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FUEL GAS DEMONSTRATION PLANT PROGRAM

SMALL-SCALE INDUSTRIAL PROJECT

MECHANICAL DESIGN

PHASE I VOLUME 5

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Prepared for the

U.S. DEPARTMENT OF ENERGY

Assistant Secretary for Energy Technology
Office of Fossil Fuels

Under CONTRACT ET-77-C-01-2582

Industrial Fuel Gas Demonstration Plant Program

TASK III REPORT

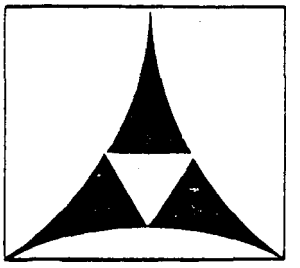
DEMONSTRATION PLANT MECHANICAL DESIGN

VOLUME V

GAS COMPRESSION

GAS TREATING

Prepared For
The Department of Energy
Under Contract ET-77-C-01-2582



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In Association with
FOSTER WHEELER ENERGY CORPORATION
INSTITUTE OF GAS TECHNOLOGY
DELTA REFINING COMPANY

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DEMONSTRATION PLANT MECHANICAL DESIGN

REPORT VOLUMES

Volume I	Overall Plant Description
Volume II	Air Separation
Volume III	Coal/Coke Treating & Feed Coal/Coke Handling Dock Facilities
Volume IV	Gasification Gas Cooling and Scrubbing Ash Treatment
Volume V	Gas Compression Gas Treating
Volume VI	Sour Water Stripping
Volume VII	Sulfur Recovery Tail Gas Treating
Volume VIII	Credit Generation
Volume IX	Utility Area
Volume X	Waste Water Treatment
Volume XI	Cooling Tower Flare
Volume XII	General Facilities Buildings

DEMONSTRATION PLANT MECHANICAL DESIGN

Volume V Table of Contents

A. Gas Compression - Section 350
B. Gas Treating - Section 360

Volume V Table of Contents (Cont'd)

A - Combined with Process Flow Diagrams contained in Task II Report
B - Capital Investment Estimate prepared under Task III contained in Economic Assessment Report
C - Combined with Process Design (Task II Report)
D - Combined with Bid Package Terms & Conditions (Supply Subcontract), provided under separate cover.

Section 1.0

INTRODUCTION

1.1 Program Summary

The United States Department of Energy (DOE) awarded a contract to Memphis Light, Gas and Water Division (MLGW) which requires MLGW to perform process analysis, design, procurement, construction, testing, operation, and evaluation of a plant which will demonstrate the feasibility of converting high sulfur bituminous coal to industrial fuel gas with a heating value of 300 ± 30 Btu per standard cubic foot (SCF). The demonstration plant is to be based on the U-Gas process, with its product gas to be used in commercial applications in Memphis, Tennessee.

In order to perform this work, MLGW has established an industrial team, which includes:

MLGW - Memphis Light, Gas and Water Division, Memphis, Tenn.
The prime contractor and distributor of the industrial fuel gas.

FWEC - Foster Wheeler Energy Corporation, Livingston, N.J.
The engineer-construction manager.

IGT - Institute of Gas Technology, Chicago, Illinois.
The process developer.

DRC - Delta Refining Company, Memphis, Tenn.
To provide operating experience.

The contract specifies that the work is to be conducted in three phases. Phase I costs are financed entirely by DOE. Costs for Phases II and III will be shared equally by DOE and MLGW. The Phases are:

Phase I - Program Development and Conceptual Design
Phase II - Demonstration Plant Final Design, Procurement and Construction
Phase III - Demonstration Plant Operation

Under Task III of Phase I a Mechanical Design and Cost Estimate for the Demonstration Plant was completed. The output of this Task, in addition to the cost estimate, is comprised of the following items:

a. Drawings/Flowsheets
b. Equipment List
c. Procurement Requisitions
d. Instrumentation Data
e. Plot Plans
f. Building Sketches

This report, entitled "Demonstration Plant Mechanical Design", is intended to provide all engineering information necessary for the preliminary design of the plant. This report, which should be used in conjunction with the Task II report "Demonstration Plant Process Design" includes information on all plant units shown on Table 1.

This Task III report is provided in twelve volumes as shown on Page i.

This is Volume V, Gas Compression and Gas Treating. Combined with the other volumes comprising the Demonstration Plant Mechanical Design Report and the Process Design (Task II) Report, the material meets the requirements for deliverables No. 17, 19, 21 and 24; as specified within Appendix A - Statement of Work.

Table 1

AREA DESIGNATIONS
FOR DEMONSTRATION PLANT

Area No.	Title	Section No.
2230	Process Units	-
2231	Air Separation	310
2232	Coal/Coke Treating & Feed	320
2233	Coal Gasification	330
2234	Gas Cooling & Scrubbing	340
2235	Gas Compression (Raw/Recycle Gas)	350
2236	Gas Treating	360
2237	Sour Water Stripping	370
2238	Sulfur Recovery	380
2239	Tail Gas Treating	390
2222	Credit Generation	220
2240	Support Facilities	-
2241	Coal/Coke Handling	410
2242	Ash Treatment	420
2243	Utility Area Steam Generation Raw Water Storage BFW Treatment Plant Air	430
2244	Waste Water Treatment	440
2245	Cooling Tower	450
2246	Flare	460
2247	General Facilities Long Term Coal Storage Long Term Ash & Solid Waste Storage Interconnecting Piping Roads & Fences Firewater System Power & Lighting, & Communication Sewers	470
2248	Buildings	480
2249	Dock Facilities	490

Note: Section numbers shown on Drawings are the last two digits of the area number, followed by a zero (e.g. Section 310 is Air Separation Unit). Area numbers have been established for Cost Control Purposes in Phase II.

1.2 Plant Summary

The Industrial Fuel Gas Demonstration Plant produces a nominal 50 billion BTU/Day of product gas, which is equivalent in energy output to approximately a 10,000 barrel/day oil refinery. The product gas has a heating value of 300 ± 30 BTU/SCF. 45 billion BTU/Day of this gas is available as send-out gas to IFG customers. The remaining 5 billion BTU/Day of this gas is further processed to pipeline quality (950 BTU/SCF) and deposited in the Memphis natural gas distribution system to generate BTU credit. The BTU credit can be withdrawn and used to satisfy IFG customer demand when the U-Gas production facility is totally or partially down for maintenance. By the use of the credit generation system the demand of IFG customers can thus be assured.

Drawing 2202-1-50-00104 is the plant block flow diagram showing the process sequence and process related support facilities of this demonstration plant. Each process unit as well as each process related support facility is described briefly in the following summary.

Section 310, Air Separation Plant
Compresses intake air and separates it into oxygen and nitrogen. The oxygen is compressed and sent to the gasifiers. A small portion of the nitrogen is returned for plant use. Liquid oxygen and nitrogen can also be produced to keep their respective storage tanks filled in order to provide the necessary reserve for an outage of the air separation plant.

Section 320, Coal/Coke Treating and Feed
Coal is crushed from 2" x 0" to 1/4" x 0" and dried to 2.5% moisture in a dryer mill. The dried, sized coal is stored in a coal silo. Sized coke received by the plant is also dried by a separate dryer and stored in a coke silo. Coal or coke is conveyed to the gasifier feeding systems from either the coal or coke silo. Dual conveying systems are provided to fill the gasifier feeding systems with one serving as a spare. Each gasifier has its own feeding system. The gasifier feeding system is a multi-feed hopper system, each consisting of a receiving hopper, two lock hoppers and two injection hoppers. Each injection hopper feeds into three pneumatic injection lines which transports coal or coke into the gasifier.

Section 330, Coal Gasification
Contains the coal gasifiers where steam and oxygen react with the coal in a fluidized bed at about 1875°F and 75 psig to produce hot, raw gas (CO, CO_2 and H_2). Within the reaction zone of the fluidized bed is an ash-agglomerating zone. The ash agglomerates drop into a water quench. Fines carried over with the hot, raw gas are returned to the gasifier through external cyclones.

Section 340, Gas Cooling and Scrubbing
Cools the gas from 1875°F to 450°F. For purposes of heat recovery, the gas passes in sequence through a high pressure steam generator, high pressure steam superheater, another high pressure steam generator, and a boiler feedwater preheater. After heat recovery the raw gas is quenched to saturation and passes through scrubbers. In the scrubbers particulate matter is removed by scrubbing with water. Sections 330 and 340 are four parallel trains and the balance of the plant is one train. Sour water from the knock-out drum, containing dissolved NH_3 and H_2S passes through a sour water stripper in Section 370; the overhead from the stripper goes to sulfur recovery. The water effluent goes to waste water treatment. The slurry water from the scrubber goes through a slurry water stripper. The slurry water after being stripped is clarified and filtered. The filter cake is sent to the steam generator for use as fuel. The filtrate water effluent is sent to waste water treatment.

Section 350, Gas Compression
Scrubbed gas is cooled, compressed to sufficiently high pressure and cooled again to go through gas treating and deliver the gas at 150 psig to the industrial fuel gas distribution header.

Section 360, Gas Treating
Receives the cooled gas from gas compression in Section 350. It then passes to a Selexol unit where H_2S and COS are removed to meet the product gas sulfur specification, and enough CO_2 is removed to obtain a constant heating value product gas. The product gas is then sent to Section 470 where it will be odorized and metered before being discharged to the industrial fuel gas distribution system.

Section 370, Sour Water Stripping
Receives sour water from Sections 340, 350 and 360. The major portions of ammonia and hydrogen sulfide are removed by means of steam stripping.

Section 380, Sulfur Recovery
Receives sour gas from Section 370 and acid gas from Section 360. It converts the sulfur compound in three catalytic stages of a Claus type sulfur recovery unit to achieve 96% sulfur recovery. Sulfur goes through condensers, seal pit and rundown pit, and storage tank before being loaded into tank trucks.

Section 390, Tail Gas Treating
Receives the tail gas from Section 380. It then goes to a Beavon unit package where remaining sulfur is converted to H_2S, and then removed in a Stretford Unit. The tail gas is reheated to achieve satisfactory buoyancy and discharged to the atmosphere.

Section 220, Credit Generation
Treats from 10% to 30% of the product gas from Section 360 to produce pipeline quality gas which will be deposited into the Memphis pipeline gas distribution system to generate a reserve of credit. This reserve which can be withdrawn during U-gas plant outage. Pipeline gas withdrawn from the Memphis pipeline gas distribution system will be adjusted to the U-gas heating value prior to its distribution to the U-gas customers.

Section 410, Coal/Coke Handling
Receives the incoming washed coal (2" x 0") from barges and transports it to a 14 day live coal storage pile. From there coal is transported to Section 320.

Section 420, Ash Treatment
Receives the agglomerated quenched ash slurry from the gasifiers (Section 330) and conveys it hydraulically to the dewatering bins. The dewatered ash is then discharged into trucks for disposal to the ash pile. The water from the dewatering bins is collected in the clarifier where clean water overflows into a sump tank while the underflow is pumped back to the dewatering bins. The clean water is then recycled to the gasifiers. A startup pump is provided for initial transport of slurry to the dewatering bins when the gasifier pressure is too low for conveying.

The non-process sections to support the process and to provide utilities to the process include the following functions:

Section 430, Utility Area which includes:
Steam Generation
Raw Water Storage
BFW Treatment

Section 440, Waste Water Treatment

Section 450, Cooling Tower

Section 460, Flare

Section 470, General Facilities which include:
Long Term Coal Storage for 90 days
Long Term Ash & Solid Waste Storage
Interconnecting Piping
Roads and Fences
Firewater System
Power, Lighting, and Communication
Sewers
Odorization and Metering Station

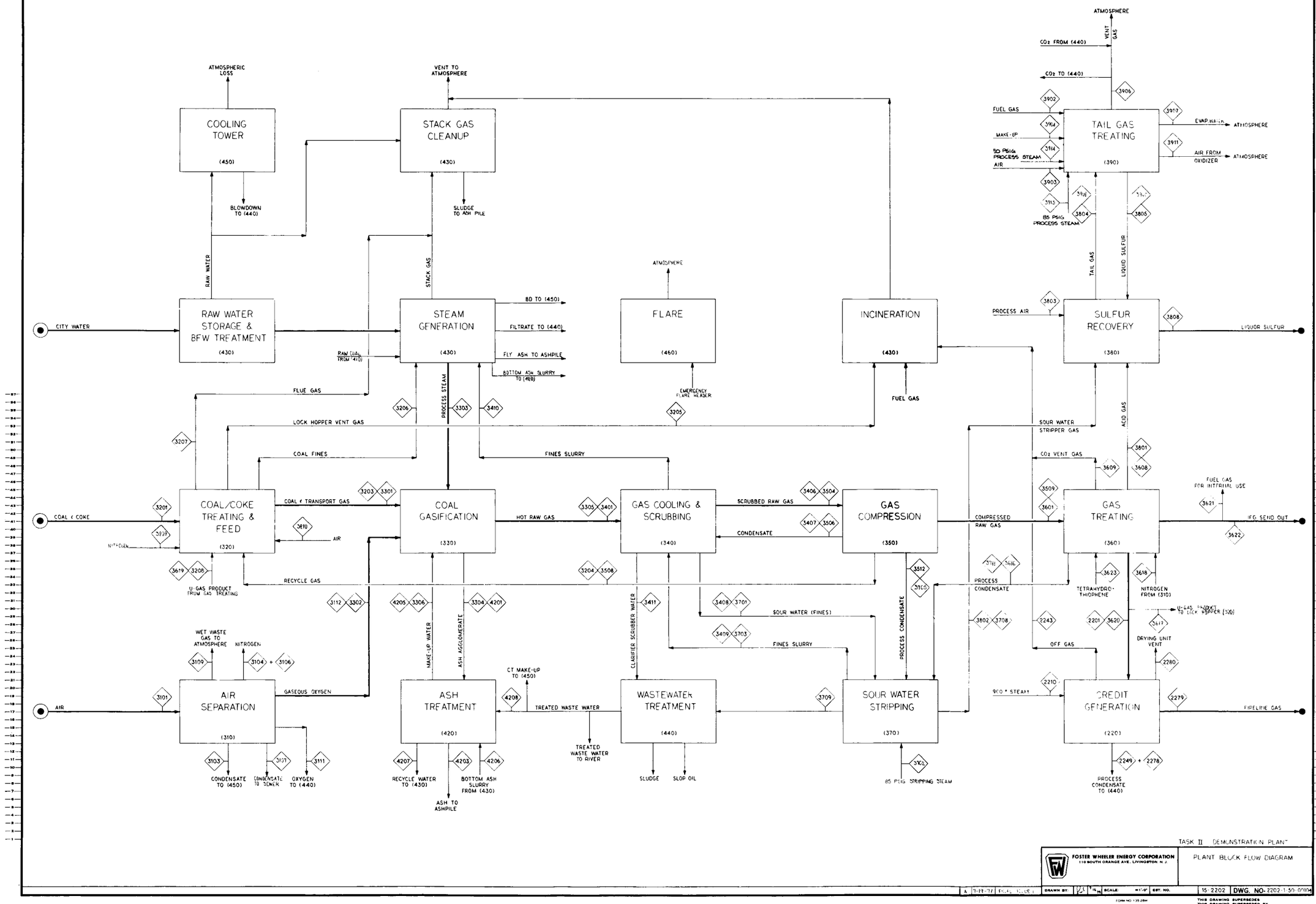
Drawing No. 2203-1-01-4701 is the Key Plot Plan for the Demonstration Plant. The site, which comprises approximately 134 acres, is located next to the T. H. Allen Steam Generating Station in Shelby County, Tennessee.

An in-depth discussion of the site selection and description can be found in the following separate documents:

a. "Site Evaluation and Selection Report" February 1979.

b. Environmental Analysis Report August 1979.

All sections of the plant are shown on the Key Plot Plan.



TASK II DEMONSTRATION PLANT

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

PLANT BLOCK FLOW DIAGRAM

A	7-19-77	FINAL ISSUE	DRAWN BY:	SCALE:	EST. NO.	15-2202	DWG. NO. 2202-1-50-01104

FORM NO. 135-28M

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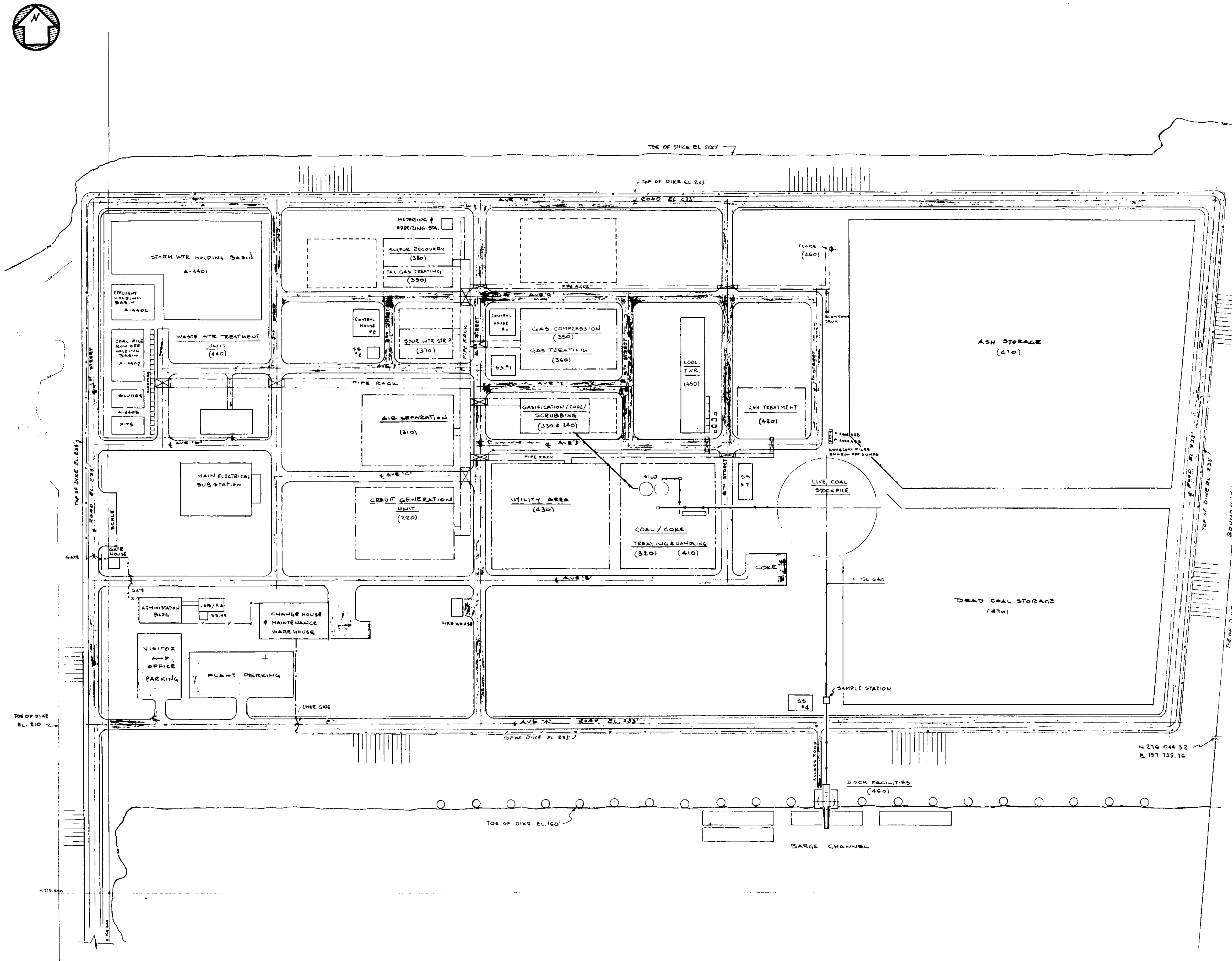

GENERAL NOTES

LEGEND

- PIPEWAY
- UNIT BATTERY LIMIT
- ROAD
- PIPE WAY BRIDGE
- SLEEPERS
- FENCE
- INTERCONNECTING CONVEYOR

UNIT TABULATION		
UNIT Nº	DESCRIPTION	ZONE Nº
220	CREDIT GENERATION	VII
310	AIR SEPARATION	VI
320	COAL/COKE TREATING, & FEED	I & II
330	COAL GASIFICATION	III
340	GAS COOLING & SCRUBING	III
350	GAS COMPRESSION	III
360	GAS TREATING	III
370	SOUR WATER STRIPPING	IV
380	SULFUR RECOVERY	V
390	TAIL GAS TREATING	V
410	COAL/COKE HANDLING	I
420	ASH TREATMENT	II & VIII
430	UTILITY AREA	IX
440	WASTE WATER TREATMENT	X
450	COOLING TOWER	XI
460	FLARE	XII
470	GENERAL FACILITIES	XIV
480	BUILDINGS	XIII
490	DOCK FACILITIES	I

50 0 50 100
SCALE IN FEET

B	OCT. 10.79	FINAL ISSUE PHASE I TASK II	A	SEPT. 28.79	INITIAL ISSUE

INDUSTRIAL FUEL GAS DEMONSTRATION PLANT
MEMPHIS, TENN.
CONTRACT No. ET 77C-01-2582

MEMPHIS LIGHT, GAS AND WATER DIVISION
MEMPHIS, TENN.

