP AT _____ RPM
DRIVER CONTINUOUS RATING _____ BHP AT _____ RPM
CONTINUOUS SPEEDS: _____ MAX. & _____ MIN. RPM
MAX. LOAD TORQUE: _____ LB-FT AT _____ RPM
SPECIFIED SPEED IS FOR ☐ DRIVER ☐ DRIVEN UNIT
START: ☐ LOADED ☐ UNLOADED
WR² OF LOAD: _____ LB-FT² REFERRED TO DRIVER SHAFT
LOAD CHARACTER: ☐ SMOOTH ☐ MODERATE SHOCK
☐ HEAVY SHOCK ☐ REVERSING TORQUE
DUTY: ☒ CONTINUOUS ☐
MIN. SERVICE FACTOR 1.5 BASED ON DRIVER H.P.
ASSEMBLY POSITION (PER API FIG. A-1): _____
ROTATION, VIEWED FROM THE DRIVER:
INPUT SHAFT ☐ CW ☐ CCW
OUTPUT SHAFT ☐ CW ☐ CCW
LOCATION: ☐ INDOOR ☒ OUTDOOR ☐ ROOF
WINTERIZATION: ☒ YES ☐ NO

SITE DATA:

AMBIENT TEMPERATURE: 93 OF MAX. TO -25 OF MIN.
UNUSUAL CONDITIONS: CHEMICAL ATMOSPHERE
AREA: ☒ CL. 1 - GR. D - DIV. 2 ☐ NON-HAZARDOUS.
COOLING WATER: TYPE COOLING TOWER
INLET 85 OF 50 PSIG. OUT _____ OF MAX. & _____ PSIG.

APPLICABLE DOCUMENTS:

SEE PAGE 1

SHOP TESTS:

	REQUIRED	WITNESSED
MECH'L RUN AT _____ LOAD	<u>YES</u>	
FULL TORQUE		
SPARE GEAR TRAIN:		
SOUND LEVEL		
DISMANTLE-INSPECT-REASS'Y.		

CERTIFIED COPIES ALL TESTS YES

COUPLINGS:

	HIGH SPEED	LOW SPEED
MANUFACTURER		
TYPE		
LUBRICATION		
FURNISHED BY	<u>REFRIG. UNIT VENDOR</u>	
MOUNTED BY	<u>REFRIG. UNIT VENDOR</u>	
GUARD	<u>REFRIG. UNIT VENDOR</u>	

PERFORMANCE:

OUTPUT RATING: _____ HP MECHANICAL _____ HP THERMAL
ACTUAL SERVICE FACTOR _____ BASED ON _____
OVER-ALL RATIO: _____ TO 1.
HP LOSS: _____ AT RATED LOAD. _____ AT NO LOAD.
BREAKAWAY TORQUE: _____ LB-FT
MAX. HEAT REJECTION OF LUBE OIL _____ BTU/HR.
MAX. LUBE VISCOSITY PERMITTED FOR START _____ SSU

SOUND LEVEL:

CONSTRUCTION DETAILS:

NO. OF SPEED CHANGES: ☐ SINGLE ☐ DOUBLE ☐
TYPE: ☐ HERRINGBONE ☐ DOUBLE HELICAL
☐ EPICYCLIC ☐ SINGLE HELICAL
TOOTH FORM: ☐ INVOLUTE ☐
DETAILS: _____ PINION _____ INTERMED. _____ L.S. GEAR
PITCH DIAMETER _____
FACE WIDTH _____
ACTIVE WIDTH _____
RMS FINISH _____
HARDNESS _____
FT/MIN. AT PITCH _____
LB/INCH OF FACE _____
FIRST CRITICAL RPM. _____
BEARING TYPE _____
BEARING SPLIT _____
THRUST LOCATION (S) _____
THRUST TYPE _____

HUNTING TEETH: ☒ YES ☐ NO
OUTPUT SHAFT EXTENSION: ☐ CYLINDRICAL ☐ TAPERED
INPUT SHAFT EXTENSION: ☐ CYLINDRICAL ☐ TAPERED
LUBE SYSTEM: ☐ BY GEAR MFR. PER PAGE NO.

☐ BY OTHERS: GEAR USES _____ GPM AT _____ PSIG
☒ BY REFRIG. UNIT VENDOR
WR² OF SET: _____ LB-FT² REFERRED TO DRIVER SHAFT.

MATERIALS:

	CASING:	PINION	INTERMEDIATE	LOW SPEED
GEAR RIM				
CENTER & HUB				
SHAFT				
BEARINGS				

MISCELLANEOUS:

☐ SUPPLY SPARE SET GEARING.
LBS. NET: GEAR _____ BASE _____ AUX. _____
LBS. MAX. MAINTENANCE _____, FOR _____
BASE PLATE BY _____ GEAR MOUNTED BY _____

FORM 135-49A

F.W.C. CONTRACT <u>15-1592</u>		REF. SITE NUMBER	DATE
FOR: <u>ERDA-FE-14-32-0001-1521</u>		<u>1592-1281 A</u>	<u>OCT. 15 1975</u>
SITE: <u>NSP LAWRENCE STATION, SIOUX FALLS, S. DAKOTA</u>		SUPERSEDED BY CHANGE NO.:	
MANUFACTURER:		C1	C3
		C2	C4
			C5
			C6

APPLICABLE DOCUMENTS:

MOTOR SPECIFICATION 1590-38A1
 PREP. FOR SHIPMENT 1590-92A1
 GENERAL NOTES 1590-1300A

SITE DATA:

ALTITUDE 1315 FT. BAROMETER 14.0 PSIA
 AMBIENT 93 °F. MAX. TO (-25) °F. MIN.
 ATMOSPHERE CHEMICAL SERVICE
 INSTALLED ☐ INDOOR ☒ OUTDOOR ☐
 AREA ☒ CL. 1 -GR. D -DIV. 2. ☐ NON-HAZARDOUS.

ITEM NUMBERS:

	ITEM A 301	ITEM A-301
TOTAL QUANTITY	ONE	ONE
DRIVEN EQUIPMENT	COMPRESSOR	LUBE OIL PUMP
HP NAMEPLATE RATING		
SERVICE FACTOR		
RPM AT FULL LOAD/ NO. POLES	400/3/60	400/3/60
VOLTS/PHASES/HERTZ		
ENCLOSURE	PTE	TEFC
°C. RISE AT FULL S.F. LOAD	80	80
TEMP. MEASUREMENT METHOD	RES.	RES.
INSULATION CLASS	B	B
INSUL. SPECIAL TREATMENT		
SPECIAL HARDWARE		
FRAME NUMBER		
MOUNTING ASSEMBLY NUMBER		
ROTATE FROM END OPP. CPLG.		
BEARINGS TYPE	BALL	BALL
LUBRICATION		GREASE
END FLOAT (IF APPL.) INS.		
N.E.M.A. DESIGN LETTER		
AMPS.: F.L./LOCKED ROTOR		
LOCKED ROTOR LIMIT, SECS.		
%EFFIC. 100%/75%/50% LOAD		
% P.F. 100%/75%/50% LOAD		
ACCESSORIES:		
SPACE HEATERS: BASE		
WATTS		
VOLTS/PH/HZ	115/1/60	
TEMP. DETECTORS: NUMBER		
TYPE		
AIR FILTERS		
MOUNTING COUPLING HALF		
OVERSIZE CONDUIT BOX FOR STRESS CONES	YES	NO
TESTS:		
N.E.M.A. STD. COMMERCIAL	YES	YES
TEST CERTIFICATES REQ'D	YES	YES
WEIGHT, LB		
NOTES:		

FOSTER WHEELER CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N.J.

CENTRIFUGAL COMPRESSORS

PAGE 11

OF 12

MATERIAL REQUISITION

FOR ERDA-FE-14-32-0001-1521 FW REF. 15-1592
 SITE NSP LAWRENCE STATION, SIOUX FALLS, S.D.
 SERVICE SOLVENT CHILLER REPAIR UNIT ITEM NO. A 301
 MATERIAL _____

SIZE AND TYPE _____ NO. REQD. _____

DRIVER: ☒ MOTOR, ☐ STEAM TURBINE, ☐ _____
 GENERAL NOTES REQUISITION SEE PG 1 IS AN

INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO.

DATE

1592-1281 A OCT. 15 1975

SUPERSEDED BY

CHG.	DATE	CHG.	DATE
C1		C4	
C2		C5	
C3		C6	

INSTRUMENTATION

LOCAL COMPRESSOR PANEL:

FURNISHED BY ☒ COMP. VENDOR, ☐ PURCHASER, ☐ NOT REQD.PURCHASERS ELECTRICAL AND INSTRUMENT CONNECTIONS SHALL BE ☒ BROUGHT OUT TO TERMINAL BOXES☒ BY THE COMP. VENDOR, ☐ MADE BY THE PURCHASER.

GAGES AND INDICATORS:

PRESSURE GAGES:	MFR. _____	SIZE AND TYPE _____
TEMPERATURE GAGES:	MFR. _____	SIZE AND TYPE _____
LEVEL INDICATORS:	MFR. _____	SIZE AND TYPE _____
SIGHT FLOW INDICATORS:	MFR. _____	SIZE AND TYPE _____
TACHOMETER:	MFR. _____	SIZE AND TYPE _____
	MFR. _____	SIZE AND TYPE _____

INSTRUMENTATION: COMPRESSOR VENDOR SHALL FURNISH THE FOLLOWING:

	LOCAL	LOCAL PANEL		LOCAL	LOCAL PANEL
PRESSURE GAGES:					
☐ OIL PUMP DISCHARGE	☐	☐	☐ MAIN STEAM INLET	☐	☐
☒ LUBE OIL EACH LEVEL	☒	☐	☐ FIRST STAGE STEAM	☐	☐
☐ SEAL OIL EACH LEVEL	☐	☐	☐ STEAM EXHAUST	☐	☐
☐ SEAL OIL DIFF.	☐	☐	☒ COMP. SUCT. PRESS.	☐	☒
☒ BEFORE/AFTER FILTERS	☒	☐	☒ COMP. INTERSTGE. PRESS.	☒	☐
☐ CONTROL OIL	☐	☐	☒ CONDENSED PRESS.	☐	☒
TEMPERATURE GAGES:			☒ COMPRESS. DISCH.	☐	☒
☐ OIL OUTLET EACH BRG.	☐	☐	☒ COMP. BEARINGS	☒	☐
☐ OIL OUTLET EACH SEAL	☐	☐	☒ GEAR BEARINGS	☒	☐
☒ BEFORE/AFTER COOLERS	☒	☐	☒ COMPRESS. SUCTION	☐	☒
SWITCHES:	ALARM	TRIP		ALARM	TRIP
☒ LOW LUBE OIL PRESS.	☒ (*)	☒ (*)	☒ COMP. HIGH DISCH. TEMP.	☐	☒ (*)
☒ LOW SEAL OIL PRESS.	☒ (*)	☒ (*)	☒ HIGH CONDENS. PRESS.	☒ (*)	☒ (*)
☐ LOW OIL RES. LEVEL	☐	☐	☒ HIGH CONDENS. TEMP.	☒	☐
☐ LOW CONTROL OIL PRESS.	☐	☐	☐	☐	☐
☒ AUX. PUMP START			☐	☐	☐

OTHER:

☒ REMOTE SHUTDOWN: ☒ ELECTRICAL, CONTACTS FOR PURCHASER'S SHUTDOWN AND ALARM SYSTEM
☐ SIGHT FLOW EACH BEARING AND SEAL OIL RETURN LINE.
☐ OIL RESERVOIR LEVEL. ☒ "FIRST OUT" INDICATOR
☒ MOTOR AMMETER (COMP. PANEL). ☒ TEST CIRCUITRY FEATURE

LATER / ALARM CONTACTS SHALL ☐ OPEN, ☐ CLOSE TO SOUND ALARM. SHUTDOWN CONTACTS SHALL
☐ OPEN, ☐ CLOSE TO SHUTDOWN. (LATER)

WHERE INDICATED BY (*), ALARM LIGHTS SHALL BE FURNISHED BY THE COMPRESSOR VENDOR AND MOUNTED ON THE LOCAL PANEL WITH ALL NECESSARY RELAY DEVICES.

PURCHASERS ELECTRICAL AND INSTRUMENT CONNECTIONS WITHIN THE CONFINES OF THE BASEPLATE AND CONSOLE SHALL BE ☒ BROUGHT OUT TO TERMINAL BOXES, ☐ MADE DIRECTLY BY THE PURCHASER.

COMMENTS REGARDING INSTRUMENTATION:

FOSTER WHEELER CORPORATION

MATERIAL REQUISITION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N.J.

CENTRIFUGAL COMPRESSORS

PAGE 12 OF 12

FOR CRDA-FE-14-32-0001-1521 FW REF. 15-1592SITE NSP LAWRENCE STATION, SIOUX FALLS, S.D.SERVICE SOLVENT CHILLER REFRIG. UNIT ITEM NO. A 301

MATERIAL

SIZE AND TYPE

NO. REQD.

DRIVER: ☒ MOTOR, ☐ STEAM TURBINE, ☐GENERAL NOTES REQUISITION SEE PG. 1 IS AN

INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO.

DATE

1592-1281 AOCT. 15, 1975

SUPERSEDED BY

CHG.

DATE

CHG.

DATE

C1

C4

C2

C5

C3

C6

CONTROL

NORMAL OPERATING: SUCTION PRESSURE TO THE COMPRESSOR IS
CONTROLLED AT A CONSTANT SETTING WHICH IN TURN
MAINTAINS A CONSTANT TEMPERATURE AT THE CHILLERS.

PERCENTAGE VAVES WILL DECREASE COMPRESSOR
CAPACITY TO THE SURGE POINT. FROM THIS POINT ON,
ADDITIONAL CAPACITY REDUCTION IS ACCOMPLISHED BY
BY-PASSING HOT GAS.

SURGE CONTROL: HOT GAS BY-PASS

INSPECTION AND TESTING

WITNESSED:

COMPRESSOR:

- ☒ SHOP INSPECTION.
☒ HYDROSTATIC TEST.
☒ IMPELLER OVERSPEED _____ % OF _____ RPM.
☒ DYNAMIC BALANCE OF ROTOR
☒ MECHANICAL RUN.
☐
☐
☐

- ☐ YES ☐ NO
☐ YES ☐ NO
☐ YES ☐ NO
☐ YES ☐ NO
☐ YES ☐ NO
☐ YES ☐ NO
☐ YES ☐ NO
☐ YES ☐ NO

DRIVER:

(SEE NOTE A)

- ☒ STANDARD COMMERCIAL TESTS
☐
☐
☐

- ☐ YES ☐ NO
☐ YES ☐ NO
☐ YES ☐ NO
☐ YES ☐ NO

GEARS &
PUMPS

(SEE NOTE B)

- ☒ SHOP INSPECTION.
☒ STANDARD COMMERCIAL TESTS
☐

- ☐ YES ☐ NO
☐ YES ☐ NO
☐ YES ☐ NO

OIL COOLERS:

- ☒ HYDROSTATIC TEST
 _____ Psig OIL SIDE. _____ Psig WATER SIDE.