DEPARTMENT OF ENERGY
COAL CONVERSION DIVISION
WASHINGTON, D.C.

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

KEY PLOT PLAN
ALLEN PLANT SITE
SECTION 470

DRAWN BY: [illegible] SEPT. 14/79 SCALE: 1" = 100' EST. NO. 15-2203 DWG. NO-2203-1-01-4701

FORM NO 135-28M

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SECTION 2.0

UNIT DESCRIPTION - GAS COMPRESSION

Scrubbed gas leaving the gas cooling and scrubbing (Section 340) at a temperature of 236°F is cooled to 110°F in Scrubbed Gas Air Cooler (E-3501) and Scrubbed Gas Cooler (E-3502). The water condensed from this raw gas is removed in Scrubbed Gas K.O. Drum (D-3503). The raw gas leaving the Scrubbed Gas K.O. Drum is compressed from 49 psig to 192 psig by two stage Centrifugal Compressor (C-3501).

A Raw Gas Compressor Intercooler (E-3507) and an Intercooler K.O. Drum (D-3505) have been installed after the first stage compression in order to reduce the energy consumption for the compressor (C-3501). After second stage compression, the raw gas is finally cooled in Compressor Aftercooler (E-3505). This results in additional condensate which is removed in Compressed Gas K.O. Drum (D-3504).

Part of the condensate from the Scrubbed Gas K.O. Drum (D-3503) is sent to Gas Cooling and Scrubbing (Section 340). The remaining condensate is combined with those from the other K.O. drums (D-3505 & D-3504) for delivery to Sour Water Stripping (Section 370).

The compressed raw gas from the overhead of the Compressed Gas K.O. Drum (D-3504) reports to Gas Treating (Section 360).

L.P. recycle gas, M.P. recycle gas and H.P. recycle gas from Gas Treating (Section 360) are compressed and recycled by L.P. Recycle Gas (C-3503) Compressor and H.P. Recycle Gas Compressor (C-3502) with intermediate cooling being provided by the 1st Compressor Intercooler (E-3503) and the 2nd Compressor Intercooler (E-3504). Removal of condensate resulting from intermediate cooling is provided by 1st Intercooler K.O. Drum (D-3501) and 2nd Intercooler K.O. Drum (D-3502). Since this condensate still contains selexol solvent, it is returned in total to Gas Treating (Section 360). The gas from 2nd stage of Compressor (C-3502) is cooled to 110°F in Recycle Gas Aftercooler (E-3506) and sent to Gas Treating (Section 360).

3.0 DRAWINGS

This section includes drawings as listed below, to further define the scope of this project.

Drawings	Number of Drawings
Symbol Drawing	1
Engineering Flow Diagrams	3
Utility Flow Diagram	1
Materials of Construction	1
Line List	4
Piping Material Specification List*	1

*Note: This list identifies the piping materials specified on the Engineering Flow Diagrams.

INSTRUMENT AND CONTROL SYMBOLS

FOR I&C SYMBOLS NOT SHOWN SEE FWEC STD. 60A3

LOCALLY MOUNTED

(V) INDICATES VENDOR-SUPPLIED INSTR.

MOUNTED ON MAIN CONTROL PANEL

MOUNTED ON LOCAL PANEL

MOUNTED BEHIND THE MAIN PANEL OR OTHER CONTROL ROOM LOCATION

MOUNTED BEHIND LOCAL PANEL

IN-LINE ROTAMETER TYPE FLOW METER

TWO INSTRUMENT FUNCTIONS IN A COMMON ENCLOSURE

IN-LINE TYPE FLOWMETER OTHER THAN ROTAMETER

ELECTROPNEUMATIC POSITIONER OR TRANSDUCER OR A CONTROL VALVE

CONTROL LOOP NO.126

1. FLANGED ORIFICE FLOW SENSOR NO.126
2. STEAM TRACED LINE TO TRANSMITTER
3. FLOW TRANSMITTER NO.126
4. ELECTRICAL INSTRUMENT SIGNALS.
5. FLOW INDICATING CONTROLLER NO.126
6. DIAPHRAGM-OPERATED GLOBE VALVE (FAIL CLOSED TYPE)

COMPUTER INPUT

INTERLOCK

RESET FOR LATCH TYPE ACTUATOR

PURGE

SCREWED RESTRICTION ORIFICE

PSV- — VALVE NUMBER
-PSIG — SET PRESSURE
— SIZE: INLET/ ORIFICE/OUTLET

PRESSURE RELIEF VALVE

PRESSURE REDUCING VALVE WITH EXTERNAL PRESSURE TAP

PSV- — VALVE NUMBER
"Hg — VACUUM RELIEF
— SIZE: INLET/ ORIFICE/OUTLET

VACUUM RELIEF VALVE

BACKPRESSURE VALVE WITH EXTERNAL PRESSURE TAP

SOLENOID VALVE (4 WAY)

TWO-WAY CONTROL VALVE
FAILURE MODE:
FC-FAIL CLOSED
FO-FAIL OPENED
FL-FAIL LOCKED

PRESSURE UNDER SEAT

PRESSURE OVER SEAT ANGLE VALVE

3-WAY CONTROL VALVE
DIRECTION AND FAILURE MODE AS SHOWN ABOVE

PRESSURE

VACUUM

RUPTURE DISKS

DIAPHRAGM-OPERATED CONTROL VALVE WITH SIDE-MOUNTED HANDWHEEL

VAC. & PRESS

PRESSURE AND VACUUM RELIEF VALVE (DUAL SERVICE)

DIAPHRAGM-OPERATED BUTTERFLY VALVE, DAMPER OR LOUVER.

CHEMICAL SEAL

CYLINDER-OPERATED VALVE

SOLENOID-OPERATED VALVE

PITOT TUBE OR ANNUBAR

SOLENOID VALVE (3-WAY) WITH MANUAL RESET SHOWING DE-ENERGIZED POSITION

VENTURI TUBE OR FLOW NOZZLE

FLANGED ORIFICE PRIMARY ELEMENT

PRESSURE REDUCING VALVE (SELF CONTAINED)

CONTROL VALVE BYPASS STATION

BACKPRESSURE VALVE (SELF CONTAINED)

HAND CONTROL VALVE (HCV)

KNIFE EDGED VALVE

SLIDE VALVE

NOTES

1. CONTROL VALVE SIZE AND TYPE SHALL BE SHOWN.
2. BYPASS SIZE AND TYPE (GLOBE, GATE, ETC.) SHALL BE INDICATED. GLOBE TYPE SHOWN ABOVE
3. UNLESS NOTED, BLOCK VALVES AND BYPASS VALVES SHALL BE UPSTREAM SPEC.
4. DRAIN VALVE, ALTHOUGH NOT SHOWN ON EFD'S IS 3/4" WITH UPSTREAM SPEC.
5. BLOCK AND BYPASS VALVES & SIZES SHALL BE PER THE CHART BELOW.

CONTROL VALVE BLOCK BYPASS VALVES

LINE SIZE:	1/2		3/4		1	
	VALVE		VALVE		VALVE	
CONTROL VALVE SIZE	BLOCK	BYPASS (GLOBE)	BLOCK	BYPASS (GLOBE)	BLOCK	BYPASS (GLOBE)
1/2	1/2	1/2	3/4	3/4	1	1
3/4	–	–	3/4	3/4	1	1
1	–	–	–	–	1	1

LINE SIZE:	1 1/2		2		3		4	
	VALVE		VALVE		VALVE		VALVE	
CONTROL VALVE SIZE	BLOCK	BYPASS (GLOBE)	BLOCK	BYPASS (GLOBE)	BLOCK	BYPASS (GLOBE)	BLOCK	BYPASS (GLOBE)
1/2	1 1/2	1 1/2	–	–	–	–	–	–
3/4	1 1/2	1 1/2	2	2	–	–	–	–
1	1 1/2	1 1/2	2	2	2	2	–	–
1 1/2	1 1/2	1 1/2	2	2	2	2	3	3
2	–	–	2	2	3	2	3	3
3	–	–	–	–	3	3	4	3
4	–	–	–	–	–	–	4	4

LINE SIZE:	6		8		10		12	
	VALVE		VALVE		VALVE		VALVE	
CONTROL VALVE SIZE	BLOCK	BYPASS (¾ GLOBE) (6 GATE)	BLOCK	BYPASS (GATE)	BLOCK	BYPASS (GATE)	BLOCK	BYPASS (GATE)
2	4	4	–	–	–	–	–	–
3	4	4	6	6	–	–	–	–
4	6	4	6	6	8	8	–	–
6	6	6	8	8	8	8	10	10
8	–	–	8	8	10	8	10	10
10	–	–	–	–	10	10	12	10
12	–	–	–	–	–	–	12	12

NOTES:
a. ALL SIZES IN INCHES.
b. BLOCK AND BYPASS VALVES AND MANIFOLDS SHALL NOT BE LARGER THAN MAIN LINE SIZE.
c. INCREASE BYPASS VALVE BODY SIZE ONE SIZE WHERE CONTROL VALVE BODY IS BUTTERFLY DESIGN (ONLY WHEN GLOBE VALVES ARE USED AS BYPASS).
d. ON FLASHING SERVICE OR WHERE THE CONTROL VALVE OUTLET LINE SIZE IS GREATER THAN THE CONTROL VALVE INLET LINE SIZE, THE OUTLET PIPING FROM BOTH THE CONTROL VALVE AND BYPASS VALVE, AND THE DOWNSTREAM BLOCK VALVE ITSELF, SHALL BE NO SMALLER THAN ONE SIZE LESS THAN OUTLET LINE SIZE.

GENERAL PIPING SYMBOLS

VALVES

GATE
GLOBE
PLUG
BALL
NEEDLE
BUTTERFLY
4-WAY
3-WAY (INDICATE FLOW DIRECTION)
CHECK
NON-RETURN (SCREW-DOWN TYPE)
CAR SEAL OPEN
CAR SEAL CLOSED
SLIDE GATE
GEAR OPERATED
NORMALLY CLOSED (TYP.)
HANDOPERATED SLIDEGATE VALVE
DIVERTER VALVE
LINE EJECTOR

OTHER

DUST SUPPRESSION NOZZLE
UNION
SWING ELBOW
STEAM TRAP
INCREASER OR REDUCER
FIGURE 8 BLIND
PADDLE BLIND
QUICK-ACTING BLIND
"Y" STRAINER
HOSE CONNECTION
FLEXIBLE HOSE
SAMPLE CONNECTION
SAMPLE COOLER
EXPANSION JOINT
CAPPED PIPE AT HUB
SULFUR SEAL LEG
DUST COLLECTION PICK-UP

GENERAL NOTES

1. ENGINEERING FLOW DIAGRAMS (EFD'S) DO NOT SHOW HIGH POINT VENTS, LOW POINT DRAINS, LOW POINT TRAPS, INSTRUMENT BLOCK VALVES ETC. REQUIREMENTS FOR THESE APPEAR IN THE JOB SPECIFICATIONS. ONLY PROCESS RELATED VENTS, DRAINS, TRAPS, ETC. ARE SHOWN.
2. DRAIN, VENT AND SAMPLE CONNECTIONS SHALL BE 3/4" UNLESS OTHERWISE NOTED.
3. CHANGES IN LINE SPEC AND/OR INSULATION SHALL BE INDICATED BY A PERPENDICULAR BREAKLINE WITH THE SPEC. NOTED ON EACH SIDE.
   (SEE EXAMPLES BELOW)
4. UNLESS OTHERWISE NOTED ALL VESSEL CONNECTIONS TO PIPING SHALL BE LINE SIZE AND SHALL MATCH THE PIPE SPEC.
5. ELECTRICAL SYMBOLS ARE NOT SHOWN ON THIS DWG.
   SEE JOB SPEC-2200-73B20.1 TO 73B20.4
6. CONTROL VALVES SHALL BE FLANGED WITH FACE TO FACE DIMENSIONS PER I.S.A.R.P 4.1 WHEREVER PRACTICABLE.

LINE TYPES USED FOR FLOW DIAGRAMS

MAIN PROCESS PIPING

(CROSSOVER)

EQUIPMENT OUTLINES, INSTRUMENTS, OTHER PROCESS OR UTILITY PIPING, MECHANICAL LINKS, ETC.

PNEUMATIC INSTRUMENT SIGNAL

INSTRUMENT CAPILLARY TUBING (FILLED SYSTEM)

ELECTRICAL INSTRUMENT SIGNAL

(CROSSOVER)

EQUIPMENT BY OTHERS (NOT FWEC/MLGW PROCUREMENT)

EXTENT OF PACKAGE SUPPLY

LOCATED ON ANOTHER DIAGRAM. NOTE: PLANT IS GRASS ROOTS. THERE IS NO EXISTING PIPING OR EQUIPMENT.

ELECTROMAGNETIC, NUCLEAR, OR SONIC SIGNAL

HYDRAULIC SIGNAL

INSULATION DESIGNATIONS

DESIGNATION	DESCRIPTION
AS	ANTISWEAT
CC	COLD CONSERVATION
CW	COATED & WRAPPED
ET	ELECTRICALLY TRACED
HC	HEAT CONSERVATION
LT	LIQUID TRACED
NI	NOT INSULATED
PP	PERSONNEL PROTECTION
PS	PROCESS STABILIZATION
SJ	STEAM JACKETED
ST	STEAM TRACED

EXAMPLES OF SPEC BREAK

(SEE GENERAL NOTE 3)

HC N1 (SEE ABOVE)

B2 A2 (SEE JOB SPEC. NO. 2200-60A10.1)

TRACING SYMBOLS

STEAM TRACING
"T" REPRESENTS HEAT TRANSFER CEMENT REQUIRED (TYPICAL)

T — STEAM TRACING

LT — LIQUID TRACING

SJ — STEAM JACKETED

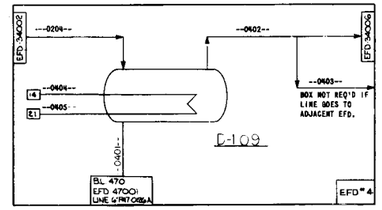
ET — ELECTRIC TRACING

NOTES: 1. THE NORMAL TRACING MEDIUM FOR THIS CONTRACT IS: STEAM (REF: FWEC ENGG STD 56A1)

LINE AND HEADER DESIGNATIONS

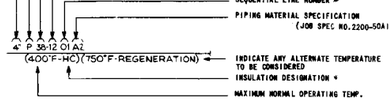
DESIGNATION	DESCRIPTION	DESIGNATION	DESCRIPTION
A	PROCESS AIR	TW	TREATED WATER
BD	BLOWDOWN	V	VENT
BH	BOILER FEED WATER (HP)	W	WASTEWATER
BL	BOILER FEED WATER (LP)	WC	CITY WATER
C	CONDENSATE	WS	WASTEWATER WITH SOLIDS
CA	CHEMICAL ADDITIVE	PA	PLANT AIR
CH	CONDENSATE, HIGH PRESSURE		
CK	COKE		
CL	CONDENSATE, LOW PRESSURE		
CM	CONDENSATE, MEDIUM PRESSURE		
CO	COAL		
CS	CARBONATE SOLUTION		
CW	COOLING WATER		
D	DRAIN		
DW	DRINKING (POTABLE) WATER		
FA	FLYASH		
FG	FUEL GAS		
FL	FLUSHING OIL		
FO	FUEL OIL		
FW	FIRE WATER		
G	CARBONATE VAPOR + STEAM		
GW	TEMPERED WATER		
GX	GASEOUS OXYGEN		
IN	INSTRUMENT NITROGEN		
LO	LUBE OIL		
LN	LIQUID NITROGEN		
LX	LIQUID OXYGEN		
N	INERT GAS (NITROGEN)		
NG	NATURAL GAS		
P	PROCESS FLUID (GAS, VAPOR, OR LIQUID)		
PO	PUMP OUT		
PS	PROCESS FLUID WITH SOLIDS		
R	RELIEF VALVE DISCHARGE		
RF	REFRIGERANT FLUID (LIQUID OR VAPOR)		
RW	REFRIGERATED WATER		
SH	900 PSIG STEAM		
SL	86 PSIG STEAM		
SM	135 PSIG STEAM		
SO	SEAL OIL		
SS	SELEXOL SOLUTION		
SW	SERVICE WATER		
SX	50 PSIG STEAM		

LINE NUMBERING SEQUENCE



LINE NUMBERING SEQUENCE ON EFD'S SHALL BE FROM LEFT TO RIGHT AND LINES CONTINUING TO OTHER EFD'S SHALL TERMINATE ALONG SIDES AS INDICATED ABOVE. LINES CROSSING TO UNIT BATTERY LIMIT SHALL TERMINATE IN A "BL" BOX AT THE BOTTOM (PREFERRED LOCATION) OR TOP. THE BOX SHALL DESIGNATE AT WHICH UNIT LIMIT THE LINE ENTERS OR LEAVES THE UNIT AND ALSO IDENTIFY THE CONNECTING FLOW DIAGRAM AND LINE NUMBER. SEE LINE NUMBERING CODE BELOW FOR EXPLANATION.

LINE NUMBERING CODE



* SEE NOTES ON THIS DRAWING.

EQUIPMENT DESIGNATIONS

A	PACKAGE ITEM OR SYSTEM		
B	BLOWER, FAN	BD	BLENDER
BR	BURNER		
BV	SOLIDS DISCHARGER		
C	COMPRESSOR		
CL	CLARIFIER		
CR	CONVEYOR		
CT	COOLING TOWER		
D	DRUM		
DC	DUST COLLECTOR		
DH	DEAERATOR		
DP	DUST SUPPRESSOR		
DR	DRYER		
DS	DESUPERHEATER		
DV	DIVERTING VALVE		
E	HEAT EXCHANGER		
EL	ELEVATOR (PASSENGER, SERVICE)		
F	FILTER		
FD	FEEDER		
FL	FLARE		
H	HEATER, FURNACE		
HH	HOISTING MACHINE		
J	EDUCTOR, EJECTOR		
KT	SAMPLE CUTTER		
LA	LOADING ARM		
M	MIXER		
P	PUMP		
R	REACTOR		
S	SEPARATOR, SCRUBBER, CYCLONE		
SG	STEAM GENERATOR, BOILER		
SK	SOLIDS STACKER		
SL	SILENCER		
SR	SIZE REDUCTION EQUIPMENT		
SS	SAMPLING SYSTEM		
T	TOWER		
TK	TANK, SILO, HOPPER		
UD	SOLIDS UNLOADER		
WS	WEIGH SCALE		

EQUIPMENT SYMBOLS

(NOT SHOWN TO SIZE FOR EFD'S)

PACKAGE UNIT

CENTRIFUGAL PUMP (MOTOR DRIVE)

PROPORTIONING PUMP (MOTOR DRIVE)

CENTRIFUGAL BLOWER (STEAM TURBINE DRIVE)

TWO CASING CENTRIFUGAL COMPRESSOR (MOTOR DRIVE)

HEAT EXCHANGER (SHELL: PROCESS STREAM, TUBE: CW)

KNOCKOUT DRUM

AIRCOOLER

BELT CONVEYOR

OR — DRUM (INLETS AND OUTLETS SHOWN)

ROTARY FEEDER

SCREW CONVEYOR

BRAZED ALUMINUM CORE EXCHANGERS

SILENCER

INLET AIR FILTER

OR CONFIGURATION SKETCH — OTHER EQUIPMENT (SPECIFICALLY IDENTIFIED BY NAME AND NUMBER)

RECIPROCATING COMPRESSOR

FRAME — CONNECTION TO DRIVER (ELECTRIC MOTOR SHOWN) — CYLINDER

(SHOW ACTUAL NUMBER OF CYLINDERS)

ROTARY OR SCREW TYPE COMPRESSOR

CONNECTION TO DRIVER (ELECTRIC MOTOR SHOWN)

REFERENCES JOB SPECS-2200

50 B 12.1	"PIPING SYMBOLS, VALVES, AND ACCESSORIES"
60 A 1	"INSTRUMENTATION"
60 A3	"INSTRUMENTATION SYMBOLS AND IDENTIFICATION"
73 B 20.1 – 4	"ELECTRICAL POWER SYMBOLS"
50 A 10.1	"PIPING MATERIAL SPEC. INDEX"
56 A 1	"STEAM TRACING STANDARD FOR PIPING, VESSELS, AND EQUIPMENT"
78 A 3	"ELECTRICAL HEAT TRACING FOR PIPING INSTRUMENTS AND EQUIPMENT"

SELECTED PROJECT DOCUMENTS

1. THE DEMONSTRATION PLANT DESIGN BASIS"
2. "BASIC ENGINEERING DATA FOR DEMONSTRATION PLANT
3. TASK I, FINAL REPORT, "CONCEPTUAL DESIGN AND EVALUATION OF COMMERCIAL PLANT" VOL I – XX
4. FWEC DWG. 2201-1-50-00103, PLANT BLOCK FLOW DIAGRAM FOR COMMERCIAL PLANT.
5. FWEC DWG. 2201-1-01-1, KEY PLOT PLAN FOR COMMERCIAL PLANT.

UNIT NAMES AND NUMBERS

PROCESS UNITS

SECTION NUMBER	DESCRIPTION
310	AIR SEPARATION
320	COAL/COKE TREATING AND FEED
330	COAL GASIFICATION
340	GAS COOLING AND SCRUBBING
350	GAS COMPRESSION (RAW/REFY'LE GAS)
360	GAS TREATING
370	SOUR WATER STRIPPING
380	SULFUR RECOVERY
390	TAIL GAS TREATING
220	CREDIT GENERATION

SUPPORT FACILITIES

410	COAL/COKE HANDLING
420	ASH TREATMENT
430	UTILITY AREA
	STEAM GENERATION
	CITY WATER STORAGE
	BFW TREATMENT
440	WASTE WATER TREATMENT
450	COOLING TOWER
460	FLARE
470	GENERAL FACILITIES
	LONG TERM COAL STORAGE
	LONG TERM ASH AND SOLID WASTE STORAGE
	INTERCONNECTING PIPING
	ROADS AND FENCES
	FIREWATER SYSTEMS
	POWER, LIGHTING, COMMUNICATION AND SEWERS
480	BUILDINGS
490	DOCK FACILITIES

UNIT ENGINEERING FLOW DIAGRAM INDEX

(LATER)

REV	DESCRIPTION	DATE	BY	CK'D	APP'D
B	FINAL ISSUE - PHASE I, TASK III	6-10-75	JRD		
A	INITIAL ISSUE	6-11-73			

INDUSTRIAL FUEL GAS DEMONSTRATION PLANT
MEMPHIS, TENN.
CONTRACT No. ET 77C-01-2582

MEMPHIS LIGHT, GAS AND WATER DIVISION, MEMPHIS, TENN.

DEPARTMENT OF ENERGY, COAL CONVERSION DIVISION, WASHINGTON, D.C.

TASK II 15-2202 DEMO. PLANT PROCESS & SYST.

TASK III 15-2203 DEMO. PLANT PROCESS & MECH. DESIGN

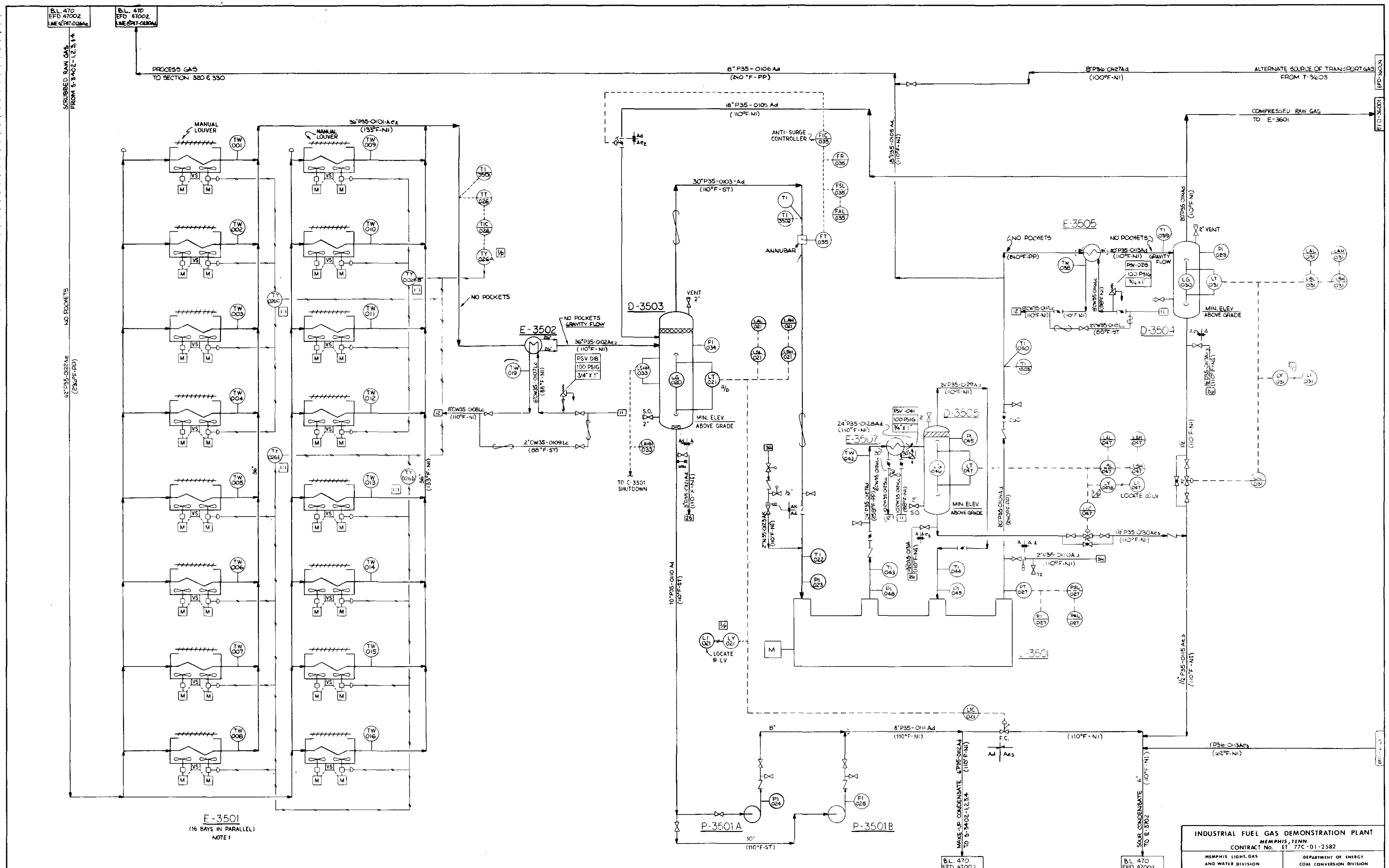
UNIT NAMES AND NUMBERS (SEE ABOVE)

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

ENGINEERING FLOW DIAGRAM
GENERAL NOTES, SYMBOLS AND DETAILS

EST. NO. | DRAWN BY K.O. 5-21-73 | SH. 1 OF 1
CONTRACT NUMBER 2203 | DWG. NO 2203-1-50-1 | B

THIS DRAWING SUPERSEDED 135-940-M REV. B
THIS DRAWING SUPERSEDED BY –



B.L. 470
EFD 47002
PROCESS GAS
TO SECTION 320 & 330
8" P35-0106 Ad
(240 °F-PP)
8"P36-0127 Ad
(100°F-NI)
ALTERNATE SOURCE OF TRANSPORT GAS
FROM T-3603
COMPRESSED RAW GAS
TO E-3601
18" P35-0105 Ad
(110°F-NI)
ANTI-SURGE CONTROLLER
ANNUBAR
30"P35-0103-Ad
(110°F-ST)
SCRUBBED RAW GAS
FROM S-3402-1,2,3,4
NO POCKETS
MANUAL LOUVER
36"P35-0101-Ac2
(133°F-NI)
NO POCKETS
E-3502
NO POCKETS
GRAVITY FLOW
36"P35-0102Ac2
(110°F-NI)
PSV 018
100 PSIG
3/4" x 1"
8"CW35-0108Lc
(110°F-NI)
2"CW35-0109Lc
(88°F-ST)
D-3503
VENT 2"
MIN. ELEV. ABOVE GRADE
TO C-3501 SHUTDOWN
E-3505
NO POCKETS
(240°F-PP)
GRAVITY FLOW
PSV-028
100 PSIG
3/4 x 1
2" VENT
D-3504
MIN. ELEV ABOVE GRADE
D-3506
E-3507
24"P35-0128Ad
(110°F-NI)
PSV-041
100 PSIG
3/4" x 1"
MIN. ELEV
ABOVE GRADE
LOCATE @ LV
1½"P35-0130Ae3
(110°F-NI)
2"V35-0110A
(110°F-NI)
C-3501
LOCATE @ LV
M
8"P35-0111 Ad
(110°F-NI)
F.C.
(110°F-NI)
P-3501A
P-3501B
10"
(110°F-ST)
E-3501
(16 BAYS IN PARALLEL)
NOTE 1
MAKE-UP CONDENSATE
TO S-3402-1,2,3,4
SOUR CONDENSATE 6"
TO E-3702
B.L. 470
EFD 47002
LINE 6"P47-0221 Ad
B.L. 470
EFD 47002
LINE 6"P47-0217 Ae3

LEGEND									
11 COOLING WATER SUPPLY	16 50# STEAM	21 L.P. CONDENSATE	26 OILY OR DIRTY WATER SEWER	31 PUMPOUT	36 INERT GAS (NITROGEN)	41 BOILER FEED WATER (HP)	46 GASEOUS OXYGEN	51	
12 COOLING WATER RETURN	17 POTABLE WATER	22 TREATED WATER	27 PROCESS SEWER	32 PURGE GAS	37 INERT GAS (330 UNIT)	42 DISCHARGE TO GRADE	47 DIRTY [illegible] SEWER	52	
13 900# HP STEAM	18 PROCESS AIR	23 NATURAL GAS	28 SANITARY SEWER	33 BLOWDOWN	38 DEMINERALIZED WATER	43 BOILER FEEDWATER (LP)	48 STEAM CONDENSATE (SRU)	53	
14 125# STEAM	19 INSTRUMENT AIR	24 FUEL GAS	29 FIRE WATER	34 FLARE	39 SOUR WATER DRAIN	44 SERVICE WATER	49 SELEXOL DRAIN	54	
15 85# STEAM	20 H.P. CONDENSATE	25 CLEAN WATER SEWER	30 FLUSHING WATER	35 TO ATMOSPHERE	40 CITY WATER	45 PROCESS GAS	50 BENFIELD DRAIN	55	

NOTES

1. SYMMETRICAL PIPING ARRANGEMENT SHOULD BE MADE IN THE AIRCOOLER FOR UNIFORM FLOW.
2. BLINDS CAN BE INSTALLED ON VALVE IF NECESSARY SO THAT THE VALVE COULD BE REPAIRED WHILE MAINTAINING THE FLOW.
3. INSTRUMENT NO'S IN THIS SECTION SHALL BE PREFIXED WITH "35."

ITEM NO.	P-3501A/B	C-3501
SERVICE	SOUR CONDENSATE PUMP	RAW GAS COMPRESSOR
S.G. AT P.T.	0.98	21.01 MW
DES. G.P.M. AT P.T.	600	36712 SCFM
DES. DIFF. P.S.I.	42.8	—
MAX. DISCH. P.S.I.G.	95	207 PSIA
MATERIAL	CS	CAST STEEL
INSULATION	—	—

ITEM NO.	E-3501	E-3502	E-3505	E-3507
SERVICE	SCRUBBED GAS AIR COOLER	SCRUBBED GAS COOLER	COMPRESSOR AFTERCOOLER	RAW GAS COMP. INTERCOOLER
SHELL DES. P. & T.	—	76 PSIG/185°F	100 PSIG/170°F	100 PSIG/170°F
TUBE DES. P. & T.	85 PSIG/300°F	100 PSIG/170°F	220 PSIG/267°F	140 PSIG/310°F
SURFACE	—	8876 FT²	3417 FT²	5457 FT²
MATL. SHELL	—	KILLED CS	CS	CS
MATL. TUBE	CS	CS	SS	SS
INSULATION	—	—	—	—

ITEM NO.	D-3503	D-3504	D-3505
SERVICE	SCRUBBED GAS K.O. DRUM	COMPRESSED GAS K.O. DRUM	RAW GAS COMP. INTERCOOLER K.O. DRUM
SIZE	12'-6" ID × 25' T/T	11'-0" ID × 22' T/T	10'-6" ID × 21 T/T
DES. PRESS-TEMP.	75 PSIG/160°F	212 PSIG/160°F	148 PSIG/160°F
OPER. PRESS-TEMP.	50 PSIG/110°F	187 PSIG/110°F	112.5 PSIG/110°F
MATERIAL	KILLED CS	KILLED CS	KILLED CS
INSULATION	—	—	

REVISIONS			
B	10-12-79	FINAL ISSUE, PHASE I TASK III	
A	8-27-79	INITIAL ISSUE	

FORM-135-29M REV

BRUNING 40-5353 23763-3

INDUSTRIAL FUEL GAS DEMONSTRATION PLANT

MEMPHIS, TENN.

CONTRACT No. ET 77C-01-2582

MEMPHIS LIGHT, GAS AND WATER DIVISION
MEMPHIS, TENN.

DEPARTMENT OF ENERGY
COAL CONVERSION DIVISION
WASHINGTON, D.C.

ITEM NOS. THIS DWG.

C-3501
D-3503
D-3504
D-3505
E-3501
E-3502
E-3505
E-3507
P-3501A
P-3501B

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

ENGINEERING FLOW DIAGRAM
GAS COMPRESSION
SECTION 350

EST. NO.		DRAWN BY: RKB	7-2-79	SH. 1 OF 3
CONTRACT NUMBER	15-2203	DWG. No. -2203-1-50-35001		B

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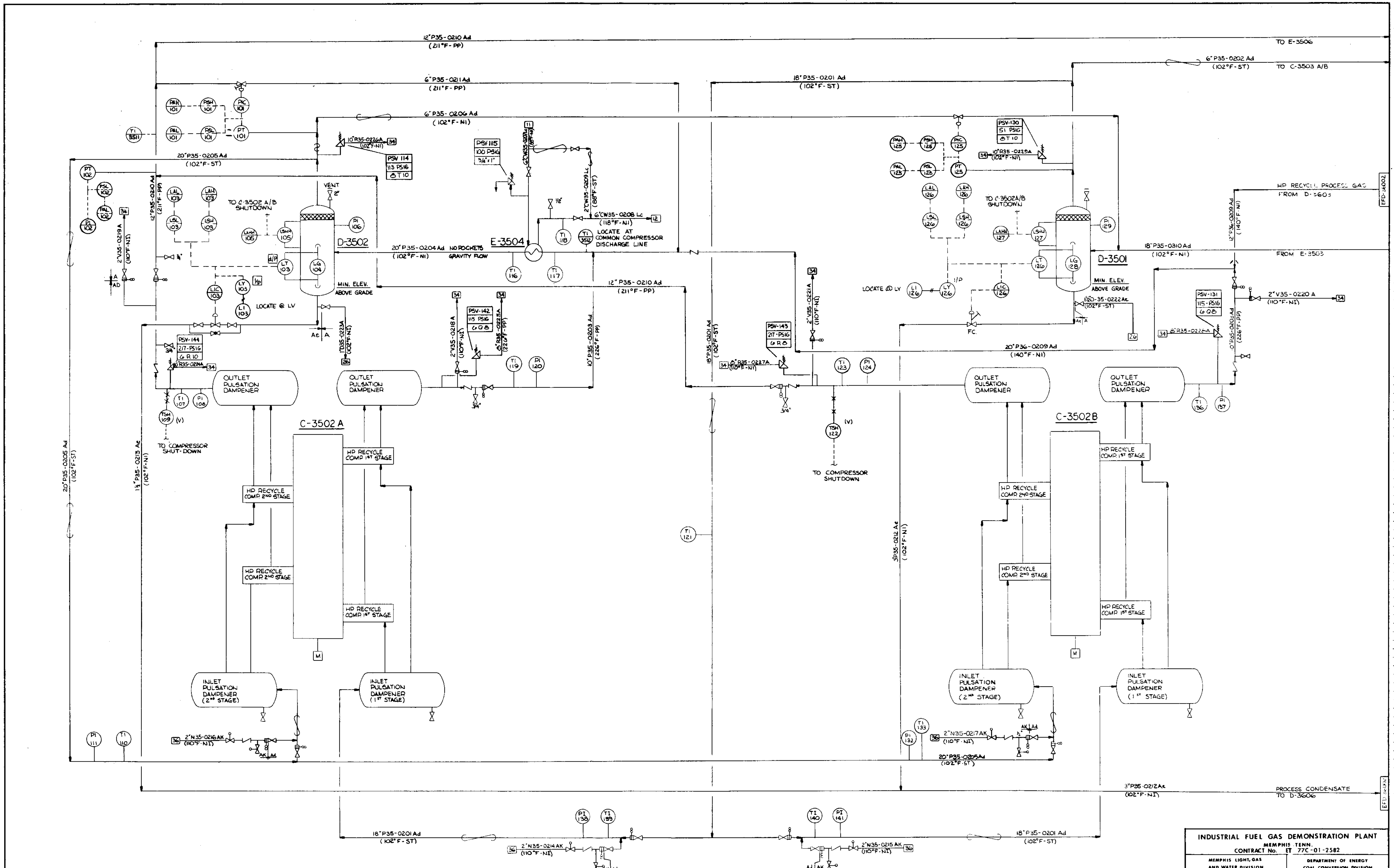


L E G E N D						
11 COOLING WATER SUPPLY	16 50# STEAM	21 L.P. CONDENSATE	26 OILY OR DIRTY WATER SEWER	31 PUMPOUT	36 INERT GAS (NITROGEN)	41 BOILER FEED WATER (H.P.)
12 COOLING WATER RETURN	17 POTABLE WATER	22 TREATED WATER	27 PROCESS SEWER	32 PURGE GAS	37 INERT GAS (300 UNIT)	42 DISCHARGE TO GRADE
13 900# HP STEAM	18 PROCESS AIR	23 NATURAL GAS	28 SANITARY SEWER	33 BLOWDOWN	38 DEMINERALIZED WATER	43 BOILER FEED WATER (LP)
14 125# STEAM	19 INSTRUMENT AIR	24 FUEL GAS	29 FIRE WATER	34 FLARE	39 SOUR WATER DRAIN	44 SERVICE WATER
15 85# STEAM	20 H.P. CONDENSATE	25 CLEAN WATER SEWER	30 FLUSHING WATER	35 TO ATMOSPHERE	40 CITY WATER	45 PROCESS GAS

NOTES

ITEM NO.	C-3502 A/B
SERVICE	HP RECYCLE GAS COMPRESS.
S.G. AT P.T.	42.64 MW
DES. G.P.M. AT P.T.	16036/30830 SCFM
DES. DIFF. P.S.I.	
MAX. DISCH. P.S.I.G.	104.5/207 PSIA
MATERIAL	C.S.
INSULATION	

ITEM NO.	E-3504
SERVICE	2ND COMPRESS INTERCOOLER
SHELL DES. P. & T.	100 PSIG/170°F
TUBE DES. P. & T.	115 PSIG/255°F
SURFACE	3363 FT²
MATL. SHELL	C.S.
MATL. TUBE	S.S.
INSULATION	–

ITEM NO.	D-3501	D-3502
SERVICE	FIRST INTER-COOLER K.O. DRUM	2ND INTER-COOLER K.O. DRUM
SIZE	5'-6" ID×15' T/T	6'-6" ID×18' T/T
DES. PRESS-TEMP.	51 PSIG/152°F	113 PSIG/152°F
OPER. PRESS-TEMP.	26 PSIG/102°F	88 PSIG/102°F
MATERIAL	C.S.	C.S.
INSULATION	–	–

REVISIONS

B	10-12-??	FINAL ISSUE PHASE I TASK III		A	8/29/79	INITIAL ISSUE

INDUSTRIAL FUEL GAS DEMONSTRATION PLANT
MEMPHIS TENN.
CONTRACT No. ET 77C-01-2582

MEMPHIS LIGHT, GAS AND WATER DIVISION MEMPHIS, TENN.

DEPARTMENT OF ENERGY COAL CONVERSION DIVISION WASHINGTON, D.C.