- ☐ YES ☐ NO

INTERCOOLERS:

- ☒ HYDROSTATIC TEST
 _____ Psig AIR SIDE. _____ Psig WATER SIDE.

- ☐ YES ☐ NO

COMMENTS REGARDING TESTING:

(A) MOTOR MANUFACTURERS SHALL FURNISH CERTIFIED COPIES OF
STANDARD COMMERCIAL TESTS.

(B) CERTIFIED PUMP TEST SHALL BE PROVIDED.

PUMPS

FOSTER WHEELER CORPORATION

CENTRIFUGAL PUMPS

PAGE 1 OF 1

FOR ERDA-FE-14-32-0001-1521		F.W. CONTRACT 15-1592		REQUISITION NO. 1592-1311-A	DATE 9-2-75
SITE: VGP LAWRENCE STATION, SIOUX FALLS, SOUTH DAKOTA				SUPERSEDED BY CHANGE NO.	
SERVICE: RICH SOLVENT PUMP				C1 1-26-76	C5
NO. REQ'D 1 ITEM NOS. P-301				C2 3-23-76	C6
NO. OF MOTORS REQ'D 1		ITEM NOS.		SUPPLIED BY PUMP MFR MOUNTED BY PUMP MFR	
NO. OF TURBINES REQ'D		ITEM NOS.		SUPPLIED BY MOUNTED BY	
PUMP MFR.		SIZE & MODEL		NO. STAGES	

OPERATING CONDITIONS, EACH PUMP:

LIQUID: FLAMMED SOLVENT	U.S. GPM @ PT: MIN NORM 990	RTD. *	PROPOSAL CURVE NO.
P.T. °F. MAX *	DISCH. PSIG	RTD. *	RPM NPSHR (WATER), FT.
SP. GR. AT PT *	SUCT. PSIG (MAX. *)	RTD. *	MIN. CONTINUOUS U.S. GPM
VAP. PSIA @ PT *	DIFF. PSI	*	ROTATION, VIEWING FROM COUPLING
VIS. @ PT * SMS *	TOTAL DIFF. HEAD, FT.	*	WITH RATED IMPELLER:
CORR. EROS. FROM H ₂ S, CO ₂	NPSHA, FT.	*	EFFICIENCY AT RATED POINT, %
	HYD HP. *		IF EFF. IS VISCOUS, WATER EFF. =

CONSTRUCTION: ANSI B73.1 - 1974

NOZZLES	SIZE	ANSI RATING	FACING	LOCATION
SUCTION	300	RF	END	
DISCHARGE	300	RF	TOP	

CASE-MOUNT ☐ CENTERLINE ☒ FOOT ☐ BRACKET ☐ IN-LINE ☐

-SPLIT: ☐ AXIAL ☒ RADIAL

-VOLUTE: ☐ SINGLE ☒ DOUBLE ☐ DIFFUSER ☐

-DESIGN: PSIG @ °F. HYDRO TEST PSIG

-AUX. CONNECTS: ☒ VENTS ☒ DRAINS ☐ GAGES ☐

IMPELLER: DIA.: RATED, MAX., MIN. TYPE

MOUNTING ☐ BETWEEN BEARINGS ☒ OVERHUNG ☐

WEAR RINGS: ☐ INLET ONLY ☐ BOTH SIDES ☐ CASE ONLY ☐ CASE & IMPELL.

BEARINGS: TYPE: RADIAL - BALL, THRUST - BALL

LUBE: ☐ RING ☒ FLOOD ☐ FLINGER ☐ MIST ☐ PRESSURE

COUPLING: MFR: MODEL: SPACER TYPE

DRIVER 1/2 MTD BY: ☒ PUMP MFR. ☐ DRIVER MFR. ☐ PURCH.

GUARD TYPE:

PACKING: MFR & TYPE SIZE NO. RINGS

MECH. SEAL: MFR & MODEL MFR'S CODE API CODE 45PXL

CRANE ? OF EQUAL

SEAL GASKET MATERIAL: X*ETHYLENE PROPYLENE

AUXILIARY PIPING:

C.W. PIPE PLAN WITH ☐ C.S. ☐ S.S. ☐ TUBING ☐ PIPE

TOTAL C.W. REQ'D GPM. INCLUDE: ☐ FLOW INDIC. ☐ VALVE "C"

PACKING INJECTION: FLUID= °F. REQ'D= GPM @ PSIG

SEAL FLUSH PLAN WITH ☒ C.S. ☐ S.S. ☒ TUBING ☐ PIPE

EXT. FLUSH FLUID= °F. REQ'D= GPM @ PSIG

AUX. SEAL PLAN WITH ☐ C.S. ☐ S.S. ☐ TUBING ☐ PIPE

QUENCH FLUID:

MOTOR DRIVERS:

HP, S.F., RPM, FRAME 460 V/3 PH/60 HZ

MFR. BEARINGS BALL, LUBE

TYPE INSUL. CLASS B AMPS, FULL LOAD

ENCL. IFFC RISE °C 80 AMPS, LOCKED ROTOR

VERT. UNITS: ☐ VSS ☐ VHS THRUST CAP., LBS. UP DN.

TURBINE DRIVERS:

☐ IF BY PUMP VENDOR SEE PAGE ATTACHED

☐ IF BY OTHERS: MFR. MODEL BHP

APPLICABLE DOCUMENTS: 1590-1300A, 1590-38A1, 1590-50A2, 1590-50A4, 1590-92A1, 1590-31A2

NOTE (1) SPACED BY P-302B WITH A PRESSURE REDUCING VALVE.

* PROPRIETARY DATA

FOR <u>1590-14-32-0001-1521</u>	F.W. CONTRACT <u>15 1592</u>	REQUISITION NO. <u>1592-1311-B</u>	DATE <u>9-2-75</u>
SITE <u>MC LAWRENCE STATION, SIOUX FALLS, SOUTH DAKOTA</u>		SUPERSEDED BY CHANGE NO.	
SERVICE <u>LEAN SOLVENT PUMPS</u>		C1 <u>1-26-76</u>	C3 <u>C5</u>
NO. REQ'D <u>2</u>	ITEM NOS. <u>P-302 A/B</u>	C2 <u>3-23-76</u>	C4 <u>C6</u>

NO. OF MOTORS REQ'D 2 : ITEM NOS. _____ SUPPLIED BY PUMP MFR MOUNTED BY PUMP MFR

NO. OF TURBINES REQ'D _____ : ITEM NOS. _____ SUPPLIED BY _____ MOUNTED BY _____

PUMP MFR. _____ SIZE & MODEL _____

NO. STAGES _____

OPERATING CONDITIONS, EACH PUMP:

LIQUID <u>LEAN SOLVENT</u>	U.S. GPM @ PT: MIN _____ NORM _____ * RTD. _____ * PROPOSAL CURVE NO. _____
P.T. °F. _____ *	DISCH. PSIG _____ RTD. <u>660</u> RPM _____ NPSHR (WATER), FT. _____
SP. GR. AT PT _____ *	SUCT. PSIG (MAX. _____) RTD. _____ * MIN. CONTINUOUS U.S. GPM _____
VAP. PSIA @ PT _____ *	DIFF. PSI _____ * ROTATION, VIEWING FROM COUPLING _____
VIS. @ PT _____ *	TOTAL DIFF. HEAD, FT. _____ *
CORR. EROS. FROM _____	NPSHA, FT. _____
	HYD HP _____ * WITH RATED IMPELLER:

CONSTRUCTION

NOZZLES	SIZE	ANSI RATING	FACING	LOCATION
SUCTION		<u>300</u>	<u>RF</u>	
DISCHARGE		<u>300</u>	<u>RF</u>	

CASE-MOUNT ☒ CENTERLINE ☐ FOOT ☐ BRACKET ☐ IN-LINE ☐-SPLIT: ☐ AXIAL ☒ RADIAL-VOLUTE: ☐ SINGLE ☒ DOUBLE ☐ DIFFUSER ☐

-DESIGN: _____ PSIG @ _____ °F. HYDRO TEST _____ PSIG

-AUX. CONNECTS: ☒ VENTS ☒ DRAINS ☐ GAGES ☐

IMPELLER: DIA.: RATED _____, MAX. _____, MIN. _____ TYPE _____

MOUNTING ☒ BETWEEN BEARINGS ☐ OVERHUNG ☐WEAR RINGS: ☐ INLET ONLY ☒ BOTH SIDES ☒ CASE ONLY ☐ CASE & IMPELL.BEARINGS: TYPE: RADIAL = SLEEVE THRUST = BALLLUBE: ☒ RING ☐ FLOOD ☐ FLINGER ☐ MIST ☐ PRESSURECOUPLING: MFR: _____ MODEL: SPACER TYPEDRIVER 1/2 MTD BY: ☒ PUMP MFR. ☐ DRIVER MFR. ☐ PURCH.

GUARD TYPE: _____

PACKING: MFR & TYPE _____ SIZE _____ NO. RINGS _____

MECH. SEAL: MFR & MODEL _____ MFR'S CODE _____ API CODE BSTGLPLANT 9B 11 EQUAL

AUXILIARY PIPING:

C.W. PIPE PLAN _____, WITH ☐ C.S. ☐ S.S. ☐ TUBING ☐ PIPETOTAL C.W. REQ'D _____ GPM. INCLUDE: ☐ FLOW INDIC. ☐ VALVE "C"

PACKING INJECTION: FLUID= _____ °F. REQ'D= _____ GPM @ _____ PSIG

SEAL FLUSH PLAN 11, WITH ☒ C.S. ☐ S.S. ☒ TUBING ☐ PIPE

EXT. FLUSH FLUID= _____ °F. REQ'D= _____ GPM @ _____ PSIG

AUX. SEAL PLAN _____, WITH ☐ C.S. ☐ S.S. ☐ TUBING ☐ PIPE

QUENCH FLUID= _____

MOTOR DRIVERS:

HP _____, S.F. _____, RPM _____, FRAME 4000V/3 PH/60 HZ

MFR. _____ BEARINGS _____, LUBE _____

TYPE _____ INSUL. CLASS B AMPS, FULL LOAD _____ENCL. W/22 RISE °C 80 AMPS, LOCKED ROTOR _____VERT. UNITS: ☐ VSS ☐ VHS THRUST CAP., LBS. _____ UP _____ DN. _____

TURBINE DRIVERS:

☐ IF BY PUMP VENDOR SEE PAGE _____ ATTACHED☐ IF BY OTHERS: MFR. _____ MODEL _____ BHP _____APPLICABLE DOCUMENTS: 1590-1300A, 1590-38A1, 1590-50A2, 1590-50A4, 1590-92A1, 1590-31A11590-1300A PUMP P-302R IS A COMMON SHAPE FOR P-301 AND P-302A(C) INLET STEAM @ 680 PSIG, 750 °F; EXHAUST TO 70 PSIG * PROPRIETARY DATA

PERFORMANCE

PROPOSAL CURVE NO. _____
RPM _____ NPSHR (WATER), FT. _____
MIN. CONTINUOUS U.S. GPM _____
ROTATION, VIEWING FROM COUPLING _____
WITH RATED IMPELLER:
EFFICIENCY AT RATED POINT, % _____
IF EFF. IS VISCOUS, WATER EFF. = _____
BHP: RATED _____ NORM _____ MAX _____
IF HP IS VISC., RATED WATER BHP = _____
MAX. TOTAL HEAD, FT. _____
MAX. POSSIBLE DISCH. PRESS.: _____ PSIG
WITH RATED SUCT. PRESS. = _____
WITH MAX. SUCT. PRESS. = _____

SHOP TESTS:

	REQUIRED	WITNESSED
PERFORMANCE	<u>YES</u>	<u>NO</u>
NPSHR		
DISMANTLE & INSPECT		
HYDROTEST CASE	<u>YES</u>	<u>NO</u>
HYDROTEST BOWLS		

MATERIALS:

☒ PUMP API CLASS <u>S-1</u>
☐

BASE PLATE

VERTICAL PUMPS

THRUST, LBS. _____ UP. _____ DOWN

OTHER DETAILS PER PAGE NO. _____

APPROX. WEIGHTS

(LBS NET EACH)
PUMP ONLY _____ MOTOR _____
BASE _____ TURBINE _____

SITE DATA

AMBIENT 23 °F MAX TO 25 °F MIN.INSTALLED ☒ OUTDOORS ☐ INDOORS☒ CL I - GR D - DIV 2 ☐ NON-HAZARDOUS

COOLING WATER: TYPE _____

°F & PSIG IN, °F MAX & PSIG OUT

FOSTER WHEELER CORPORATION

CENTRIFUGAL PUMPS

PAGE / OF/

FOR ENDA-FE-14-32-0001-1521

F.W. CONTRACT 15-1592

REQUISITION NO.

DATE

SITE NIS LAWRENCE STATION, SIOUX FALLS, SOUTH DAKOTA

SUPERSEDED BY CHANGE NO.

SERVICE SOLVENT STRIPPER CONDENSATE PUMP

C1 1-26-76

C3

C5

NO. REQ'D 1 ITEM NOS. P-303A/B

C2 3-8-76

C4

C6

NO. OF MOTORS REQ'D 1 : ITEM NOS.

SUPPLIED BY PUMP MFR

MOUNTED BY PUMP MFR

NO. OF TURBINES REQ'D : ITEM NOS.

SUPPLIED BY

MOUNTED BY

PUMP MFR.

SIZE & MODEL

NO. STAGES

OPERATING CONDITIONS, EACH PUMP:

LIQUID SOLVENT WATER

U.S.GPM @ PT: MIN _____ NORM * _____ RTD. * _____

DISCH. PSIG _____

SUCT. PSIG (MAX. *) _____

P.T. °F. (MAX. *) _____

SP. GR. AT PT _____

VAP. PSIA @ PT _____

VIS. @ PT _____

CORR./EROS. FROM H₂S, CO₂

TOTAL DIFF. HEAD, FT. _____

NPSHA, FT. _____

HYD HP. 0.63

PERFORMANCE

PROPOSAL CURVE NO. _____

RPM _____ NPSHR (WATER), FT. _____

MIN. CONTINUOUS U.S.GPM _____

ROTATION, VIEWING FROM COUPLING _____

WITH RATED IMPELLER:

EFFICIENCY AT RATED POINT, % _____

IF EFF. IS VISCOUS, WATER EFF. = _____

BHP: RATED _____ NORM _____ MAX _____

IF HP IS VISC., RATED WATER BHP = _____

MAX. TOTAL HEAD, FT. _____

MAX. POSSIBLE DISCH. PRESS.: _____ PSIG

WITH RATED SUCT. PRESS. = _____

WITH MAX. SUCT. PRESS. = _____

CONSTRUCTION SIMILAR TO PENDING ANSI STD.