ITEM NOS. THIS DWG.: C-3502 A/B, D-3501, D-3502, E-3504

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

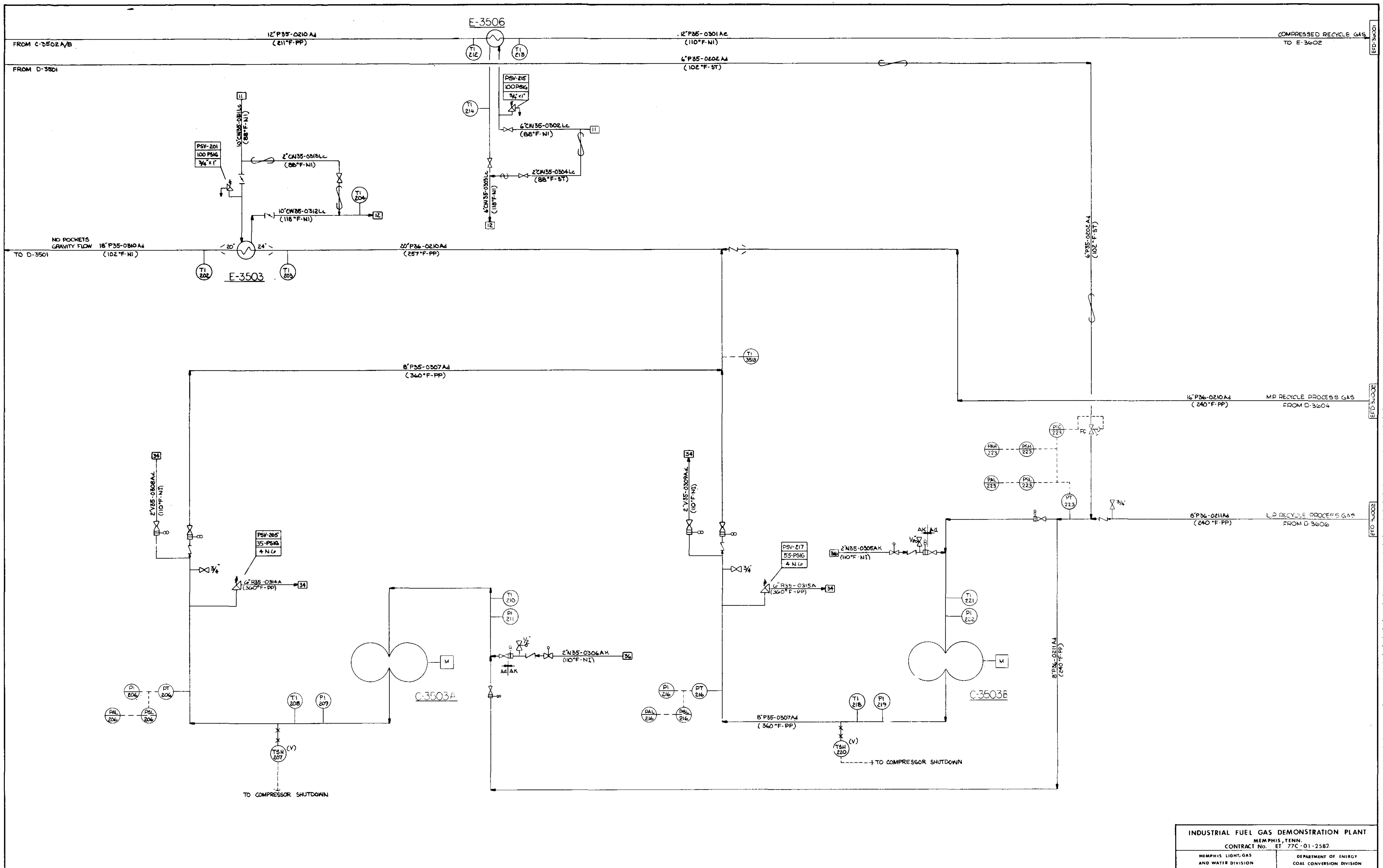
ENGINEERING FLOW DIAGRAM
G-S COMPRESSION
SECTION 350

EST. NO. | DRAWN BY: | SH. 2 OF 3
CONTRACT NUMBER 15-2203 | DWG. NO. 2203-1-50-35002 | B

THIS DRAWING SUPERSEDES

FORM-135-29M REV.

BRUNING 40-5363 23763-3



LEGEND								
11 COOLING WATER SUPPLY	16 50# STEAM	21 LP CONDENSATE	26 OILY OR DIRTY WATER SEWER	31 PUMPOUT	36 INERT GAS (NITROGEN)	41 BOILER FEED WATER (HP)	46 GASEOUS OXYGEN	51
12 COOLING WATER RETURN	17 POTABLE WATER	22 TREATED WATER	27 PROCESS SEWER	32 PURGE GAS	37 INERT GAS (S90 UNIT)	42 DISCHARGE TO GRADE	47 DIRTY BACKWASH SEWER	52
13 900# H.P. STEAM	18 PROCESS AIR	23 NATURAL GAS	28 SANITARY SEWER	33 BLOWDOWN	38 DEMINERILIZED WATER	43 BOILER FEED WATER (LP)	48 STEAM CONDENSATE (SRU)	53
14 125# STEAM	19 INSTRUMENT AIR	24 FUEL GAS	29 FIRE WATER	34 FLARE	39 SOUR WATER DRAIN	44 SERVICE WATER	49 SELEXOL DRAIN	54
15 85# STEAM	20 H.P. CONDENSATE	25 CLEAN WATER SEWER	30 FLUSHING WATER	35 TO ATMOSPHERE	40 CITY WATER	45 PROCESS GAS	50 BENFIELD DRAIN	55

NOTES

ITEM NO.	C-3503 A/B
SERVICE	LP RECYCLE GAS COMPRESS
S.G. AT P.T.	31.40 MW
DES. G.P.M. AT P.T.	2522 SCFM
DES. DIFF. P.S.I.	
MAX. DISCH. P.S.I.G.	44.5 PSIA
MATERIAL	C.S.
INSULATION	

ITEM NO.	E-3503	E-3506
SERVICE	1ST COMPRESS. INTERCOOLER	RECYCLE GAS AFTERCOOLER
SHELL DES. P. & T.	100PSIG/170°F	100PSIG/170°F
TUBE DES. P. & T.	75PSIG/310°F	220PSIG/265°F
SURFACE	3960 FT²	1187 FT²
MATL. SHELL	CS	CS
MATL. TUBE	SS	SS
INSULATION	—	

ITEM NO.	
SERVICE	
SIZE	
DES. PRESS-TEMP.	
OPER. PRESS-TEMP.	
MATERIAL	
INSULATION	

REVISIONS

B	10-12-79	FINAL ISSUE PHASE I TASK III		A	8-29-79	INITIAL ISSUE	

INDUSTRIAL FUEL GAS DEMONSTRATION PLANT
MEMPHIS, TENN.
CONTRACT No. ET 77C-01-2582

MEMPHIS LIGHT, GAS AND WATER DIVISION
MEMPHIS, TENN.

DEPARTMENT OF ENERGY
COAL CONVERSION DIVISION
WASHINGTON, D.C.

ITEM NOS. THIS DWG.
C-3503 A/B
E-3503
E-3506

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

ENGINEERING FLOW DIAGRAM
GAS COMPRESSION
SECTION 350

EST. NO. | DRAWN BY: BD | SH. 3 OF 3
CONTRACT NUMBER 15-2203 | DWG. NO.-2203-1-50-35003 B

THIS DRAWING SUPERSEDES

BRUNING 40-5353 23763-3
FORM-186-20M REV.

MATERIALS OF CONSTRUCTION NOTES

1. CORROSION DESIGN LIFE BASIS:
20 YEAR LIFE FOR VESSELS, DRUMS, PUMP CASING, PIPING, EXCHANGER SHELLS & CHANNELS, AIR FAN HEADERS.
10 YEAR LIFE FOR EXCHANGER TUBING, PUMP INTERNALS, HEATER TUBES AND REMOVABLE VESSEL INTERNALS.

2. NOMINAL CORROSION ALLOWANCE
1/8" ON VESSELS, DRUMS, AND AIRFAN HEADERS CONSTRUCTED OF C.S. THRU 9CR.
1/8" ON EXCHANGER SHELLS, CHANNELS AND PUMP CASINGS CONSTRUCTED OF C.S. THRU 9CR.
0.03" ON EQUIPMENT CONSTRUCTED OF ALLOY GREATER THAN 9CR.
0.05" ON CARBON STEEL THRU 9CR PIPING.
0.03" ON PIPING CONSTRUCTED OF ALLOY GREATER THAN 9CR.
CLADDING SHALL BE 5/64" MINIMUM ON VESSELS AS PER TEMA "R" ON EXCHANGERS EXCEPT AS NOTED.
SUBSTITUTE CLADDING MATERIAL SHALL NOT BE ALLOWED W/O APPROVAL OF TECHNICAL SERVICES.

3. ALL WELD PROCEDURES SHALL BE SUBMITTED TO FWEC FOR APPROVAL IMMEDIATELY AFTER PURCHASE OF EQUIPMENT.

4. MATERIAL SELECTION BASIS
-NACE CORROSION DATA SURVEY.
-PAST FW EXPERIENCE AND CORROSION RACK INFORMATION
-FOR HYDROGEN RESISTANCE, NELSON CURVES API REPORT JUNE 1977 WITH A 25°F SAFETY FACTOR.
-FOR H2S RESISTANCE, A.S. COUPER AND J.W. GORMAN JAN.1971 AND J.D. McCOY CORROSION 1974.
-FOR SULFUR RESISTANCE, H.F. McCONOMY API REPORT 1963. (50% OF PUBLISHED DATA).

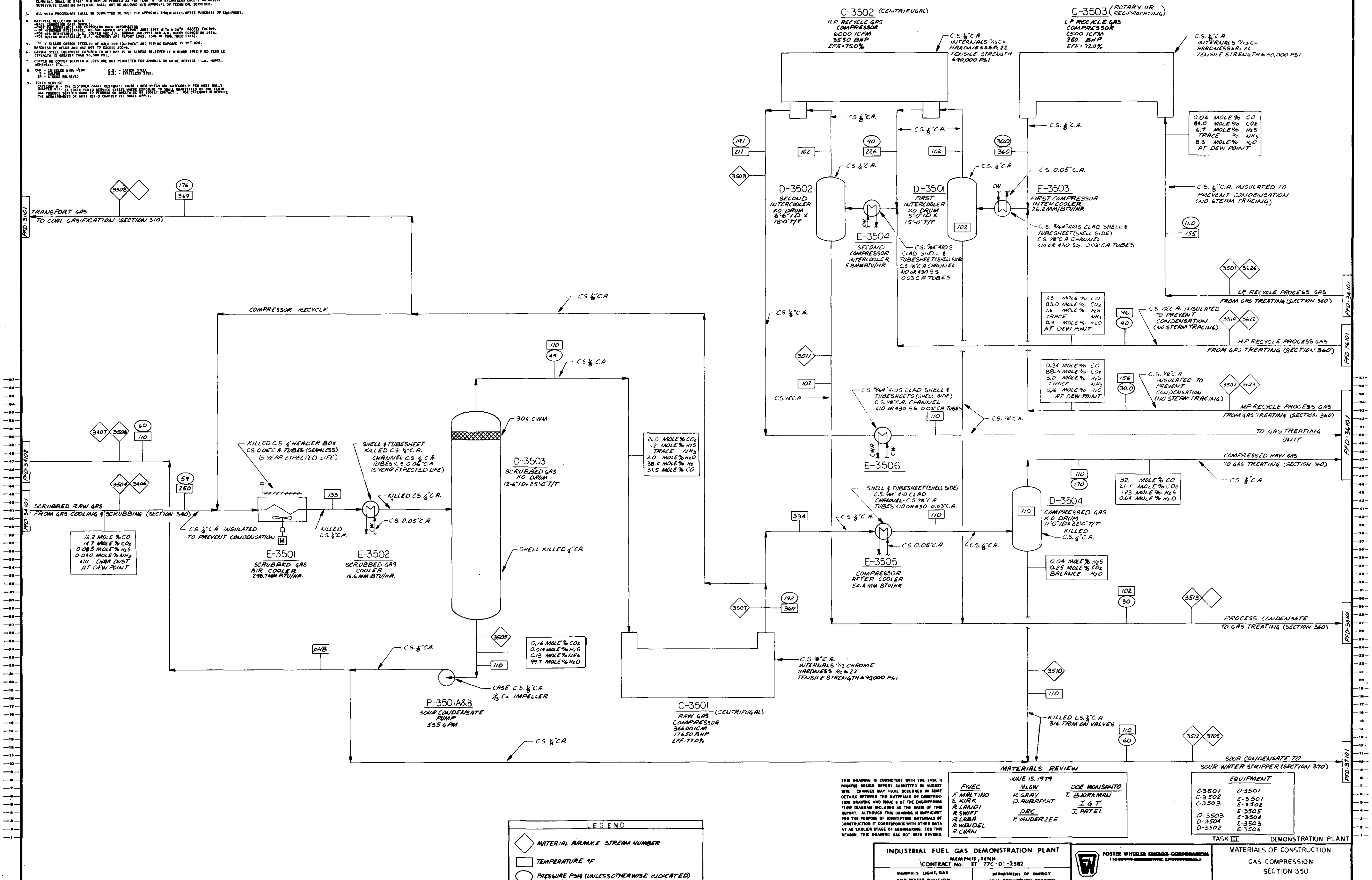
5. FULLY KILLED CARBON STEEL TO BE USED FOR EQUIPMENT AND PIPING EXPOSED TO WET H2S.
HARDNESS OF WELDS AND HAZ NOT TO EXCEED 200HB.

6. CARBON STEEL EQUIPMENT EXPOSED TO WET H2S TO BE STRESS RELIEVED IF MINIMUM SPECIFIED TENSILE STRENGTH IS GREATER THAN 90,000 PSI.

7. COPPER OR COPPER BEARING ALLOYS ARE NOT PERMITTED FOR AMMONIA OR AMINE SERVICE (i.e. MONEL, ADMIRALTY ETC.).

8. CWM - CRINKLED WIRE MESH; S - SULFUR; SR - STRESS RELIEVED; C.S. - CARBON STEEL; S.S. - STAINLESS STEEL

9. TOXIC SERVICE
CATEGORY M - THE CUSTOMER SHALL DESIGNATE THOSE LINES WHICH ARE CATEGORY M PER ANSI B31.3 CHAPTER VII. (A TOXIC FLUID SERVICE EXISTS WHERE EXPOSURE TO SMALL QUANTITIES OF THE FLUID CAN PRODUCE SERIOUS HARM TO PERSONS ON BREATHING OR BODILY CONTACT). FOR CATEGORY M SERVICE THE REQUIREMENTS OF ANSI B31.3 CHAPTER VII SHALL APPLY.



C-3502 (CENTRIFUGAL)
H.P. RECYCLE GAS COMPRESSOR
6000 ICFM
3550 BHP
EFF: 75.0%
C-3503 (ROTARY OR RECIPROCATING)
L.P. RECYCLE GAS COMPRESSOR
2500 ICFM
250 BHP
EFF: 72.0%
D-3502 SECOND INTERCOOLER K.O. DRUM 6'6" I.D. x 18'0" T/T
D-3501 FIRST INTERCOOLER K.O. DRUM 5'0" I.D. x 15'0" T/T
E-3503 FIRST COMPRESSOR INTERCOOLER 26.2 MM BTU/HR
E-3504 SECOND COMPRESSOR INTERCOOLER 5.8 MM BTU/HR
TRANSPORT GAS TO COAL GASIFICATION (SECTION 310)
COMPRESSOR RECYCLE
SCRUBBED RAW GAS FROM GAS COOLING & SCRUBBING (SECTION 340)
16.2 MOLE % CO
14.7 MOLE % CO2
0.085 MOLE % H2S
0.040 MOLE % NH3
NIL CHAR DUST
AT DEW POINT
E-3501 SCRUBBED GAS AIR COOLER 298.7 MM BTU/HR
E-3502 SCRUBBED GAS COOLER 16.6 MM BTU/HR
D-3503 SCRUBBED GAS K.O. DRUM 12'6" ID x 25'0" T/T
P-3501A&B SOUR CONDENSATE PUMP 535 GPM
C-3501 (CENTRIFUGAL) RAW GAS COMPRESSOR 36600 ICFM 17650 BHP EFF: 77.0%
E-3506
E-3505 COMPRESSOR AFTER COOLER 54.4 MM BTU/HR
D-3504 COMPRESSED GAS K.O. DRUM 11'0" ID x 22'0" T/T
LP RECYCLE PROCESS GAS FROM GAS TREATING (SECTION 360)
HP RECYCLE PROCESS GAS FROM GAS TREATING (SECTION 360)
MP RECYCLE PROCESS GAS FROM GAS TREATING (SECTION 360)
TO GAS TREATING UNIT
COMPRESSED RAW GAS TO GAS TREATING (SECTION 360)
PROCESS CONDENSATE TO GAS TREATING (SECTION 360)
SOUR CONDENSATE TO SOUR WATER STRIPPER (SECTION 370)
KILLED C.S. ¼" C.A. 316 TRIM ON VALVES
LEGEND
MATERIAL BALANCE STREAM NUMBER
TEMPERATURE °F
PRESSURE PSIG (UNLESS OTHERWISE INDICATED)

THIS DRAWING IS CONSISTENT WITH THE TASK II PROCESS DESIGN REPORT SUBMITTED IN AUGUST 1978. CHANGES MAY HAVE OCCURRED IN SOME DETAILS BETWEEN THE MATERIALS OF CONSTRUCTION DRAWING AND ISSUE II OF THE ENGINEERING FLOW DIAGRAM INCLUDED AS THE BASIS OF THIS REPORT. ALTHOUGH THIS DRAWING IS SUFFICIENT FOR THE PURPOSE OF IDENTIFYING MATERIALS OF CONSTRUCTION IT CORRESPONDS WITH OTHER DATA AT AN EARLIER STAGE OF ENGINEERING. FOR THIS REASON, THIS DRAWING HAS NOT BEEN REVISED.

MATERIALS REVIEW

JUNE 15, 1979

FWEC	MLGW	DOE MONSANTO
F. MALTINO	R. GRAY	T. BJORKMAN
S. KIRK	D. AUBRECHT	IGT
R. LANDI	DRC	J. PATEL
R. SWIFT	P. VANDERZEE	
R. LABA		
R. WENDEL		
R. CHAN		

EQUIPMENT

C-3501	D-3501
C-3502	E-3501
C-3503	E-3502
	E-3505
D-3503	E-3504
D-3504	E-3503
D-3502	E-3506

TASK III DEMONSTRATION PLANT

INDUSTRIAL FUEL GAS DEMONSTRATION PLANT
MEMPHIS, TENN.
CONTRACT No. ET 77C-01-2582

MEMPHIS LIGHT, GAS AND WATER DIVISION, MEMPHIS, TENN.

DEPARTMENT OF ENERGY, COAL CONVERSION DIVISION, WASHINGTON, D.C.

FOSTER WHEELER ENERGY CORPORATION

MATERIALS OF CONSTRUCTION
GAS COMPRESSION
SECTION 350

A | 6-18-79 | INITIAL ISSUE

DRAWN BY: | SCALE: | EST. NO. | 15-2203 | DWG. NO-2203-1-50-3520 | A

FORM NO. 135-28M

THIS DRAWING SUPERSEDES
THIS DRAWING SUPERSEDED BY

FORM NO. 135-906

FOSTER WHEELER ENERGY CORP. PROCESS PLANTS DIVISION	CONTRACT: 15-2203 SECTION: 350	LINE CLASSIFICATION LIST	CLIENT: MLGW LOCATION: MEMPHIS, TENNESSEE	PAGE 1 OF 1

REVISION	ORIGINAL	1	2	3	4	5	6	7	8	9	10	11
DATE	8-29-79	10-12-79										

INDEX

PAGE	REVISIONS 0	1	2	3	4	5	6	7	8	9	10	11
1	X	X										
2	X	X										
3	X	X										

PAGE	REVISIONS 0	1	2	3	4	5	6	7	8	9	10	11

NOTES

1. LINES ARE DESIGNED FOR OPERATING TEMPERATURE AND PRESSURE UNLESS DESIGN CONDITIONS INDICATE OTHERWISE.
2. INSULATION THICKNESS IS BASED ON OPERATING TEMPERATURE UNLESS OTHERWISE NOTED.
3. PIPE WALL THICKNESS SHALL BE SHOWN ONLY WHEN IT IS NECESSARY TO CALCULATE PER PIPE SPEC.
4. PWHT MEANS POST WELD HEAT TREATMENT REQUIRED. SEE JOB SPECIFICATION -59A3.
5. FOR UTILITY HEADER NOMENCLATURE AND PIPING SERVICE DESIGNATIONS SEE STANDARD SYMBOLS AND DETAILS FLOW DIAGRAM LATEST REVISION.
6. ALL THE SERIAL # FOR LINE NUMBERING ARE PREFIXED BY UNIT "35" FOR EXAMPLE: 36"P35-0101 A82.

FORM NO. 135-905

FOSTER WHEELER ENERGY CORP. — PROCESS PLANTS DIVISION

CONTRACT: 15-2203 | SECTION: 350

LINE CLASSIFICATION LIST

FLOW SHEET NUMBER & REVISION: 2203-1-50-35001

REVISION	ORIGINAL	1	2	3	4	5	6	7	8	9	10	11
DATE	8-29-79	10-12-79										

LINE NUMBER SIZE	SERIAL		SPEC	LINE EXTREMITIES FROM	TO	OPERATING TEMP °F.	OPERATING PRESS PSIG	DESIGN TEMP °F.	DESIGN PRESS PSIG	INSULATION TYPE	INSULATION THK	PLAN OR ISOMETRIC DRAWING NO.	PIPE WALL THK	FLU. CAT.	REMARKS
36"	P	0101	Ae2	E-3501	E-3502	133	52			NI	-		STD		
36"	P	0102	Ae2	E-3502	D-3503	110	51			NI	-		STD		
30"	P	0103	Ad	D-3503	C-3501	110	50			ST			STD		
30"	P	0104	A1	C-3501	E-3507	240	192			PP	3"		STD		
18"	P	0105	Ae2/Ad	P35-0114	D-3503	110	192			NI					(1)
8"	P	0106	Ad	P35-0104	BL [SEC 320]	240	192			PP	3"				(1)
8"	CW	0107	Lc	[11]	E-3502	88	70			NI	-				
8"	CW	0108	Lc	E-3502	[12]	110	70			NI	-				
2"	CW	0109	Lc	CW35-0107	CW35-0108	88	70			ST					
10"	P	0110	Ad	D-3503	P-3501 A/B	110	52			ST					
8"/6"	P	0111	A1/Ae3	P-3501 A/B	BL [SEC. 370]	110	95			NI	-				
6"	P	0112	Ad	P35-0111	BL	110	95			NI	-				
20"	P	0113	Ad	E-3505	D-3504	110	192			NI	-		STD		(1)
20"	P	0114	Ad	D-3504	E-3601 [SEC. 360]	110	187			ST					(1)
1½"	P	0115	Ae3	D-3504	P35-0111	110	187			NI	-				
8"	CW	0116	Lc	[11]	E-3505	88	70			NI	-				(1)
8"	CW	0117	Lc	E-3505	[12]	110	70			NI	-				(1)
2"	CW	0118	Lc	CW35-0116	CW35-0117	88	70			ST					
1½"	D	0119	Ae3/A	P35-0115	[26]	110	ATM			NI	-				(1)
2"	V	0120	Ad	P35-0104	[34]	110	ATM			NI	-				
3"	D	0121	Ad/A	P35-0110	[26]	110	ATM			NI	-				(1)
42"	P	0122	Ae	[BL]	E-3501	126	89			PP	3"		XS		
2"	N	0123	AK	[BL]	C-3501	110	150			NI	-				(1)
10"	CW	0124	Lc	[11]	E-3507	88	70			NI	-				(1)
10"	CW	0125	Lc	E-3507	[12]	110	70			NI	-				(1)
2"	CW	0126	Lc	CW35-0124	CW35-0125	88	70			NI	-				(1)
24"	P	0127	Ad	C-3501	E-3507	259	116			PP	3"				(1)
24"	P	0128	Ad	E-3507	D-3505	110	127			NI	-				(1)
24"	P	0129	Ad	D-3505	C-3501	110	127			NI	-				(1)
1½"	P	0130	Ae3	D-3505	P35-0115	110	113			NI	-				(1)
1½"	P	0131	A	P35-0130	[26]	110	ATM			NI	-				(1)

⑤ ← SEE NOTES–LINE CLASSIFICATION LIST INDEX → ① ① ① ① ② ③ ④

FORM NO. 135-905

FOSTER WHEELER ENERGY CORP. PROCESS PLANTS DIVISION	CONTRACT: 15-2203 SECTION: 350	LINE CLASSIFICATION LIST	FLOW SHEET NUMBER & REVISION 2203-1-SD-3500 2	PAGE 2 OF 3

REVISION	ORIGINAL	1	2	3	4	5	6	7	8	9	10	11
DATE	8-29-79	10-12-79										

LINE NUMBER				LINE EXTREMITIES		OPERATING		DESIGN		INSULATION		PLAN OR ISOMETRIC DRAWING NO.	PIPE WALL THK	FLU. CAT.	REMARKS
SIZE	SERIAL		SPEC	FROM	TO	TEMP °F.	PRESS PSIG	TEMP °F.	PRESS PSIG	TYPE	THK				
18"	P	0201	A1	D-3501	C-3502 A/B	102	26			ST			STD		
6"	P	0211	A1	P35-0211	P36-0211	102	26			ST					
10"	P	0203	A1	C-3502 A/B	P36-0209	226	90			PP	3"				
20"	P	0204	A1	E-3504	D-3502	102	90			NI	-		STD		
20"	P	0205	A1	D-3502	C-3502 A/B	102	90			ST			STD		
6"	P	0206	A1	P35-0205	P35-0210	102	90			ST					
6"	CW	0207	Lc	[11]	E-3504	88	70			NI	-				
6"	CW	0208	Lc	E-3504	[12]	118	70			NI	-				
2"	CW	0209	Lc	CW35-0207	CW35-0208	88	70			ST					
12"	P	0210	A1	C-3502 A/B	E-3506	211	191			PP	3"				
6"	P	0211	A1	P35-0210	P36-0209	211	191			PP	2"				
4"	P	0212	Ae	D-3501	D-3606 [illegible]	102	30			NI	-				
1½"	P	0213	Ae	D-3502	P35-0212	102	88			NI	-				
2"	N	0214	AK	[36]	P35-0201 [C-3502 A]	110	150			NI	-				(1)
2"	N	0215	AK	[36]	P35-0201 [C-3502 B]	110	150			NI	-				(1)
2"	N	0216	AK	[36]	P35-0205 (C-3502 A)	110	150			NI	-				(1)
2"	N	0217	AK	[36]	P35-0205 (C-3502 B)	110	150			NI	-				(1)
2"	V	0218	Ad	P35-0203 (C-3502 A)	[39]	110	ATM			NI	-				
2"	V	0219	Ad	P35-0210 (C-3502 A)	[39]	110	ATM			NI	-				
2"	V	0220	Ad	P35-0203 (C-3502 B)	[39]	110	ATM			NI	-				
2"	V	0221	Ad	P35-0210 (C-3502 B)	[39]	110	ATM			ST					
1½"	D	0222	A/Ac	P35-0212	[26]	102	ATM			ST					
1"	D	0223	A/Ac	P35-0219	[26]	102	ATM			ST					
10"	R	0224	Ad	PSV-149	[39]	211	ATM			PP	3"				(1)
8"	R	0225	Ad	PSV-142	[39]	226	ATM			PP	3"				(1)
10"	R	0226	Ad	PSV-114	[39]	102	ATM			NI	-				(1)
8"	R	0227	Ad	PSV-143	[39]	211	ATM			PP	3"				(1)
8"	R	0228	Ad	PSV-131	[39]	226	ATM			PP	3"				(1)
10"	R	0229	Ad	PSV-130	[39]	102	ATM			NI	-				(1)

⑤ ← SEE NOTES–LINE CLASSIFICATION LIST INDEX → ① ① ① ① ② ③ ④

FORM NO. 135-905

FOSTER WHEELER ENERGY CORP. — PROCESS PLANTS DIVISION

CONTRACT: 15-2203 | SECTION: 350

LINE CLASSIFICATION LIST

FLOW SHEET NUMBER & REVISION: 2203-1-50-35003

REVISION	ORIGINAL	1	2	3	4	5	6	7	8	9	10	11
DATE	8-29-79	10-12-79										

LINE NUMBER SIZE	SERIAL		SPEC	LINE EXTREMITIES FROM	TO	OPERATING TEMP °F.	OPERATING PRESS PSIG	DESIGN TEMP °F.	DESIGN PRESS PSIG	INSULATION TYPE	INSULATION THK	PLAN OR ISOMETRIC DRAWING NO.	PIPE WALL THK	FLU CAT.	REMARKS
12"	P	0301	A1	E-3506	F-3602 [Sec. 3601]	110	190			NI	-		XH		
6"	CW	0302	Lc	[11]	E-3506	88	10			NI	-				
6"	CW	0303	Lc	E-3506	[12]	118	10			NI	-				
2"	CW	0304	Lc	CW35-0302	CW35-0303	88	10			ST					
2"	N	0305	AK	[36]	P36-0211 [C-3503 B]	110	150			NI	-				(1)
2"	N	0306	AK	[36]	P36-0211 [C-3503 A]	110	150			NI	-				(1)
8"	P	0307	A1	C-3503 A/B	P36-0210	360	30			PP	3"				
2"	V	0308	A1	P35-0207 [C-3503 A]	[39]	110	ATM			NI					
2"	V	0309	A1	P35-0207 [C-3503 B]	[39]	110	ATM			NI					
18"	P	0310	A1	E-3503	D-3501	102	2.8			NI			STD		
10"	CW	0311	Lc	[11]	E-3503	88	10			NI					
10"	CW	0312	Lc	E-3502	[12]	118	10			NI					
2"	CW	0313	Lc	CW35-0311	CW35-0312	88	10			ST					
6"	R	0314	A1	PSV-205	[39]	360	ATM			PP	3"				(1)
6"	R	0315	A1	PSV-217	[39]	360	ATM			PP	3"				(1)

(5) ← SEE NOTES—LINE CLASSIFICATION LIST INDEX → (1) (1) (1) (1) (2) (3) (4)

PIPING MATERIAL SPECIFICATION LISTING

Pipe Spec	Service	Class	Material	Ca
A	General Service	150	CS	.050
A2	General Service	150	CS*	.050
Ad	Corrosive Service	150	CS	.125
Ad2	Corrosive Service	150	CS*	.125
Ae	Corrosive Service	150	CS/SS	.250/.030
Ae2	Corrosive Service	150	CS*/SS	.250/.030
Ae3	Corrosive Service	150	CS**/SS	.250/.030
Af	Steam	150	CS	.050
Afl	Power Piping Code	150	CS	.050
Ak	Fuel Gas, Non-Corr. Gases	150	CS	.050
An	Corrosive Services	150	CS	.1875
An2	Corrosive Services	150	CS**	.1875
Ar	Gasifier Effluent	150	Refrac. Lined	-
Ax	Sulfur	150	-	.125
Ay	Corrosive Service	150	CS-Polypro. Lined	-
Bb	Steam	300	CS	.125
Bbl	Power Piping Code	300	CS	.125
Bc	Gasifier Effluent	300	1¼Cr-½MO, Incoloy Clad.	-
Bd	Corrosive Service	300	CS	.125
Bf	Corrosive Service	300	C - ½MO	.125
Bf2	Corrosive Service	300	C - ½MO	.125
Bk	Fuel Gas, Non-Corr. Gases	300	CS	.050
Bn	Corrosive Service	300	1¼Cr-½MO	.125
Bn2	Corrosive Service	300	1¼Cr-½MO	.125
Db	Steam	600	CS	.125
Dbl	Power Piping Code	600	CS	.125
Dc	Gasifier Effluent	600	1¼Cr-½MO, Incoloy Clad.	-

PIPING MATERIAL SPECIFICATION LISTING (Cont'd.)

Pipe Spec	Service	Class	Material	Ca
Fb	Steam	1500	CS	.125
L	Category D	125	CS	.050
La	Drinking Water	125	Galv Steel	.050
Lc	Water	125	CS	.050
Lf	Firewater	125&175	CS	.063
Ra	Oxygen - Gaseous	150	304L	.030
Rh	General Service	150	304L	.030
Rn	Nitrogen - Liquid	150	304L	.030
Ro	Oxygen - Liquid	150	304L	.030
Rc	Corrosive Service	150	304	.030
Sh	General Services	300	304L	.030
Uc	Chemical Injection	600	304L	.030
Eb	Steam	900	CS	.125
Eb1	Power Piping Code	900	1¼Cr-½MO	.125
P	Chlorine Water Soln	Special	PVC	—

* Killed
**Killed W.316 Trim

4.0 EQUIPMENT LIST

Attached is a tabulation listing the equipment included in this unit. The item number corresponds to that called out on the Engineering Flow Diagram. The number shown under Engineering Flow Diagram (EFD) is the last digit of the appropriate EFD for reference.

FORM NO. 135 904

FOSTER WHEELER ENERGY CORP. PROCESS PLANTS DIVISION	CONTRACT: 15-2203 SECTION: 350	**EQUIPMENT LIST**	NAME OF UNIT: Gas Compression	PAGE 1 OF 2

CLIENT: MLGW/DOE ET-77-C-101-2582 LOCATION: Memphis, Tennessee

			REVISION	ORIGINAL	1	2	3	4	5
			DATE	5/25/79	6/5/79	6/21/79	8-9-79*	10-8-79	
CLASS	ITEM NO.	DESCRIPTION	EFD	REQ'N NO.	P.O. NO.				REV.
DRUMS	D-3501	1st Intercooler KO Drum	1	1131-A					3
	D-3502	2nd Intercooler KO Drum	2	1131-B					3
	D-3503	Scrubbed Gas KO Drum	1	1131-C					3
	D-3504	Compressed Gas KO Drum	1	1131-D					3
	D-3505	Raw Gas Comp. Intercooler K.O. Drum	1	1131-E					4
EXCHANGERS	E-3501	Scrubbed Gas Air Cooler	1	1231-A					3
	E-3502	Scrubbed Gas Cooler	1	1211-A					3
	E-3503	1st Compressor Intercooler	2	1211-B					3
	E-3504	2nd Compressor Intercooler	2	1211-C					3
	E-3505	Compressor Aftercooler	1	1211-D					3
	E-3506	Recycle Gas Aftercooler	2	1211-E					3
	E-3507	Raw Gas Comp. Intercooler	1	1211-F					4

FORM NO. 135 904

FOSTER WHEELER ENERGY CORP. PROCESS PLANTS DIVISION	CONTRACT: 15-2203 SECTION: 350	**EQUIPMENT LIST**	NAME OF UNIT: Gas Compression	PAGE 2 OF 2

CLIENT: MLGW/DOE ET-77-C-01-2582

LOCATION: Memphis, Tennessee

					REVISION	ORIGINAL	1	2	3	4	5	
					DATE	5/25/79	6/5/79	6/21/79	8-9-79	10-8-79		
CLASS	ITEM NO.	DESCRIPTION	EFD	REQ'N NO.	P O NO.							REV
PUMPS	P-3501A	Sour Condensate Pump	1	1311-A								3
	P-3501B	Spare for P-3501A	1	1311-A								3
COMPRESSORS	C-3501	Raw Gas Compressor	1	1321-A								3
	C-3502A	HP Recycle Gas Compressor	2	1322-A								3
	C-3502B	Spare for C-3502A	2	1322-A								3
	C-3503A	LP Recycle Gas Compressor	2	1323-A								3
	C-3503B	Spare for C-3503A	2	1323-A								3

5.0 EQUIPMENT AND MECHANICAL SPECIFICATION

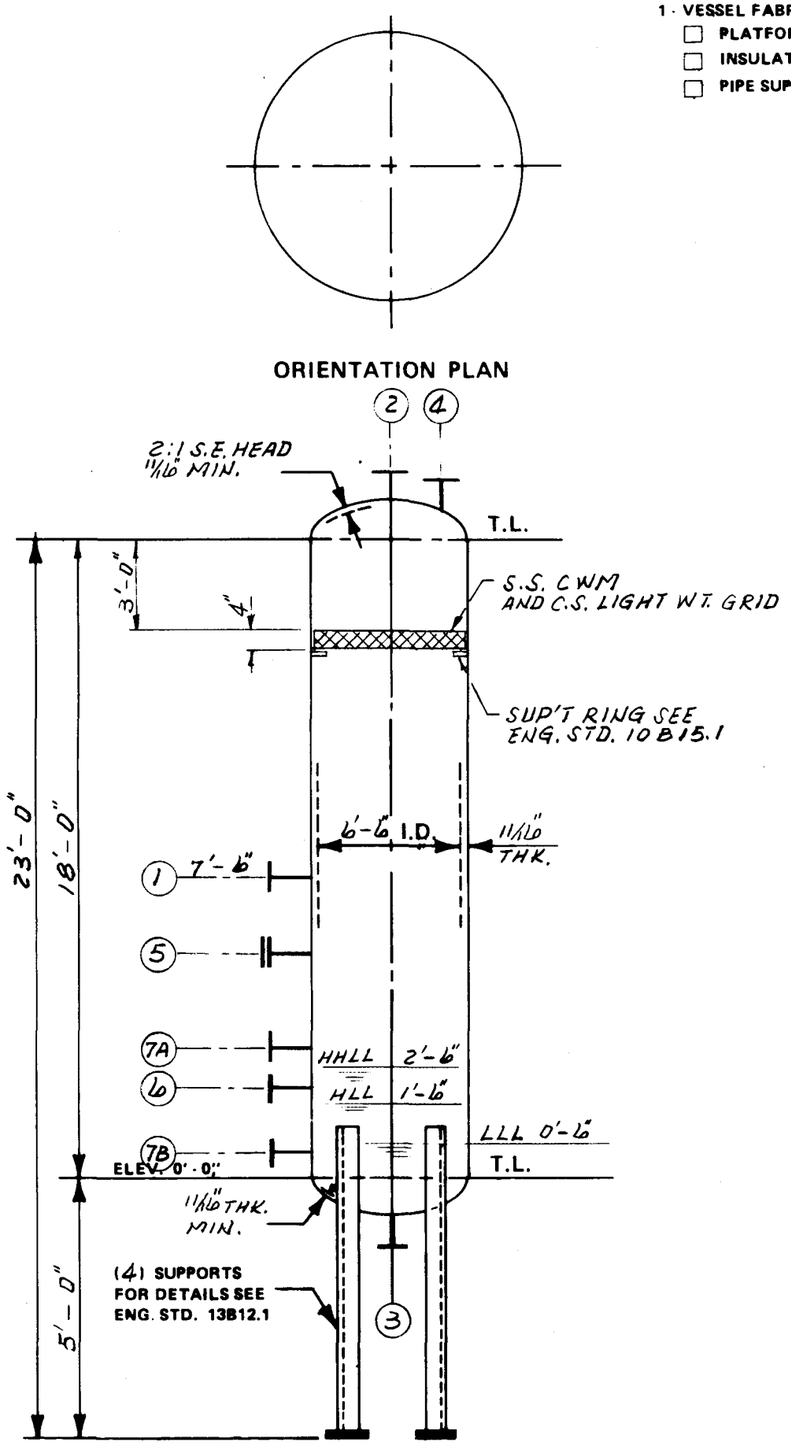
This section contains equipment and mechanical specifications (requisitions) for items employed within this unit. Refer to the appropriate Equipment List for a complete cross reference of:

Class (type of equipment)
Item Number (indicated on Engineering Flow Diagram)
Description
Engineering Flow Diagram
Requisition Number

NOTES:

1 · VESSEL FABRICATOR TO SUPPLY AND INSTALL (AS MARKED)

- ☐ PLATFORM AND LADDER ATTACHMENTS
- ☐ INSULATION ATTACHMENTS
- ☐ PIPE SUPPORTS



RELEASES

DWG. REV.	DATE	ISSUED FOR
	DATE OF ORDER	PURCHASE SHELL AND HEAD MATERIAL. PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.
		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
		FIELD CONSTRUCTION

NOZZLE CHART

CONN NO.	SIZE	ANSI RATING	SERVICE	NO. REQ'D
1	20"	150# R.F.	FLUID IN	1
2	20"	150# R.F.	VAPOR OUT	1
3	1½"	6000# CPLG	LIQUID OUT	1
4	2"	150# R.F.	VENT	1
5	18"	150# R.F.	MANWAY	1
6	1"	6000# CPLG	STEAM OUT	1
7	1"	6000# CPLG	LG	2

REV.	DATE	BY	DESCRIPTION
2	8/31/79	P.S.	REV. AS NOTED
1	7/3/79	P.S.	REV. SHELL AND HD. THK.