NOZZLES SIZE ANSI RATING FACING LOCATION

SUCTION _____ 300 RF SIDE

DISCHARGE _____ 300 RF SIDE

CASE-MOUNT ☐ CENTERLINE ☐ FOOT ☐ BRACKET ☒ IN-LINE ☐-SPLIT: ☐ AXIAL ☒ RADIAL-VOLUTE: ☒ SINGLE ☐ DOUBLE ☐ DIFFUSER ☐

-DESIGN: _____ PSIG @ _____ °F. HYDRO TEST _____ PSIG

-AUX. CONNECTS: ☐ VENTS ☒ DRAINS ☐ GAGES ☐

IMPELLER: DIA.: RATED _____, MAX. _____, MIN. _____ TYPE _____

MOUNTING ☐ BETWEEN BEARINGS ☐ OVERHUNG ☐WEAR RINGS: ☐ INLET ONLY ☐ BOTH SIDES ☐ CASE ONLY ☐ CASE & IMPELL.

BEARINGS: TYPE: RADIAL -BALL IN DRIVER THRUST = BALL IN DRIVER

LUBE: ☐ RING ☐ FLOOD ☐ FLINGER ☐ MIST ☐ PRESSURE

COUPLING: MFR: _____ MODEL: SPACER TYPE

DRIVER 1/2 MTD BY: ☒ PUMP MFR. ☐ DRIVER MFR. ☐ PURCH.

GUARD TYPE: _____

PACKING: MFR & TYPE _____ SIZE _____ NO. RINGS _____

MECH. SEAL: MFR & MODEL _____ MFR'S CODE _____ API CODE 45TGL

CRANE 9 OR EQUAL

SHOP TESTS:

PERFORMANCE REQUIRED YES NO

NPSHR _____

DISMANTLE & INSPECT

HYDROTEST CASE YES NO

HYDROTEST BOWLS _____

MATERIALS:

☐ PUMP API CLASS S-1☐

AUXILIARY PIPING:

C.W. PIPE PLAN _____, WITH ☐ C.S. ☐ S.S. ☐ TUBING ☐ PIPETOTAL C.W. REQ'D. _____ GPM. INCLUDE: ☐ FLOW INDIC. ☐ VALVE "C"

PACKING INJECTION: FLUID= _____ @ _____ °F. REQ'D= _____ GPM @ _____ PSIG

SEAL FLUSH PLAN 13, WITH ☒ C.S. ☐ S.S. ☒ TUBING ☐ PIPE

EXT. FLUSH FLUID= _____ @ _____ °F. REQ'D= _____ GPM @ _____ PSIG

AUX. SEAL PLAN _____, WITH ☐ C.S. ☐ S.S. ☐ TUBING ☐ PIPE

QUENCH FLUID= _____

MOTOR DRIVERS:

HP _____, S.F. _____, RPM _____, FRAME _____, 460 V/3 PH/60 HZ

MFR. _____ BEARINGS BALL, LUBE _____

TYPE _____ INSUL. CLASS B

AMPS, FULL LOAD _____

ENCL. TEFC RISE °C 80

AMPS, LOCKED ROTOR _____

VERT. UNITS: ☐ VSS ☐ VHS THRUST CAP., LBS. _____ UP _____ DN. _____

TURBINE DRIVERS:

☐ IF BY PUMP VENDOR SEE PAGE _____ ATTACHED☐ IF BY OTHERS: MFR. _____

MODEL _____

BHP _____

APPROX. WEIGHTS

(LBS NET EACH)

PUMP ONLY _____ MOTOR _____

BASE _____ TURBINE _____

SITE DATA

AMBIENT 23 °F MAX TO 25 °F MIN.

INSTALLED ☒ OUTDOORS ☐ INDOORS☒ CL I - GR 0-DIV 2 ☐ NON-HAZARDOUS

COOLING WATER: TYPE _____

°F & PSIG IN, °F MAX & PSIG OUT

APPLICABLE DOCUMENTS: 1590-1300A, 1590-38A1, 1590-50A2, 1590-50A4, 1590-92A1

1590-31A2

* PROPRIETARY DATA

FOR 5-80

FOR ERDA-FE-14-32-0001-1521	F.W. CONTRACT 15-1592	REQUISITION NO. 1592-1311-E	DATE 9-2-75
SITE MSP LAWRENCE STATION, SIOUX FALLS, SOUTH DAKOTA		SUPERSEDED BY CHANGE NO.	
SERVICE SOLVENT SUMP PUMP		C1 1-26-76	C3
NO. REQ'D 1	ITEM NOS. P-305	C2 3-24-76	C4

NO. OF MOTORS REQ'D. 1 : ITEM NOS. SUPPLIED BY PUMP MFR MOUNTED BY PUMP MFR

NO. OF TURBINES REQ'D : ITEM NOS. SUPPLIED BY MOUNTED BY

PUMP MFR.

SIZE & MODEL

NO. STAGES

OPERATING CONDITIONS, EACH PUMP:

LIQUID SELEXOL SOLVENT U.S.GPM @ PT: MIN 50 NORM 50 RTD. 50
DISCH. PSIG 50 RPM 50 NPSHR (WATER), FT. 50
P.T. °F. (MAX 100) 60 SUCT. PSIG (MAX. 50) RTD. 0 MIN. CONTINUOUS U.S.GPM 50
SP.GR. AT PT * DIFF. PSI 50 ROTATION, VIEWING FROM COUPLING 50
VAP. PSIA @ PT NEGL TOTAL DIFF. HEAD, FT. 111
VIS. @ PT CKS * NPSHA, FT. 27
CORR./EROS. FROM NONE HYD HP 146

PERFORMANCE

PROPOSAL CURVE NO. 50
IF EFF. IS VISCOS, WATER EFF. = 50
BHP: RATED 50 NORM 50 MAX 50
IF HP IS VISC., RATED WATER BHP = 50
MAX. TOTAL HEAD, FT. 50
MAX. POSSIBLE DISCH. PRESS.: 50 PSIG
WITH RATED SUCT. PRESS. = 50
WITH MAX. SUCT. PRESS. = 50

CONSTRUCTION

NOZZLES	SIZE	ANSI RATING	FACING	LOCATION
SUCTION			STRAINER	BOTTOM
DISCHARGE		300	RF	TOP

CASE-MOUNT ☐ CENTERLINE ☐ FOOT ☐ BRACKET ☐ IN-LINE ☒ SUMP-SPLIT: ☐ AXIAL ☒ RADIAL-VOLUTE: ☒ SINGLE ☐ DOUBLE ☐ DIFFUSER ☐-DESIGN: PSIG @ °F. HYDRO TEST PSIG-AUX. CONNECTS: ☒ VENTS ☐ DRAINS ☐ GAGES ☐IMPELLER: DIA.: RATED 50, MAX. 50, MIN. 50. TYPE 50MOUNTING ☐ BETWEEN BEARINGS ☐ OVERHUNG ☐WEAR RINGS: ☐ INLET ONLY ☐ BOTH SIDES ☐ CASE ONLY ☐ CASE & IMPELL.BEARINGS: TYPE: RADIAL - SLEEVE, THRUST = BALL IN MOTORLUBE: ☐ RING ☐ FLOOD ☐ FLINGER ☐ MIST ☐ PRESSURECOUPLING: MFR: 50. MODEL: 50DRIVER 1/2 MTD BY: ☒ PUMP MFR. ☐ DRIVER MFR. ☐ PURCH.GUARD TYPE: 50PACKING: MFR & TYPE 50 SIZE 50 NO. RINGS 50MECH. SEAL: MFR & MODEL 50 MFR'S CODE 50 API CODE 50

SHOP TESTS:

	REQUIRED	WITNESSED
PERFORMANCE	YES	NO
NPSHR		
DISMANTLE & INSPECT		
HYDROTEST CASE	YES	NO
HYDROTEST BOWLS		

MATERIALS:

☐ PUMP API CLASS S-1☐

AUXILIARY PIPING:

C.W. PIPE PLAN 50, WITH ☐ C.S. ☐ S.S. ☐ TUBING ☐ PIPETOTAL C.W. REQ'D. 50 GPM. INCLUDE: ☐ FLOW INDIC. ☐ VALVE "C"PACKING INJECTION: FLUID= 50 @ 50 °F. REQ'D= 50 GPM @ 50 PSIGSEAL FLUSH PLAN 50, WITH ☐ C.S. ☐ S.S. ☐ TUBING ☐ PIPEEXT. FLUSH FLUID= 50 @ 50 °F. REQ'D= 50 GPM @ 50 PSIGAUX. SEAL PLAN 50, WITH ☐ C.S. ☐ S.S. ☐ TUBING ☐ PIPEQUENCH FLUID= 50

MOTOR DRIVERS:

HP 50, S.F. 50, RPM 50, FRAME 50, V/ 50 PH/ 50 HZMFR. 50. BEARINGS 50, LUBE 50TYPE 50. INSUL. CLASS B AMPS, FULL LOAD 50ENCL. TEFC. RISE °C 80 AMPS, LOCKED ROTOR 50VERT. UNITS: ☐ VSS ☐ VMS THRUST CAP., LBS. 50 UP 50 DN. 50

TURBINE DRIVERS:

☐ IF BY PUMP VENDOR SEE PAGE 50 ATTACHED☐ IF BY OTHERS: MFR. 50 MODEL 50 BHP 50APPLICABLE DOCUMENTS: 1590-1300A, 1590-38A1, 1590-50A2, 1590-50A4, 1590-92A1, 1590-31A2

* PROPRIETARY DATA

BASE PLATE

VERTICAL PUMPS

THRUST, LBS. 50 UP, 50 DOWNOTHER DETAILS PER PAGE NO. 2

APPROX. WEIGHTS

(LBS NET EACH)

PUMP ONLY 50 MOTOR 50BASE 50 TURBINE 50

SITE DATA

AMBIENT 50 °F MAX TO 25 °F MIN.INSTALLED ☒ OUTDOORS ☐ INDOORS☒ CL 1-GRD-DIV 2 ☐ NON-HAZARDOUSCOOLING WATER: TYPE 50

°F & PSIG IN, °F MAX & PSIG OUT

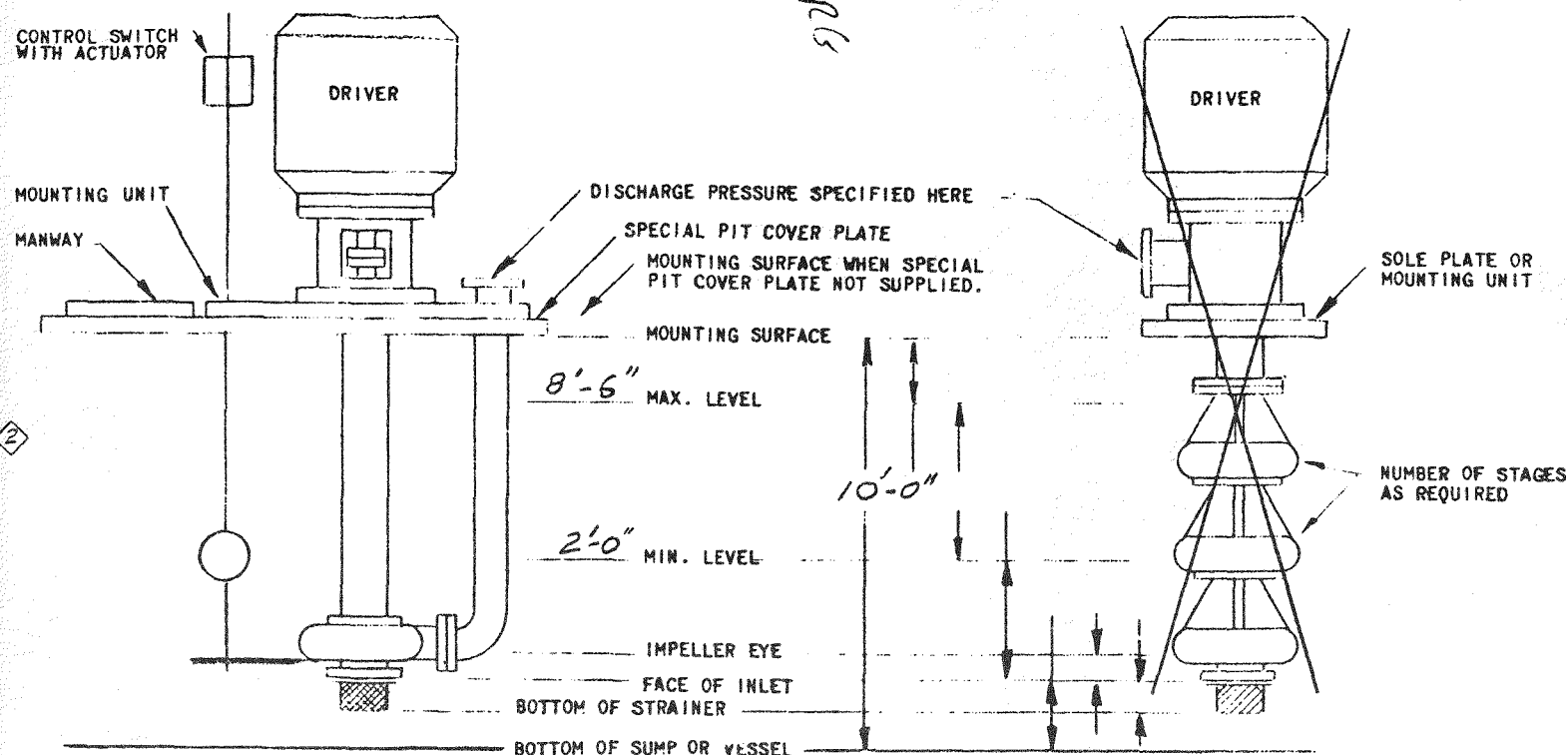
WPC

FORM 131

FOSTER WHEELER CORPORATION

VERTICAL CENTRIFUGAL PUMPS

PAGE 2 OF 2



TYPE "S" (DISCHARGE PIPE EXTERNAL TO COLUMN)

TYPE "T" (DISCHARGE INSIDE COLUMN)

VENDOR COMPLETE MISSING DIMENSIONS ABOVE TO SPECIFY EQUIPMENT AND REQUIREMENTS: IMPELLER EYE LOCATION REQUIRED ONLY

WHEN NPSH IS LIMITED OR NPSHA TEST REQUIRED. VENDOR ALSO COMPLETE DATA BELOW WHEN IN SCOPE OF SUPPLY.