REVISIONS

VESSEL DATA

1	ITEM NO: D 3502 NO. REQ'D: ONE			
2	SERVICE: 2ND INTERCOOLER KO DRUM			
3				
4	OPER. PRESSURE ABOVE LIQUID LEVEL	NORM:	88	PSIG
5		MAX:	88	PSIG
6	DESIGN PRESSURE	INT:	115	PSIG ⚠2
7		EXT:	—	PSIG
8	OPER. LIQUID HOLD-UP PRESS:		1.1	PSIG
9	OPER. PRESS. DROP THRU VESSEL:		0.1	PSIG
10	MAX. RELIEVING PRESS. AT TOP HD:		113	PSIG ⚠2
11	MAX. OPER. TEMPERATURE:		102	°F
12	DESIGN TEMPERATURE:		152	°F
13	SPECIFIC GRAVITY (PROCESS FLUID):		1.0	
14	WIND DATA: SPEC. 2200-40A1			
15				
16	EARTHQUAKE DATA: SPEC. 2200-40A1			
17	CODE: ASME SECT VIII DIV 1 STAMPED: YES			
18	P.W.H.T. FOR CODE: NO FOR PROCESS: NO			
19	RADIOGRAPHED: SPOT			
20	JOINT EFFICIENCY: 85%			
21	CORROSION ALLOW./CLAD TK: 0.25"			
22	MAT'L. SHELL: SA-285-C			
23	MAT'L. HEADS: SA-285-C			
24	MAT'L. SUPPORTS: SA-283-C			
25	MAT'L. FLANGES: SA-181-GR1			
26	MAT'L. NOZZLES: SA-106-A OR B			
27	EXTERNAL BOLTING: SA-193-B7 & SA-194-2H			
28	INTERNAL BOLTING: —			
29	GASKETS: 1/16" THK. COMPRESSED ASBESTOS			
30	TYPE OF HEADS: ELLIPTICAL			
31	INSULATION: NO			
32	PAINT: PREPARATION:			
33	PRIMER:			
34	COATS:			
35	PARTS:			
36	SHIPMENT: ONE PIECE			
37				
38	EMPTY WGT:		20,000	LBS.
39	WATER(ONLY)WGT:		42,000	LBS.
40	INSULATION WGT:		—	LBS.
41	GUNITE WGT:		—	LBS.
42	OPER. LIQUID WGT:		7380	LBS.
43				
44				

REFERENCE DRAWINGS, REQUISITIONS, STANDARDS

ENG. STD. 10B16.1, 13B12.1
SPEC. 2200-10A1, 11A1, 1100A

DRAWN	P.S.	6/4/79
CHECKED		
APPROVED		

CONTRACT NUMBER: 15-2203

REQUISITION NUMBER: 2235-1131-B

P.O. NUMBER:

2ND INTER COOLER KO DRUM D-3502
GAS COMPRESSION (SECT. 350)
MLGW / DOE

MEMPHIS TENNESSEE

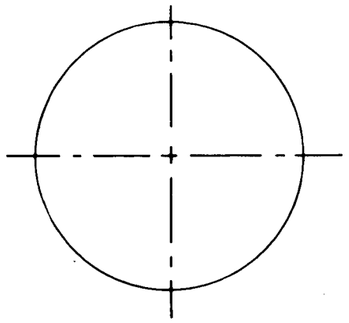
DRAWING NUMBER: 2203-4-11-16

REV.: 2

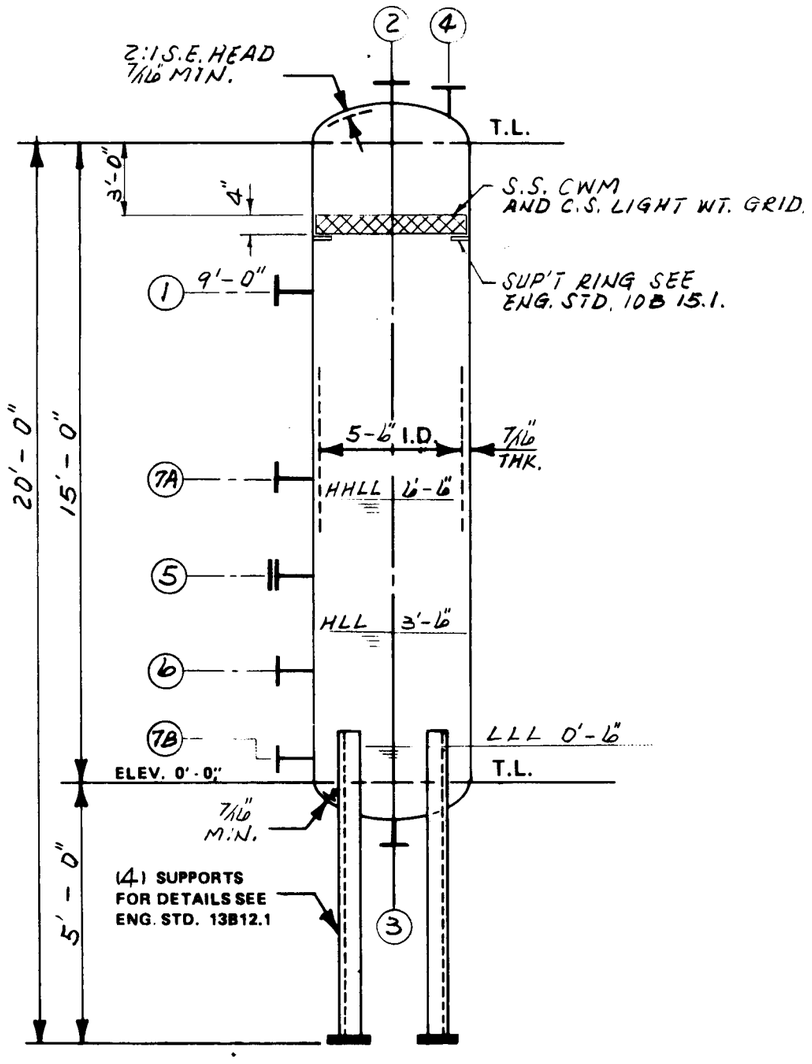
NOTES:

1 · VESSEL FABRICATOR TO SUPPLY AND INSTALL (AS MARKED)

- ☐ PLATFORM AND LADDER ATTACHMENTS
- ☐ INSULATION ATTACHMENTS
- ☐ PIPE SUPPORTS



ORIENTATION PLAN



RELEASES

DWG. REV.	DATE	ISSUED FOR
	DATE OF ORDER	PURCHASE SHELL AND HEAD MATERIAL. PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.
		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
		FIELD CONSTRUCTION

NOZZLE CHART

CONN NO.	SIZE	ANSI RATING	SERVICE	NO. REQ'D
1	18"	150# R.F.	FLUID INLET	1
2	18"	150# R.F.	VAPOR OUTLET	1
3	4"	150# R.F.	LIQUID OUTLET	1
4	2"	150# R.F.	VENT	1
5	18"	150# R.F.	MANWAY	1
6	1"	6000# CPLG	STEAMOUT	1
7	1"	6000# CPLG	LG	2

REV.	DATE	BY	DESCRIPTION
2	8/31/79	P.S.	REV. AS NOTED
1	7/3/79	P.S.	REV. SHELL AND HD. THK.

REVISIONS

VESSEL DATA

1	ITEM NO: D 3501	NO. REQ'D: ONE		
2	SERVICE: 1ST INTERCOOLER KO DRUM			
3				
4	OPER. PRESSURE ABOVE LIQUID LEVEL	NORM:	26	PSIG
5		MAX:	26	PSIG
6	DESIGN PRESSURE	INT:	54	PSIG ⚠2
7		EXT:	—	PSIG
8	OPER. LIQUID HOLD-UP PRESS:		2.9	PSIG
9	OPER. PRESS. DROP THRU VESSEL:		0.1	PSIG
10	MAX. RELIEVING PRESS. AT TOP HD:		51	PSIG ⚠2
11	MAX. OPER. TEMPERATURE:		102	°F
12	DESIGN TEMPERATURE:		152	°F
13	SPECIFIC GRAVITY (PROCESS FLUID):		1.0	
14	WIND DATA: SPEC. 2200 - 40A1			
15				
16	EARTHQUAKE DATA: SPEC. 2200-40A1			
17	CODE: ASME SECT VIII DIVI	STAMPED: YES		
18	P.W.H.T. FOR CODE: NO	FOR PROCESS: NO		
19	RADIOGRAPHED: SPOT			
20	JOINT EFFICIENCY: 85%			
21	CORROSION ALLOW./CLAD TK: .25"			
22	MAT'L. SHELL: SA-285-C			
23	MAT'L. HEADS: SA-285-C			
24	MAT'L. SUPPORTS: SA-283-C			
25	MAT'L. FLANGES: SA-181-GR1			
26	MAT'L. NOZZLES: SA-106-A OR B			
27	EXTERNAL BOLTING: SA-193-B7 & SA-194-2H			
28	INTERNAL BOLTING: —			
29	GASKETS: 1/16" THK. COMPRESSED ASBESTOS			
30	TYPE OF HEADS: ELLIPTICAL			
31	INSULATION: NO			
32	PAINT: PREPARATION:			
33	PRIMER:			
34	COATS:			
35	PARTS:			
36	SHIPMENT: ONE PIECE			
37				
38	EMPTY WGT:		14,000	LBS.
39	WATER(ONLY)WGT:		25,000	LBS.
40	INSULATION WGT:		—	LBS.
41	GUNITE WGT:		—	LBS.
42	OPER. LIQUID WGT:		10,940	LBS.
43				
44				

REFERENCE DRAWINGS, REQUISITIONS, STANDARDS			
ENG. STD. 10B 15.1, 13B 12.1 SPEC. 2200-10A1, 11A1, 1100A	DRAWN	P.S.	6/14/79
	CHECKED		
	APPROVED		

FIRST INTERCOOLER KO DRUM D-3501
GAS COMPRESSION (SECT. 350)
MLGW / DOE

MEMPHIS TENNESSEE

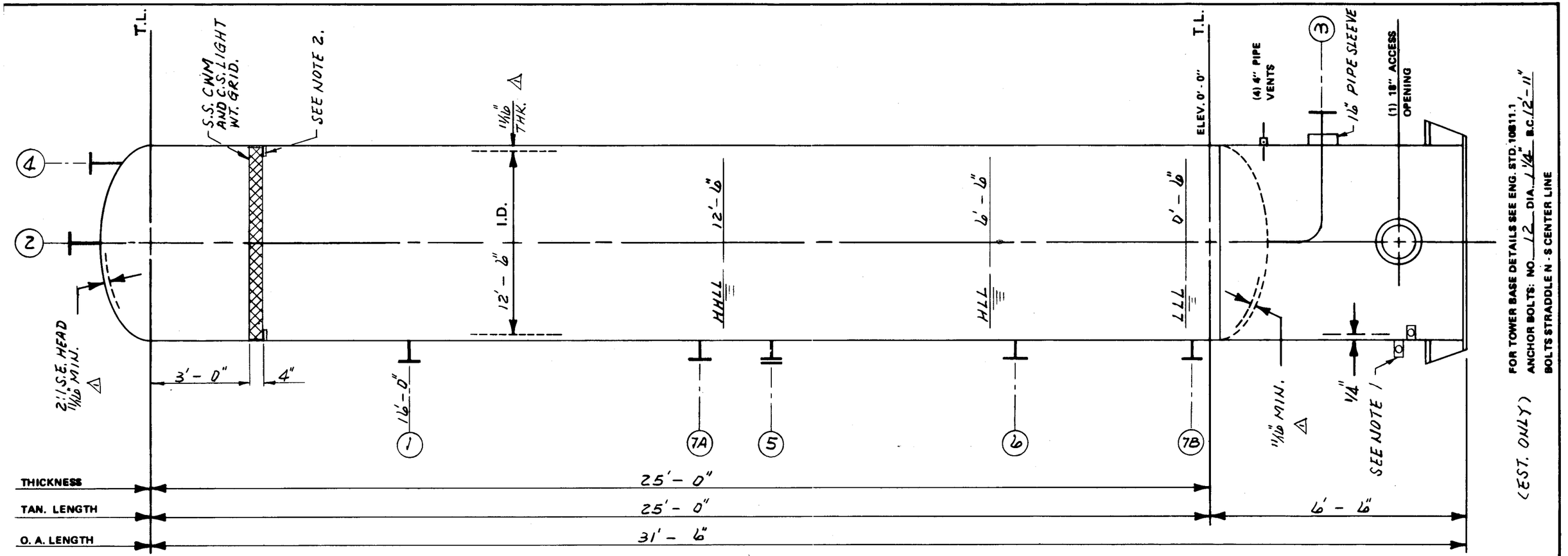
CONTRACT NUMBER: 15 - 2203

REQUISITION NUMBER: 2235-1131-A

P.O. NUMBER:

DRAWING NUMBER: 2203-4-11-15

REV.: 2



(EST. ONLY)

FOR TOWER BASE DETAILS SEE ENG. STD. 10B11.1
ANCHOR BOLTS: NO. 12 DIA. 1 1/4" B.C. 12'-11"
BOLTS STRADDLE N.-S CENTER LINE

NOTE:
1. 1/2" NUTS WELDED ON EDGE AND SPACED ON 24" CENTERS IN BOTH DIRECTIONS SEE ENG. STD. 10B 14.1.
2. FOR 4" CWM SUPPORT RING SEE ENG. STD. 10B 15.1.

REV.	DATE	BY	DESCRIPTION
1	7/3/79	P.S.	REV. AS NOTED

REVISIONS

REFERENCE DRAWINGS, REQUISITIONS, STANDARDS
2203-4-11-16

DRAWN	P.S.	6/15/79
CHECKED		
APPROVED		

SCRUBBED GAS KO DRUM D-3503
GAS COMPRESSION (SECT. 350)
MLGW / DOE

MEMPHIS TENNESSEE

CONTRACT NUMBER: 15-2203
REQUISITION NUMBER: 2235-1131-C
P.O NUMBER:
DRAWING NUMBER: 2203-4-11-17 | 1

NOTES

1 - THIS VESSEL AND ITS SUPPORTS HAVE NOT BEEN DESIGNED TO WITHSTAND A FLOODED OR HYDROSTATIC TEST CONDITION IN THE VERTICAL POSITION. CONTACT FOSTER WHEELER ENERGY CORPORATION PRIOR TO ANY REQUESTED FIELD TEST.

2 - VESSEL FABRICATOR TO SUPPLY AND INSTALL (AS MARKED)

- ☐ TRAYS (TRAYS SUPPLIED BY OTHERS)
- ☐ TRAY SUPPORTS
- ☐ INSULATION ATTACHMENTS
- ☐ FIREPROOFING ATTACHMENTS
- ☐ PLATFORM AND LADDER ATTACHMENTS
- ☐ PIPE SUPPORTS

3 - VESSEL MUST BE SHIPPED WITH ORIENTATION _____ MARK UP

RELEASES

DWG. REV.	DATE	ISSUED FOR
	DATE OF ORDER	PURCHASE SHELL AND HEAD MATERIAL; PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.
		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.
		FIELD CONSTRUCTION

NOZZLE CHART

CONN NO.	SIZE	ANSI RATING	SERVICE	NO REQ'D
1	36"	API 605 150# R.F.	FLUID INLET	1
2	30"	API 605 150# R.F.	VAPOR OUTLET	1
3	10"	150# R.F.	LIQUID OUTLET	1
4	2"	150# R.F.	VENT	1
5	18"	150# R.F.	MANWAY	1
6	2"	150# R.F.	STEAM OUT	1
7	1"	6000# CPLG	LG	2

REV.	DATE	BY	DESCRIPTION
2	8/31/79	P.S.	REV. AS NOTED
1	7/3/79	P.S.	REV. AS NOTED

REVISIONS

VESSEL DATA

1	ITEM NO: D-3503	NO. REQ'D: ONE		
2	SERVICE: SCRUBBED GAS KO DRUM			
3				
4	OPER. PRESSURE ABOVE LIQUID LEVEL	NORM:	50	PSIG
5		MAX:	50	PSIG
6	DESIGN PRESSURE	INT:	81	PSIG
7		EXT:	—	PSIG
8	OPER. LIQUID HOLD-UP PRESS:		5.4	PSIG
9	OPER. PRESS. DROP THRU VESSEL:		0.1	PSIG
10	MAX. RELIEVING PRESS. AT TOP HD:		75	PSIG
11	MAX. OPER. TEMPERATURE:		110	°F
12	DESIGN TEMPERATURE:		160	°F
13	SPECIFIC GRAVITY (PROCESS FLUID):		0.99	
14	WIND DATA: SPEC. 2200-40A1			
15				
16	EARTHQUAKE DATA: SPEC. 2200-40A1			
17	CODE: ASME SECT VIII DIV. 1 STAMPED: YES			
18	P.W.H.T. FOR CODE: NO FOR PROCESS: NO			
19	RADIOGRAPHED: SPOT			
20	JOINT EFFICIENCY: 85%			
21	CORROSION ALLOW. / CLAD TK: 0.25"			
22	MAT'L. SHELL: SA-516-70			
23	MAT'L. HEADS: SA-516-70			
24	MAT'L. SUPPORTS: SA-283-C			
25	MAT'L. FLANGES: SA-181-GR1			
26	MAT'L. NOZZLES: SA-106-A OR B			
27	EXTERNAL BOLTING: SA-193-B7 & SA-194-2H			
28	INTERNAL BOLTING:	—		
29	GASKETS: 1/16 THK. COMPRESSED ASBESTOS			
30	TYPE OF HEADS: ELLIPTICAL			
31	INSULATION: NO			
32	PAINT: PREPARATION:			
33	PRIMER:			
34	COATS:			
35	PARTS:			
36	SHIPMENT: ONE PIECE			
37				
38	EMPTY WGT: (EXC. REMOVABLE TRAYS):		52,000	LBS.
39	WATER (ONLY) WGT:		224,000	LBS.
40	REMOVABLE TRAY WGT:		—	LBS.
41	PACKING, CATALYST, ETC. WGT:		—	LBS.
42	INSULATION WGT:		—	LBS.
43	GUNITE WGT:		8,960	LBS.
44	OPER. LIQUID WGT:		110,600	LBS.

REFERENCE DRAWINGS, REQUISITIONS, STANDARDS			
2203-4-11-17, ENG. STD. 10B 14.1, 15.1. SPEC. 2200-10A1, 11A1, 1100A	DRAWN	P.S.	6/15/79
	CHECKED		
	APPROVED		

SCRUBBED GAS KO DRUM D-3503
GAS COMPRESSION (SECT. 350)
MLGW / DOE

MEMPHIS TENNESSEE

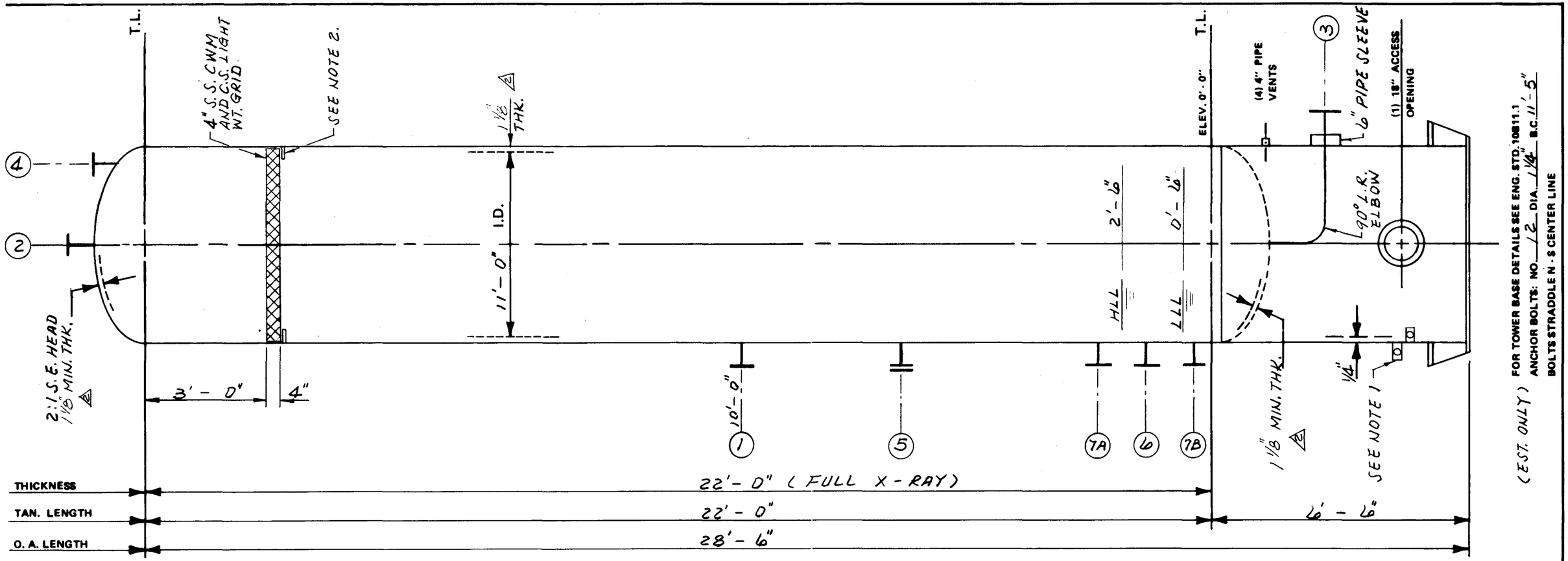
CONTRACT NUMBER: 15-2203

REQUISITION NUMBER: 2235-1131-C

P.O. NUMBER:

DRAWING NUMBER: 2203-4-11-18

REV.: 2



(EST. ONLY) FOR TOWER BASE DETAILS SEE ENG. STD. 10B11.1
ANCHOR BOLTS: NO. 12 DIA. 1¼" B.C. 11'-5"
BOLTS STRADDLE N-S CENTER LINE

NOTE:
1. ½" NUTS WELDED ON EDGE AND SPACED ON 24" CENTERS IN BOTH DIRECTION SEE ENG. STD. 10B 14.1.
2. FOR 4" CWM SUPPORT RING SEE ENG. STD. 10B 15.1.

REV.	DATE	BY	DESCRIPTION
2	8/31/79	P.S.	REV. AS NOTED
1	7/31/79	P.S.	REV. AS NOTED

REVISIONS

REFERENCE DRAWINGS, REQUISITIONS, STANDARDS: 2203-4-11-20,

DRAWN	P.S.	6/5/79
CHECKED		
APPROVED		

COMPRESSED GAS KO DRUM D-3504
GAS COMPRESSION (SECT. 350)
MLGW/DOE

MEMPHIS TENNESSEE

CONTRACT NUMBER: 15-2203
REQUISITION NUMBER: 2235-1131-D
P.O NUMBER:
DRAWING NUMBER: 2203-4-11-19 2

NOTES

1 - THIS VESSEL AND ITS SUPPORTS HAVE NOT BEEN DESIGNED TO WITHSTAND A FLOODED OR HYDROSTATIC TEST CONDITION IN THE VERTICAL POSITION. CONTACT FOSTER WHEELER ENERGY CORPORATION PRIOR TO ANY REQUESTED FIELD TEST.