PURCHASER'S FLUID CONTAINER TYPE: STEEL PURCHASER'S MOUNTING SURFACE: STEEL PLATE

ARRANGEMENT ☒ TYPE "S" ☐ TYPE "T" COVER CONSTRUCTION: ☐ OPEN ☒ RAIN TIGHT ☐ GAS TIGHT ☐

MOUNTING COLUMN: ☒ FLANGED ☐ SCREWED MATERIALS STEEL

DISCHARGE PIPING: ☒ FLANGED ☐ SCREWED MATERIALS STEEL

INCLUDE: ☒ MOUNTING UNIT = ☒ VENDOR'S STD. ARRGT. ☐ SOLE PLATE MAT'L. _____

☐ SPECIAL PIT COVER = ☐ VENDOR'S STD. ARRGT. ☐ SOLE PLATE ☐ MANWAY MAT'L. _____

☒ INLET STRAINER = ☒ VENDOR'S STD. ARRGT. ☐ MESH MAT'L. _____

☐ LEVEL CONTROL ACTUATOR = TYPE _____ MAT'L. _____

☐ LEVEL CONTROL SWITCH = ☐ START-STOP ☐ ALTERNATOR ☐ _____

_____ VOLT- _____ PH.- _____ HZ. ENCLOSURE _____

☐ _____

☐ _____

FOR ERDA-FE-14-32-0001-1521	F.W. CONTRACT 15-1592	REQUISITION NO.	DATE
SITE NPS LAWRENCE STATION, SIOUX FALLS, SOUTH DAKOTA		1592-1311-E	9-2-75
ITEM NO. P-305		SUPERSEDED BY CHANGE NO.	
		C1 12676 C3	C5
		C2 132476 C4	C6

FILTER

MATERIAL REQUISITION

FOSTER WHEELER ENERGY CORPORATION

PAGE 1 OF 1

FOR <u>ERDA-FOSSIL ENERGY</u>	F.W. REF. <u>15-1592</u>	REQUISITION NUMBER	DATE
SITE <u>STIOUX FALLS, SOUTH DAKOTA</u>		<u>1592-1349A</u>	<u>2/9/76</u>
MATERIAL <u>SOLVENT FILTER F-301</u>	SUPERSEDED BY CHANGE NO.:		
	C1		C4
	C2		C5
	C3		C6

A. SCOPE

The vendor shall furnish a solvent filter which shall meet the following specifications:

Type Drum with replacable cartridge

1. PROCESS DATA

Fluid Handled	Organic Solvent
Sp Gravity	*
Viscosity	* CP
Flow	25 GPM
Operating Pressure	* PSIG
Operating Temperature	* F

Pressure Drop	
Clean	By Vendor
Dirty	30 PSI

Particle Size 20 Micron

2. CONNECTIONS

Inlet	2"
Outlet	2"
Drain	By Vendor
Vent	By Vendor
Design Pressure	By Vendor (161 PSIG Min.)
Design Temperature	* F/150 F
Cartridge Material	Polypropylene

B. REFERENCES

1590-1900A General Notes Miscellaneous Equipment

*PROPRIETARY DATA

BY:	P.O. NO.	SUPPLIER:
-----	----------	-----------

FOSTER WHEELER ENERGY CORPORATION
INSTRUMENT PROCESS DATA

PREPARED BY JDF

(1) ITEM NUMBER OR SERVICE		(2) NOM. LINE SIZE	(3) FLUID TYPE & STATE	(4) NORMAL lb/h	FLOW %		SP. GR. AT.		(9) MOL. WT.	(10) VISC. CFS. - TEMP.	(11) LIQ. VAPOR PRESS. PSIA	(12) L/O CRITICAL PRESS. lb/in ² a	(13) VAPOR COMP. FACTOR	(14) VAPOR Cp/Cv	(15) NORM. OP. TEMP. °F	PRESSURES AT NORM. FLOW		PRESSURES AT MAX. FLOW		PRESSURES AT MIN. FLOW		(18) DOWNSTREAM FLASHING	(19) TIGHT SHUTOFF	(20) AIR FAILURE	(21) REMARKS AND/OR ALARM AND SHUTDOWN SETTINGS	(22) REVISION
(5) MAX.	(6) MIN.	(7) 60°F	(8) COND.	(16a) UPSTREAM lb/in ² a	(17a) DOWN- STREAM lb/in ² a	(16b) UPSTREAM lb/in ² a	(17b) DOWN- STREAM lb/in ² a	(16c) UPSTREAM lb/in ² a								(17c) DOWN- STREAM lb/in ² a										
FLOW																										
FT-3001	T-301 LIQUID OUT	6"	1-LIQUID	*			*	*		*	375				*	382										
FIC-3001																										
FY-3001																										
FICY-3001		6"	1-LIQUID	*	110	75	*	*		*	375	3200			*	380	35	130	35	380	35	YES	NO	C	1.0 WT % FLASHED VAPOR MW = 39.6	
FT-3002	E-307 TO E-302	3"	14-GAS	*	110	33			39.6	.02			1.	1.3	120	381		381		127						
FR-3002																										
FI-3003	BFW TO P-301	1"	1-WATER	*	200	60	1.	1.		1.	1.				AMB			*		*						
FI-3005	F-301 INLET	2"	1-LIQUID	*	150	50	*	*		*	*	3200			*	*		*		*						
FCV-3006	P-301 DISCHARGE	8"	1-LIQUID	*	110	(1)	*	*		*	*	3200			*	*	*	*		*		NO	YES		YARWAY "ARC" VALVE OR EQ. (1) RECIRC. FLOW BY P-301 VENDOR	
FCV-3007	P-302B DISCHARGE	8"	1-LIQUID	*	110	(1)	*	*		*	*	3200			*	674	672	674		674					YARWAY "ARC" VALVE OR EQ. (1) RECIRC. FLOW BY P-302 VENDOR	
FCV-3008	P-302A DISCHARGE	8"	1-LIQUID	*	110	(1)	*	*		*	*	3200			*	674	672	674		674					YARWAY "ARC" VALVE OR EQ. (1) RECIRC. FLOW BY P-302 VENDOR	
FT-3009	P-303 DISCHARGE	1½"	1-WATER	*	140	70	1.	*		.62	*	3200			110	*		*		*						
FR-3009																										
FT-3010	STEAM TO E-305	8"	8-STEAM	20,400	120	50			18.02	.02			1.	1.32	520	124										
FR-3010																										
FIC-3010																										
FICY		8"	8-STEAM	20,400					18.02	.02					450	122	114.					NO		C		
FY-3004	P-302 TO E-304	8"	1-LIQUID	*	110	75	*	*		*	*				*	670										
FIC-3004																										

JOB NO. 15-1592
PAGE 2 OF 9
REVISION 0
DATE 4/27/76
PREPARED BY JDF

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[illegible]

JOB NO. 15-1592
PAGE 3 OF 9
REVISION 0
DATE 4/27/76
PREPARED BY JDF

PREPARED BY: JDF

70

**FOSTER WHEELER ENERGY CORPORATION
INSTRUMENT PROCESS DATA**

JOB NO. 15-1592
PAGE 4 OF 9
REVISION 0
DATE 4/27/76
PREPARED BY JDF

ENG. FLOW SHEET NO. OP-751-577

(1) ITEM NUMBER OR SERVICE		(2) NOM. LINE SIZE	(3) FLUID TYPE & STATE	(4) NORMAL lb/h	FLOW %		SP. GR. AT.		(9) VOL. WT.	(10) VISC. CPS. @ TEMP.	(11) LIQ. VAPOR PRESS. PSIA	(12) LIQ. CRITICAL PRESS. lb/in ² a	(13) VAPOR COMP. FACTOR	(14) VAPOR CP/Cv	(15) NORM. OP. TEMP. °F	PRESSURES AT FLOW		PRESSURES AT MAX. FLOW		PRESSURES AT MIN. FLOW		(18) DOWNSTREAM FLASHING	(19) TIGHT SHUTOFF	(20) AIR FAILURE	(21) REMARKS AND/OR ALARM AND SHUTDOWN SETTINGS	(22) REVISION	
					(5) MAX.	(6) MIN.	(7) 60 °F	(8) COND.								(16a) UPSTREAM lb/in ² a	(17a) DOWN- STREAM lb/in ² a	(16b) UPSTREAM lb/in ² a	(17b) DOWN- STREAM lb/in ² a	(16c) UPSTREAM lb/in ² a	(17c) DOWN- STREAM lb/in ² a						
LEVEL (CONTD)																											
LG-3008	D-304	-	1-LIQUID			*	*								95.	368.											
LT-3009	D-304	-	1-LIQUID			*	*								95.	368.											
LSH-3009																									SET @ 6'-6" ABOVE BTL		
LAH-3009																									SET @ 6" ABOVE BTL		
LSL-3009																											
LAL-3009																											
LSHH-3019	D-304		1-LIQUID			*	*								95.	368.										SET @ 7'-0" ABOVE BTL	
LAHH-3019																											
LG-3010	D-305		14-LIQUID			*	*								*	*										TO BE CONFIRMED BY A-301 VENDOR	
LT-3011	D-305		14-LIQUID			*	*								*	*										TO BE CONFIRMED BY A-301 VENDOR	
LC-3011																									NLL @ 4'-0"		
LCV-3011	FREON TO D-305	8"	14-LIQUID	*		*	*								100.	*					YES	NO	C			UPSTREAM CONDS BY A-301 VENDOR	
LSH-3011																									SET @ 7'-3" ABOVE BTL		
LAH-3011																											
LSL-3011																									SET @ 0'-9" ABOVE BTL		
LAL-3011																											
LSHH-3014	D-302		1-LIQUID			*	*								*	*										SET @ 5'-9" ABOVE BTL	
LAHH-3014																											
LG-3012	D-302		1-LIQUID			*	*								*	*											
LT-3013	D-302		1-LIQUID			*	*								*	*											
LR-3013																											
LSH-3013																									SET @ 5'-0" ABOVE BTL		
LAH-3013																											
LSL-3013																									SET @ 1'-0" ABOVE BTL		
LAL-3013																											
*PROPRIETARY DATA																											

JOB NO. 15-1592
PAGE 5 OF 9
REVISION 0
DATE 4/27/76
PREPARED BY JDF

PREPARED BY JDF

72

* PROPRIETARY DATA

15-1592
JOB NO. _____
PAGE 6 OF 9
REVISION 0
DATE 4/27/76
PREPARED BY JDF

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[illegible]

JOB NO. 15-1592
PAGE 7 OF 9
REVISION 0
DATE 4/27/76
PREPARED BY JDF

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**FOSTER WHEELER ENERGY CORPORATION
INSTRUMENT PROCESS DATA**

JOB NO. 15-1592
PAGE 8 OF 9
REVISION 0
DATE 4/27/76
PREPARED BY JDF

ENG. FLOW SHEET NO. OP-751-577

(1) ITEM NUMBER OR SERVICE		(2) NOM. LINE SIZE	(3) FLUID TYPE & STATE	(4) NORMAL lb/h	FLOW %		SP. GR. AT.		(9) MOL. WT.	(10) VISC. CPS. @ TEMP.	(11) LIQ. VAPOR PRESS. PSIA	(12) LIQ. CRITICAL PRESS. lb/in ² _a	(13) VAPOR COMP. FACTOR	(14) VAPOR CP/CP	(15) NORM OP. TEMP. °F	PRESSURES AT NORM. FLOW		PRESSURES AT MAX. FLOW		PRESSURES AT MIN. FLOW		(18) DOWNSTREAM FLASHING	(19) TIGHT SHUTOFF	(20) AIR FAILURE	(21) REMARKS AND/OR ALARM AND SHUTDOWN SETTINGS	(22) REVISION
					(5) MAX.	(6) MIN.	(7) 60°F	(8) COND.								(16a) UPSTREAM lb/in ² _a	(17a) DOWN- STREAM lb/in ² _a	(16b) UPSTREAM lb/in ² _a	(17b) DOWN- STREAM lb/in ² _a	(16c) UPSTREAM lb/in ² _a	(17c) DOWN- STREAM lb/in ² _a					
TEMPERATURE																										
TI-3001	E-302 TO D-301	12"	11-GAS												*	379.										
TI-3002	SECT. 200 TO E-302	12"	11-GAS												110.	382.										
TI-3003	T-301 TO E-302	12"	11-GAS												*	374.										
TI-3004	T-301 TOP	-	11-GAS												*	377.										
TI-3005	T-301 BOTTOM	-	11-GAS												*	377.										
TI-3006	T-301 LIQUID OUT	6"	1-LIQUID												*	382										
TI	E-302 TO D-304	12"	14-GAS												95	369.										
TI-3007	E-303 TO T-301	8"	1-LIQUID												*	414.										
TI-3008	E-303 TO T-301	8"	1-LIQUID												*	414.										
FICV-3008	D-305 TO A-301	16"	14-VAP.	*	110	75		*					0.9	*	*	*	*	*	*	*		NO	O	SET AT 25°F		
FSH-3008																										
TAH-3008																										
TI-3008	D-305		14-LIQUID												*	*										
TI-3010	A-301 TO D-305	8"	14-LIQUID												100.									A-301 VENDOR TO CONFIRM		
TI-3020	E-304 TO E-303	8"	1-LIQUID												*	*										
TI-3011	D-302 LIQ. OUT	10"	1-LIQUID												*	*										
TI-3012	E-304 TO T-302	10"	1-LIQUID												*	*										
TI-3013	T-302 LIQ. OUT	10"	1-LIQUID												*	*										
TI-3014	T-302 VAPOR OUT	10"	11-VAPOR												*	*										
* PROPRIETARY DATA																										

FOSTER WHEELER ENERGY CORPORATION
INSTRUMENT PROCESS DATA

JOB NO. 15-1592
PAGE 9 OF 9
REVISION 0
DATE 4/27/76
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ENG. FLOW SHEET NO. OP-751-577

[illegible]

22

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[illegible]

FOSTER WHEELER CORPORATION
RELIEF VALVES
PROCESS DATA - SECT. 300

PLANT ERDA-FE
LOCATION SIOUX FALLS

BY JDF DATE 4/30/76

SHEET NO. 1 OF 1
JOB NO. 15-1592

ITEM NO. (Flow Plan Symbol)		PSV-3005	PSV-3008	PSV- 3015	PSV-
Service		D-305 SOLV. CHILLER K.O. DRUM	D-302 SOLVENT FLASH DRUM	T-302 SOLVENT STRIPPER	
Number of Valves Required		1	1	1	
In Regular Use		1	1	1	
As Spares		0	0	0	
Interlocks Required		NO	NO	NO	
Fluid and State		FREON-22 VAPOR	LOW-BTU GAS	OVERHEAD VAPOR	
Corrosive Compounds		-	H ₂ S, NH ₃	H ₂ S, NH ₃	
Flow (Total) at Relieving Conditions	gal/min				
	lb/h	*	BY INSTRU- MENT GROUP	*	
Sp. gr. at Relieving Conditions		-	-		
Molecular Weight		80.5	*	25.	
Compressibility Factor		0.9	1.0	1.0	
Normal Operating Temperature, ¹ °F		*	*	*	
Relieving Temperature, ² °F		28	110	*	
Relieving (Set) Pressure, lb/in ²		55	45	42	
Superimposed Back Pressure, ³ lb/in ²		0	10	10	
Built-up Back Pressure, ⁴ lb/in ²		5	18	17	
Allowable Accumulation, %		10	10	10	
Minimum Orifice Area Required, in ²					
Governing Conditions ⁵		TICV-3008 CLOSED	FICV-3001 WIDE OPEN	PICV-3012 CLOSED	
Relief Valve Type			BALANCED	BALANCED	
Relief Valve Size					
Balanced Type ⁶		NO	YES	YES	
Total Orifice Area (effective) Provided					
* PROPRIETARY DATA					