2 - VESSEL FABRICATOR TO SUPPLY AND INSTALL (AS MARKED)
- ☐ TRAYS (TRAYS SUPPLIED BY OTHERS)
- ☐ TRAY SUPPORTS
- ☐ INSULATION ATTACHMENTS
- ☐ FIREPROOFING ATTACHMENTS
- ☐ PLATFORM AND LADDER ATTACHMENTS
- ☐ PIPE SUPPORTS

3 - VESSEL MUST BE SHIPPED WITH ORIENTATION _____° MARK UP

RELEASES

DWG. REV.	DATE	ISSUED FOR
	DATE OF ORDER	PURCHASE SHELL AND HEAD MATERIAL: PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.
		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.
		FIELD CONSTRUCTION

NOZZLE CHART

CONN NO.	SIZE	ANSI RATING	SERVICE	NO REQ'D
1	30"	API 605 150# R.F.	FLUID INLET	1
2	30"	API 605 150# R.F.	VAPOR OUTLET	1
3	1½"	6000# CPLG	LIQUID OUTLET	1
4	2"	150# R.F.	VENT	1
5	18"	150# R.F.	MANWAY	1
6	2"	150# R.F.	STEAMOUT	1
7			LG	2

REV.	DATE	BY	DESCRIPTION
2	8/21/79	P.S.	REV. AS NOTED
1	7/3/79	P.S.	REV. AS NOTED

REVISIONS

VESSEL DATA

1	ITEM NO: D-3504	NO. REQ'D: ONE		
2	SERVICE: COMPRESSED GAS KO DRUM			
3				
4	OPER. PRESSURE ABOVE LIQUID LEVEL	NORM:	187	PSIG
5		MAX:	187	PSIG
6	DESIGN PRESSURE	INT:	214	PSIG
7		EXT:	—	PSIG
8	OPER. LIQUID HOLD - UP PRESS:		1.1	PSIG
9	OPER. PRESS. DROP THRU VESSEL:		0.1	PSIG
10	MAX. RELIEVING PRESS. AT TOP HD:		212	PSIG
11	MAX. OPER. TEMPERATURE:		110	°F
12	DESIGN TEMPERATURE:		160	°F
13	SPECIFIC GRAVITY (PROCESS FLUID):		1.0	
14	WIND DATA: SPEC. 2200-40A1			
15				
16	EARTHQUAKE DATA: SPEC. 2200-40A1			
17	CODE: ASME SECT. VIII DIV. 1 STAMPED: YES			
18	P.W.H.T. FOR CODE: NO FOR PROCESS: NO			
19	RADIOGRAPHED: FULL			
20	JOINT EFFICIENCY: 100%			
21	CORROSION ALLOW. / CLAD TK: 0.25"			
22	MAT'L. SHELL: SA-516-70			
23	MAT'L. HEADS: SA-516-70			
24	MAT'L. SUPPORTS: SA-283-C			
25	MAT'L. FLANGES: SA-181-GR1			
26	MAT'L. NOZZLES: SA-106-A OR B			
27	EXTERNAL BOLTING: SA-193-B7 & SA-194-2H			
28	INTERNAL BOLTING:			
29	GASKETS: 1/16" THK. COMPRESSED ASBESTOS			
30	TYPE OF HEADS: ELLIPTICAL			
31	INSULATION: NO			
32	PAINT: PREPARATION:			
33	PRIMER:			
34	COATS:			
35	PARTS:			
36	SHIPMENT: ONE PIECE			
37				
38	EMPTY WGT: (EXC. REMOVABLE TRAYS):		59,000	LBS.
39	WATER (ONLY) WGT:		152,300	LBS.
40	REMOVABLE TRAY WGT:		—	LBS.
41	PACKING, CATALYST, ETC. WGT:		—	LBS.
42	INSULATION WGT:		—	LBS.
43	GUNITE WGT:		7,900	LBS.
44	OPER. LIQUID WGT:		25,700	LBS.

REFERENCE DRAWINGS, REQUISITIONS, STANDARDS			
2203-4-11-19, ENG. STD. 10B14.1, 15.1, SPEC. 2200-10A1, 1100A, 11A1	DRAWN	P.S.	6/5/79
	CHECKED		
	APPROVED		

COMPRESSED GAS KO DRUM D-3504
GAS COMPRESSION (SECT. 350)
MLGW / DOE

MEMPHIS TENNESSEE

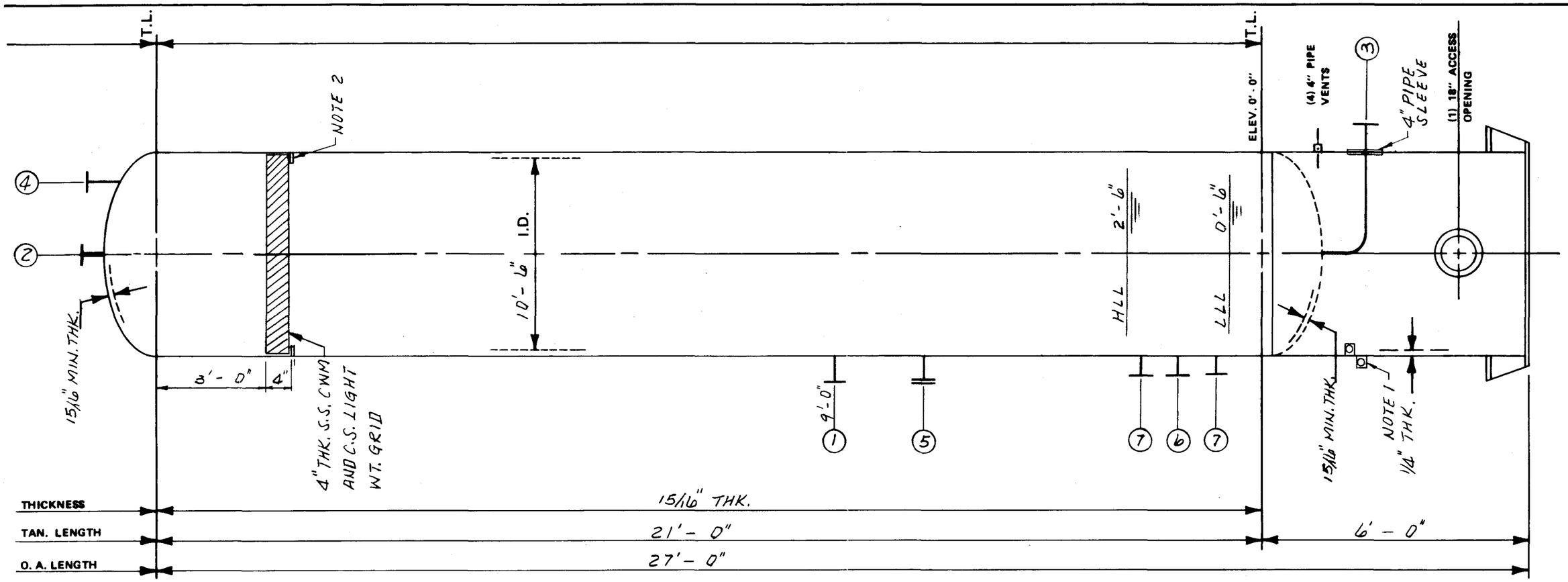
CONTRACT NUMBER: 15-2203

REQUISITION NUMBER: 2235-1131-D

P.O. NUMBER:

DRAWING NUMBER: 2203-4-11-20

REV.: 2



FOR TOWER BASE DETAILS SEE ENG. STD. 10B11.1
ANCHOR BOLTS: NO. 12 DIA. 1 1/4" B.C.
BOLTS STRADDLE N - S CENTER LINE

NOTE :
1. 1/2" NUTS WELDED ON EDGE AND SPACED ON 24" CENTERS IN BOTH DIRECTION SEE ENG. STD. 10B 14.1.
2. FOR 4" CWM SUPPORT RING SEE ENG. STD. 10B 15.1

REV.	DATE	BY	DESCRIPTION
			REVISIONS

REFERENCE DRAWINGS, REQUISITIONS, STANDARDS: 2203-4-11-120

DRAWN	P. S.	9/25/79
CHECKED		
APPROVED		

RAW GAS COMPRESSOR INTERCOOLER
KO DRUM D-3505
GAS COMPRESSION SECT. - 350
MLGW / DOE
MEMPHIS TENNESSEE

CONTRACT NUMBER: 15 - 2203
REQUISITION NUMBER: 2235 - 1131 - E
P.O NUMBER:
DRAWING NUMBER: 2203-4-11-119 | 0

NOTES

1 - VESSEL FABRICATOR TO SUPPLY AND INSTALL (AS MARKED)

- ☐ INSULATION ATTACHMENTS
- ☐ PLATFORM AND LADDER ATTACHMENTS
- ☐ PIPE SUPPORTS

RELEASES

DWG. REV.	DATE	ISSUED FOR
	DATE OF ORDER	PURCHASE SHELL AND HEAD MATERIAL. PREPARE BUT DO NOT SUBMIT SHOP DETAIL DRAWINGS.
		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.
		FIELD CONSTRUCTION

NOZZLE CHART

CONN NO.	SIZE	ANSI RATING	SERVICE	NO. REQ'D
1	30"	API-605 150#R.F.	INLET	1
2	30"	API-605 150#R.F.	VAPOR OUTLET	1
3	1½"	6000#CPLG	LIQUID OUTLET	1
4	2"	150#R.F.	VENT	1
5	20"	150#R.F.	MANWAY	1
6	2"	150#R.F.	STEAM OUT	1
7			LG, LC	2

REV.	DATE	BY	DESCRIPTION
			REVISIONS

VESSEL DATA

1	ITEM NO: D-3505	NO REQ'D: ONE		
2	SERVICE: RAW GAS COMPRESSOR			
3	INTERCOOLER KO DRUM			
4	OPER.PRESSURE ABOVE LIQUID LEVEL	NORM:	112.5	PSIG
5		MAX:	112.5	PSIG
6	DESIGN PRESSURE	INT:	150	PSIG
7		EXT:	—	PSIG
8	OPER.LIQUID HOLD-UP PRESS:		1.1	PSIG
9	OPER.PRESS.DROP THRU VESSEL:			PSIG
10	MAX.RELIEVING PRESS.AT TOP HD:		148	PSIG
11	MAX.OPER.TEMPERATURE:		110	°F
12	DESIGN TEMPERATURE:		160	°F
13	SPECIFIC GRAVITY (PROCESS FLUID):		1.0	
14	WIND DATA: 2200-40A1			
15				
16	EARTHQUAKE DATA: 2200-40A1			
17	CODE: ASME SEC. VIII DIV 1 STAMPED YES			
18	P.W.H.T. FOR CODE: NO FOR PROCESS: NO			
19	RADIOGRAPHED: SPOT			
20	JOINT EFFICIENCY: 85%			
21	CORROSION ALLOW./CLAD TK: 0.25"			
22	MAT'L.SHELL: SA-516-70			
23	MAT'L.HEADS: A-516-70			
24	MAT'L.SUPPORTS: SA-283-C			
25	MAT'L.FLANGES: SA-181-GR1			
26	MAT'L.NOZZLES: SA-106-A OR B			
27	EXTERNAL BOLTING: SA-193-B7 & 194-2H			
28	INTERNAL BOLTING: C.S.			
29	GASKETS: 1/16" THK. COMPRESSED ASBESTOS			
30	TYPE OF HEADS: ELLIPTICAL			
31	INSULATION: NO			
32	PAINT:PREPARATION:			
33	PRIMER:			
34	COATS:			
35	PARTS:			
36	SHIPMENT: ONE PIECE			
37				
38	EMPTY WGT:		50,000	LBS.
39	WATER(ONLY)WGT:		140,000	LBS.
40	INSULATION WGT:			LBS.
41	GUNITE WGT:		14,000	LBS.
42	OPER.LIQUID WGT:		23,000	LBS.
43				
44				

REFERENCE DRAWINGS, REQUISITIONS, STANDARDS			
2203-4-11-119 ENG. STD. 10B 14.1, 15.1 SPEC. 2200-10A1, 40A1 1100A	DRAWN	P.S.	9/25/79
	CHECKED		
	APPROVED		

RAW GAS COMPRESSOR INTERCOOLER
KO DRUM D-3505
GAS COMPRESSION SECT.-350
MLGW/DOE
MEMPHIS TENNESSEE

CONTRACT NUMBER	15-2203
REQUISITION NUMBER	2235-1131-E
P.O. NUMBER	
DRAWING NUMBER	2203-4-11-120
REV.	0

FORM NO. 135-129B

MATERIAL REQUISITION

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

AIR COOLED EXCHANGERS

CONTRACT NO. 15-2235	ITEM NO. E-3501	REQ'N. NO. 2235-1231-A	DATE 6-18-79
CUSTOMERS NAME VISTA		LOCATION MEMPHIS, TENNESSEE	

SUPERSEDED BY

CHANGE NO.	C-1	C-2	C-3	C-4	C-5	C-6
DATE	7-3-79					

PERFORMANCE PER UNIT

SERVICE SCRUBBER GAS COOLER		TYPE (FORCED) (~~INDUCED~~) DRAFT	
SURFACE/UNIT..EXTERNAL	SQ.FT.	SURFACE/UNIT...BARE TUBE	SQ.FT.
HEAT EXCHANGED 298,700,000	BTU/HR.	EFFECTIVE MTD	°F
TRANSFER RATE BARE, SERVICE		TRANSFER RATE...EXTERNAL, SERVICE	

TUBE SIDE

FLUID CIRCULATED	RAW GAS (1)	TEMP. IN	250 °F	TEMP. OUT	133 °F
FLUID FOULING/CORROSIVE	$H_2S + CO_2$	VISCOSITY	0.02 CP @(VAP. MIX)		240 °F
TOTAL FLUID ENTERING	745,685 LB/HR	VISCOSITY	0.015 CP @(VAP. OUT)		133 °F
VAPOR	— LB/HR	SPECIFIC HEAT (AVG)	0.33 (MIX)		BTU/LB°F
LIQUID	— LB/HR	LATENT HEAT (AVG)	981.3		BTU/LB
STEAM	274,018 LB/HR	GRAVITY-LIQUID			
NON-CONDENSABLES	471,667 (2) LB/HR	MOL. WT. - VAPORS	19.83 WET; 21.07 DRY (INLET)		
VAPOR CONDENSED	— LB/HR	INLET PRESS.	56.0 (PSIG) (~~PSIA~~)		
STEAM CONDENSED	259,309 LB/HR	ΔP - ALLOW.	4.0 PSI	ΔP CALC'D.	PSI
FOULING RESISTANCE, MIN.	0.001	POUR POINT FREEZE POINT = 32			°F

AIR SIDE

TEMP. IN	94 °F	TEMP. OUT	°F	WINTER DESIGN TEMP.	+17 °F
AIR QUANTITY/UNIT	SCFM	AIR QUANTITY/FAN			ACFM
ALTITUDE SEA LEVEL	FT.	STATIC PRESS.	IN. WATER	FACE VELOCITY	FT/MIN

CONSTRUCTION (*) HEADERS (IN/OUT) = 42"/36"

DESIGN PRESS.	85 PSIG.	TEST PRESS. PER CODE	PSIG	DESIGN TEMP.	300 °F
BUNDLE		HEADER		TUBE	
SIZE / ROWS		TYPE	PLUG BOX	MATERIAL	A179 C-STL
NO/BAY / BAYS/UNIT	(4)	MATERIAL	KILLED STEEL	O.D.	1 IN. 12 BWG (~~AVG~~) (MIN)
BUND. ARRG'T.	PAR. x SER.	NO. OF PASSES		NO/BUND.	LENGTH 32'-0"
BAY ARRG'T.	PAR. x SER.	CORROSION ALLOW.	1/4"	PITCH	IN. Δ
RECIRCULATION (NONE) (~~INTER.~~) (~~EXT.~~)		NOZZLE SIZE: IN * IN	OUT * IN.	FIN MATERIAL	ALUMINUM
STRUCTURE	GALVANIZED	NOZZLE RATING	150# RF	FIN O.D. IN.	NO./IN.
LOCATION (AT GRADE) (ON PIPE RACK)		CODE REQUIREMENT	ASME VIII D1	TYPE	FOOTED WRAP-ON

℄ → ℄ PIPERACK = 26'-0"

MECHANICAL EQUIPMENT

FAN		DRIVER		SPEED REDUCER	
MODEL	MFG.	TYPE	ELECTRIC MOTOR	TYPE	V-BELT
NO/BAY 2	BHP/FAN	MFG.		MFG.	
DIA. FT.	RPM	ENCLOSURE	TEFC	AGMA RATING	HP@ RPM
NO. BLADES		HP/DRIVER	NO./BAY 2	RATIO	NO./BAY 2
BLADE MATERIAL		VOLTS/PHASES/CYCLES	460/3/60	COUPLING	SUSPENDED
HUB MATERIAL	MFG. STD	F.L. AMPS	L.R. AMPS		

STEAM COIL (NONE)

INLET PRESS.	PSIG	DESIGN PRESS.	PSIG	NOZZLE SIZE: IN	IN OUT IN.
INLET TEMP.	°F	DESIGN TEMP.	°F	NOZZLE RATING	
STEAM QUANTITY	LB/HR	~~NO/BAY~~	ROWS	TUBE O.D. IN.	BWG (AVG) (MIN)
MAT'L ~~TUBE~~	FINS	FIN O.D.	NO/IN.	LENGTH	

ACCESSORIES

LADDERS YES	PLATFORMS YES	LOUVRES (YES) (~~NO~~) (MAN.) (~~AUTO~~)	100% AVE	LOUVRE POSITIONER (~~YES~~) (NO)
FAN GUARD YES	BELT GUARD YES	FAN PITCH ADJM'T. (~~MAN.~~) (AUTO)		FAN PITCH POSITIONER (YES) (~~NO~~)
CPLG GUARD —		VIBRATION SWITCH (YES) (NO)		

REMARKS: (1) SEE PAGE 2 FOR HEAT RELEASE TUBESIDE

(2) MOL% NC = 27.51 CO, 25.11 CO_2, 40.22 H_2, 4.95 CH_4, 1.23 H_2S, 0.87 N_2, 0.11 - COS + NH_3

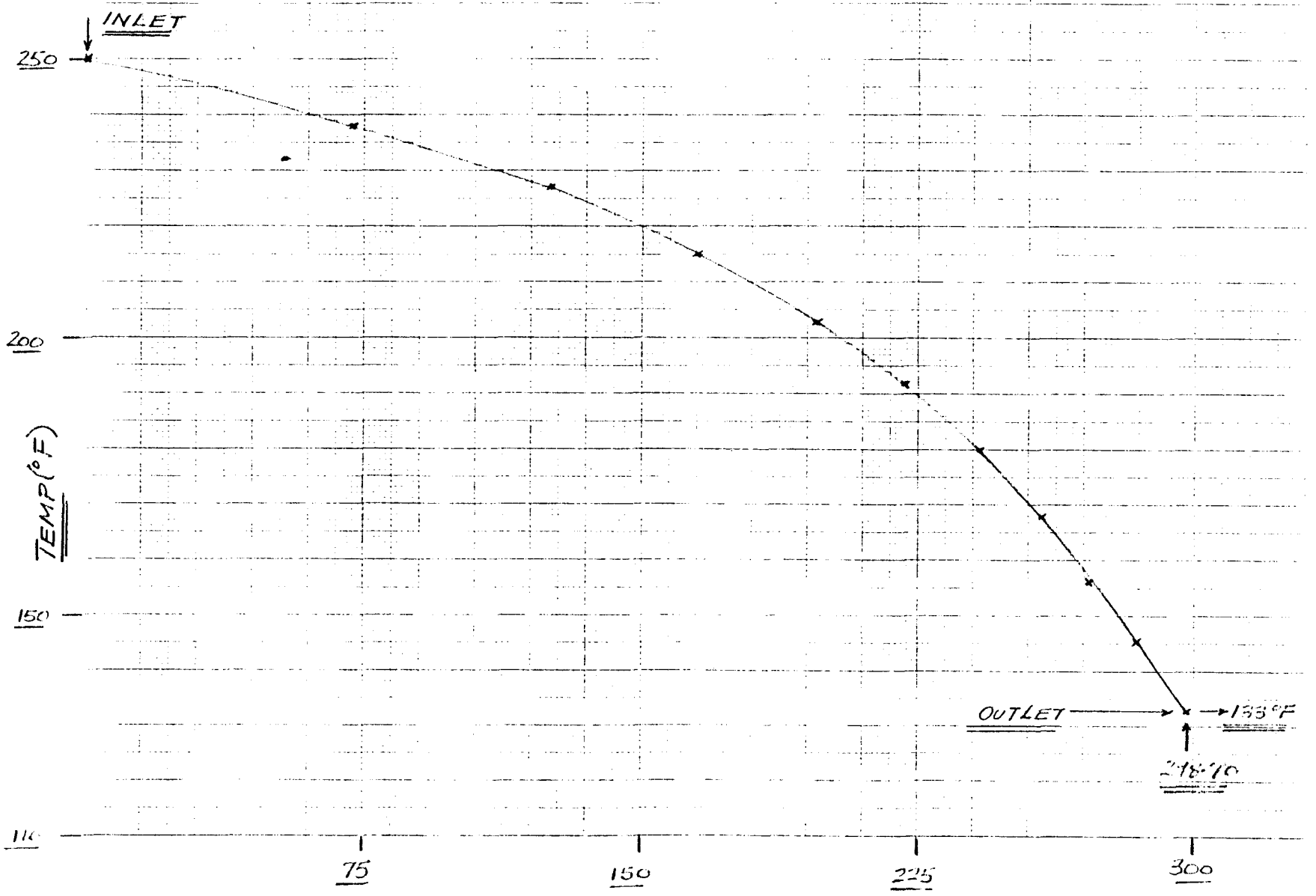
(3) FOR GENERAL NOTES REFER TO REQ'N. 2200-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N.

(4) 12, 16, OR 20 BAY DESIGN REQUIRED

JOB 15-2235
ITEM E-3501

RAW GAS
HEAT RELEASE CURVE

REQ 2275-231-A
PAGE 2 OF 2



FORM NO. 135-128A

MATERIAL REQUISITION

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

SHELL & TUBE EXCHANGERS

CONTRACT NO. 15-2235			REQ'N. NO. 2235-1211-A		DATE 6-20-79	
CUSTOMERS NAME MLGW			LOCATION MEMPHIS, TENNESSEE			
SUPERSEDED BY						
CHANGE NO.	C-1	C-2	C-3	C-4	C-5	C-6
DATE						

SERVICE OF UNIT SCRUBBED GAS TRIM COOLER — ITEM NO. E-3502

SIZE 53"x20'-0" — TYPE B-J-M (HORIZ) (VERT) — CONNECTED IN —

SQ.FT.SURF./UNIT (GROSS) (EFF) 8876 — SHELLS/UNIT ONE — SQ.FT.SURF./SHELL (GROSS) (EFF) 8876

PERFORMANCE OF ONE UNIT

	SHELL SIDE	TUBE SIDE
FLUID CIRCULATED	RAW GAS (1)(3)	COOLING WATER
TOTAL FLUID ENTERING	745685 LB/HR	756500 LB/HR
VAPOR	— LB/HR	— LB/HR
LIQUID	(H2O) 259309 LB/HR	756500 LB/HR
STEAM	14,709 LB/HR	— LB/HR
NON-CONDENSABLES	471,667 LB/HR	— LB/HR
FLUID (VAPORIZED)(CONDENSED)	— LB/HR	— LB/HR
STEAM CONDENSED	6,439 LB/HR	— LB/HR
GRAVITY		
VISCOSITY WET VAPOR	0.014 CP (AVG)	
MOLECULAR WEIGHT INLET VAPOR	20.96 WET; 21.07 DRY	
SPECIFIC HEAT WET VAPOR	0.362 (AVG) BTU/LB-°F	BTU/LB-°F
THERMAL CONDUCTIVITY WET VAP	0.033 (AVG) BTU/HR-FT-°F	BTU/HR-FT-°F
LATENT HEAT	1031.3 BTU/LB	BTU/LB
TEMPERATURE IN	133 °F	88 °F
TEMPERATURE OUT	110 °F	110 °F
OPERATING PRESSURE, INLET	51 (PSIA) (PSIG)	70 (PSIA) (PSIG)
NO. PASSES PER SHELL	DIVIDED FLOW	FOUR
VELOCITY	FT/SEC	3.15 FT/SEC
PRESSURE DROP - ALLOW. / CALC'D.	5.0 PSI / 4.5 PSI	10.0 PSI / 5.0 PSI
FOULING RESISTANCE, MIN.	0.001	0.001

HEAT EXCHANGED - BTU/HR. 16,643,000 — MTD CORRECTED-°F 18.0

TRANSFER RATE - SERVICE 104.17 — CLEAN

CONSTRUCTION OF ONE SHELL

	SHELL SIDE	TUBE SIDE
DESIGN PRESSURE	76 PSIG	100 PSIG
TEST PRESSURE	PER CODE PSIG	PER CODE PSIG
DESIGN TEMPERATURE	135 °F	170 °F

TUBES A179 C-STL — NO. 2300 — O.D. 3/4" — BWG 14 (MIN) — LENGTH 20'-0" — PITCH 1" Δ

SHELL KILLED STEEL — I.D. 53" — SHELL COVER NONE (INTEG) (REMOV)

CHANNEL OR BONNET CARBON STEEL — CHANNEL COVER INTEGRAL

TUBESHEET - STATIONARY KILLED STEEL — TUBESHEET - FLOATING NONE

BAFFLES - CROSS C-STL — TYPE VERT DBL SEGM — FLOATING HEAD COVER NONE

BAFFLES - LONG — — P=29.5"; 45% CUT — IMPINGMENT PROTECTION (VAPOR BELT AT INLET)

TUBE SUPPORTS —

TUBE TO TUBESHEET JOINT EXPANDED

GASKETS

CONNECTIONS - SHELL SIDE — IN 36" ON V.B. — OUT (2)-26" — RATING 150# RF

CONNECTIONS - TUBE SIDE — IN 10" — OUT 10" — RATING 150# RF

CORROSION ALLOWANCE - SHELL SIDE 1/4 IN. — TUBE SIDE 1/8 IN.

CODE REQUIREMENTS ASME VIII-DIV 1 SPEC 2200-21A1 — TEMA CLASS R

REMARKS: (1) MOL% NC = 27.51 CO, 25.11 CO2, 40.22 H2, 4.95 CH4, 1.23 H2S, 0.87 N2, 0.11 - COS + NH3

(2) FOR GENERAL NOTES REFER TO REQ'N. 2200-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N

(3) USE STRAIGHT LINE HEAT RELEASE SHELL SIDE

FORM NO. 135-128 A

MATERIAL REQUISITION

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

SHELL & TUBE EXCHANGERS

CONTRACT NO. 15-2235				REQ'N. NO. 2235-1211-B		DATE 6/24/79	
CUSTOMERS NAME MLGW				LOCATION MEMPHIS, TENNESSEE			
SUPERSEDED BY							
CHANGE NO.	C-1	C-2	C-3	C-4	C-5	C-6	
DATE							
SERVICE OF UNIT 1ST COMPRESSOR INTERCOOLER					ITEM NO. E-3503		
SIZE 32"x 22'-0"	TYPE N-E-N SP'C'L (HORIZ) (VERT)			CONNECTED IN —			
SQ.FT. SURF./UNIT (~~GROSS~~) (EFF) 3960	SHELLS/UNIT ONE			SQ.FT. SURF./SHELL (~~GROSS~~) (EFF) 3960			

PERFORMANCE OF ONE UNIT

	SHELL SIDE		TUBE SIDE (3)	
FLUID CIRCULATED	COOLING WATER		RECYCLE GAS (1)	
TOTAL FLUID ENTERING	878424 LB/HR		150239 LB/HR	
VAPOR	— LB/HR		→ 1540 LB/HR	
LIQUID	878424 LB/HR		(SELEXOL VAPOR) LB/HR	
STEAM	— LB/HR		21613 LB/HR	
NON-CONDENSABLES	— LB/HR		127086 (1) LB/HR	
FLUID (~~VAPORIZED~~) (CONDENSED)	— LB/HR		1540 LB/HR	
STEAM CONDENSED	— LB/HR		20529 LB/HR	
GRAVITY LIQUID			AS WATER	
VISCOSITY WET GAS			0.02 CP	
MOLECULAR WEIGHT INLET			35.38 WET / 43.24 DRY	
SPECIFIC HEAT WET GAS	BTU/LB-°F		C.27 (AVG) BTU/LB-°F	
THERMAL CONDUCTIVITY	BTU/HR-FT-°F		BTU/HR-FT-°F	
LATENT HEAT (STEAM/SELEXOL)	BTU/LB		(1095/80) BTU/LB	
TEMPERATURE IN	88 °F		257 °F	
TEMPERATURE OUT	118 °F		102 °F	
OPERATING PRESSURE, INLET	70 (~~PSIA~~) (PSIG)		28 (~~PSIA~~) (PSIG)	
NO. PASSES PER SHELL	ONE		ONE	
VELOCITY	FT/SEC		FT/SEC	
PRESSURE DROP - ALLOW. / CALC'D.	10.0 PSI	10.0 PSI	1.80 PSI	1.80 PSI
FOULING RESISTANCE, MIN.	0.001		0.001	
HEAT EXCHANGED - BTU/HR. 26,300,000		MTD CORRECTED-°F 64.21		
TRANSFER RATE - SERVICE 103.43		CLEAN		

CONSTRUCTION OF ONE SHELL

DESIGN PRESSURE	100 PSIG	75 PSIG	
TEST PRESSURE	PER CODE PSIG	PER CODE PSIG	
DESIGN TEMPERATURE	170 °F	310 °F	
TUBES A-53 GR B SMLS-A268 WELD NO. 924	O.D. 3/4"	BWG 16 (MIN)	LENGTH 22'-0" PITCH 15/16" Δ
SHELL CARBON STEEL	I.D. 32"	SHELL COVER NONE	(INTEG) (REMOV)
CHANNEL OR BONNET 410"S" 5.5 CLAD (5/64")		CHANNEL COVER NONE	
TUBESHEET - STATIONARY 410'S" CLAD (TEMA R)		TUBESHEET - FLOATING NONE	
BAFFLES - CROSS C-STL TYPE VERT. SEGM.		FLOATING HEAD COVER NONE	
BAFFLES - LONG PITCH = 24"; 40% AREA		IMPINGMENT PROTECTION YES	
TUBE SUPPORTS			
TUBE TO TUBESHEET JOINT EXPANDED			
GASKETS			
CONNECTIONS - SHELL SIDE IN 10"	OUT 10"	RATING 150 # RF	
CONNECTIONS - TUBE SIDE (AXIAL) IN 24"	OUT 20"	RATING 150 # RF	
CORROSION ALLOWANCE - SHELL SIDE 1/8 IN.	TUBE SIDE — IN.		
CODE REQUIREMENTS ASME VIII DIV 1 & SPEC 2200-21A1		TEMA CLASS R	

REMARKS: (1) MOL % NC = 89.67 CO_2, 8.96 H_2S, 1.13 COS, + TRACE CO, H_2, CH_4, N_2, NH_3

(2) FOR GENERAL NOTES REFER TO REQ'N. 2200-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N

(3) DEW POINT = 213°F; DESUPER. DUTY = 1,680,000 BTU/HR

FORM NO. 135-128 A

MATERIAL REQUISITION

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

SHELL & TUBE EXCHANGERS

CONTRACT NO. 15-2235	REQ'N. NO. 2235-1211C	DATE 6/21/79
CUSTOMERS NAME MLGW/DOE	LOCATION MEMPHIS, TENNESSEE	

SUPERSEDED BY

CHANGE NO.	C-1	C-2	C-3	C-4	C-5	C-6
DATE						

SERVICE OF UNIT 2ND COMPRESSOR INTERCOOLER — ITEM NO. E-3504

SIZE 30-264 — TYPE NEN (HORIZ) (~~VERT~~) — CONNECTED IN —

SQ.FT.SURF./UNIT (~~GROSS~~) (EFF) 3363 — SHELLS/UNIT ONE — SQ.FT.SURF./SHELL (~~GROSS~~) (EFF) 3363

PERFORMANCE OF ONE UNIT

	SHELL SIDE	TUBE SIDE
FLUID CIRCULATED	COOLING WATER	RECYCLE GAS
TOTAL FLUID ENTERING	194,000 LB/HR	209,537 LB/HR
VAPOR	LB/HR	6 (SELEXOL) LB/HR
LIQUID	194,000 LB/HR	LB/HR
STEAM	LB/HR	1,733 LB/HR
NON-CONDENSABLES	LB/HR	207,798 (3) LB/HR
FLUID (VAPORIZED)(CONDENSED)	LB/HR	6 (SELEXOL) LB/HR
STEAM CONDENSED	LB/HR	843 LB/HR
GRAVITY		
VISCOSITY C.P.		0.018
MOLECULAR WEIGHT INLET		43.04 DRY ; 42.56 WET
SPECIFIC HEAT	BTU/LB-°F	0.23 BTU/LB-°F
THERMAL CONDUCTIVITY	BTU/HR-FT-°F	BTU/HR-FT-°F
LATENT HEAT	BTU/LB	STM-1005 ; SELEXOL-80 BTU/LB
TEMPERATURE IN	88 °F	205 °F
TEMPERATURE OUT	118 °F	102 °F
OPERATING PRESSURE, INLET	70 (~~PSIA~~)(PSIG)	90 (~~PSIA~~)(PSIG)
NO. PASSES PER SHELL	1	1
VELOCITY	FT/SEC	FT/SEC
PRESSURE DROP - ALLOW. / CALC'D.	10 PSI / 6.5 PSI	1.8 PSI / 1.8 PSI
FOULING RESISTANCE, MIN.	0.001	0.001

HEAT EXCHANGED - BTU/HR. 5,800,000 — MTD CORRECTED-°F 33.8

TRANSFER RATE - SERVICE 52.6 — CLEAN

CONSTRUCTION OF ONE SHELL

DESIGN PRESSURE	100 PSIG	115 PSIG	
TEST PRESSURE	PER CODE PSIG	PER CODE PSIG	
DESIGN TEMPERATURE	170 °F	255 °F	

TUBES 430 S.S. A-268 WELD. NO. 797 — O.D. 3/4" — BWG 16 (MIN) — LENGTH 22' — PITCH 15/16 Δ

SHELL C.S.	I.D. 30"	SHELL COVER —	(INTEG)(REMOV)
CHANNEL OR BONNET 410S S.S. CLAD (5/64")		CHANNEL COVER —	
TUBESHEET - STATIONARY 410S S.S. CLAD (TEMA R)		TUBESHEET - FLOATING —	
BAFFLES - CROSS C.S.	TYPE SEGM. VERT. CUT	FLOATING HEAD COVER —	
BAFFLES - LONG —	h/D = 0.2 ; P = 12 1/4"	IMPINGMENT PROTECTION YES	

TUBE SUPPORTS

TUBE TO TUBESHEET JOINT

GASKETS

CONNECTIONS - SHELL SIDE IN 6" OUT 6" RATING 150 # RF

CONNECTIONS - TUBE SIDE AXIAL IN 20" OUT 18" (Ecc.) RATING 150 # RF

CORROSION ALLOWANCE - SHELL SIDE 1/8 IN. — TUBE SIDE — IN.

CODE REQUIREMENTS ASME SECT. VIII DIV. 1 & JOB SPEC. 2200-21A1 — 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. 2200-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N

(3) GAS COMP. MOL % - CO-0.92 ; CO_2-91.18 ; H_2S-5.92 ; COS-0.92 REMINDER $H_2 + CH_4 + N_2 + NH_3$

(4) DEW POINT = 128°F ; DESUPERHEATING DUTY = 3,700,000 BTU/HR

FORM NO. 135-128 A

⚠ GENERAL REVISION

MATERIAL REQUISITION

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

SHELL & TUBE EXCHANGERS

CONTRACT NO. 15-2235			REQ'N. NO. 2235-1211 D		DATE 6-29-79	
CUSTOMERS NAME MLGW/DOE			LOCATION MEMPHIS, TENNESSEE			
SUPERSEDED BY						
CHANGE NO.	C-1	C-2	C-3	C-4	C-5	C-6
DATE	10-2-79					
SERVICE OF UNIT COMPRESSOR AFTERCOOLER					ITEM NO. E-3505	
SIZE 37"x 16'-0"	TYPE N-E-N SPECIAL (HORIZ) (VERT)			CONNECTED IN –		
SQ.FT. SURF./UNIT (GROSS) (EFF) 3417	SHELLS/UNIT ONE			SQ.FT. SURF./SHELL (GROSS) (EFF) 3417		

PERFORMANCE OF ONE UNIT

	SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED	COOLING WATER		RAW GAS (3)(4)	
TOTAL FLUID ENTERING	630,000	LB/HR	451,021	LB/HR
VAPOR		LB/HR		LB/HR
LIQUID	630,000	LB/HR		LB/HR
STEAM		LB/HR	3,881	LB/HR
NON-CONDENSABLES		LB/HR	447,140	LB/HR
FLUID (VAPORIZED)(CONDENSED)		LB/HR		LB/HR
STEAM CONDENSED		LB/HR	1,462	LB/HR
GRAVITY				
VISCOSITY			0.02	
MOLECULAR WEIGHT			20.99 WET ; 21.05 DRY	
SPECIFIC HEAT		BTU/LB-°F	0.37	BTU/LB-°F
THERMAL CONDUCTIVITY		BTU/HR-FT-°F		BTU/HR-FT-°F
LATENT HEAT		BTU/LB	1026	BTU/LB
TEMPERATURE IN	88	°F	217	°F
TEMPERATURE OUT	118	°F	110	°F
OPERATING PRESSURE, INLET	70	(PSIA)(PSIG)	192	(PSIA)(PSIG)
NO. PASSES PER SHELL	ONE		ONE	
VELOCITY		FT/SEC		FT/SEC
PRESSURE DROP - ALLOW. / CALC'D.	10 PSI / 8.5 PSI		4.0 PSI / 4.0 PSI	
FOULING RESISTANCE, MIN.	0.001		0.001	

HEAT EXCHANGED - BTU/HR. 18,900,000 MTD CORRECTED-°F 46.8 WTD

TRANSFER RATE - SERVICE 118 CLEAN

CONSTRUCTION OF ONE SHELL

DESIGN PRESSURE	100	PSIG	220	PSIG
TEST PRESSURE	PER CODE	PSIG	PER CODE	PSIG
DESIGN TEMPERATURE	170	°F	270	°F

TUBES 430 S.S.-A268 WELD. NO. 1123 O.D. 3/4" BWG 16 (MIN) LENGTH 16'-0" PITCH 15/16 Δ

SHELL C.S. I.D. 37"	SHELL COVER – (INTEG)(REMOV)
CHANNEL OR BONNET 410 S.S. CLAD (5/64")	CHANNEL COVER –
TUBESHEET - STATIONARY 410 S.S. CLAD (TEMA R)	TUBESHEET - FLOATING –
BAFFLES - CROSS C.S. TYPE SEGM. VERT. CUT	FLOATING HEAD COVER –
BAFFLES - LONG TYPE P=20"; h/D=0.3	IMPINGMENT PROTECTION YES

TUBE SUPPORTS

TUBE TO TUBESHEET JOINT EXPANDED

GASKETS

CONNECTIONS - SHELL SIDE IN 10" OUT 10" RATING 150 # RF

CONNECTIONS - TUBE SIDE IN 24" OUT 24" RATING 300 # RF

CORROSION ALLOWANCE - SHELL SIDE 1/8 IN. TUBE SIDE – IN.

CODE REQUIREMENTS ASME SECT VIII DIV 1 & JDB SPEC 2200-21A1 TEMA CLASS

REMARKS: (1) NOZZLE & SUPPORT LOCATION TO BE AS NOTED ON F.W. STD. 21B11.1

(2) FOR GENERAL NOTES REFER TO REQ'N. 2200-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N

(3) MOLE % N.C.: CO - 27.46 ; CO_2 - 25.0 ; H_2 - 40.45 ; CH_4 - 4.95 ; REST - H_2S, COS, N_2, NH_3

(4) DEW POINT: 127°F ; DESUPER. DUTY: 14,700,000 BTU/HR ; ST. LINE CONDENSATION.

FORM NO. 135-128 A

MATERIAL REQUISITION

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

SHELL & TUBE EXCHANGERS

CONTRACT NO. 15-2235	REQ'N. NO. 2235-1211-E	DATE 7/2/79
CUSTOMERS NAME MLGW	LOCATION MEMPHIS, TENNESSEE	

SUPERSEDED BY						
CHANGE NO.	C-1	C-2	C-3	C-4	C-5	C-6
DATE						

SERVICE OF UNIT RECYCLE GAS AFTERCOOLER — ITEM NO. E-3506

SIZE 21" x 16'-0" — TYPE N-E-N SP'C'L (HORIZ) (~~VERT~~) — CONNECTED IN ——

SQ.FT.SURF./UNIT (~~GROSS~~) (EFF) 1187 — SHELLS/UNIT ONE — SQ.FT.SURF./SHELL (~~GROSS~~) (EFF) 1187

PERFORMANCE OF ONE UNIT

	SHELL SIDE		TUBE SIDE (1)(3)	
FLUID CIRCULATED	COOLING WATER		RAW GAS	
TOTAL FLUID ENTERING	171,667	LB/HR	208687	LB/HR
VAPOR		LB/HR		LB/HR
LIQUID	171,667	LB/HR		LB/HR
STEAM		LB/HR	890	LB/HR
NON-CONDENSABLES		LB/HR	207,797 (1)	LB/HR
FLUID (VAPORIZED)(CONDENSED)		LB/HR		LB/HR
STEAM CONDENSED		LB/HR	263	LB/HR
GRAVITY			AS WATER	
VISCOSITY WET GAS			0.02 CP	
MOLECULAR WEIGHT INLET			42.79 WET / 43.04 DRY	
SPECIFIC HEAT WET GAS		BTU/LB-°F	0.231 (AVG)	BTU/LB-°F
THERMAL CONDUCTIVITY		BTU/HR-FT-°F		BTU/HR-FT-°F
LATENT HEAT		BTU/LB	1028 (AVG)	BTU/LB
TEMPERATURE IN	88	°F	211	°F
TEMPERATURE OUT	118	°F	110	°F
OPERATING PRESSURE, INLET	70	(~~PSIA~~)(PSIG)	192	(~~PSIA~~)(PSIG)
NO. PASSES PER SHELL	ONE		ONE	
VELOCITY		FT/SEC		FT/SEC
PRESSURE DROP - ALLOW. / CALC'D.	10 PSI / 10 PSI		4.0 PSI / 3.5 PSI	
FOULING RESISTANCE, MIN.	0.001		0.001	

HEAT EXCHANGED - BTU/HR. 5,136,000 — MTD CORRECTED-°F 47.25 WTD

TRANSFER RATE - SERVICE 91.57 — CLEAN

CONSTRUCTION OF ONE SHELL

DESIGN PRESSURE	100 PSIG	220	PSIG
TEST PRESSURE	PER CODE PSIG	PER CODE	PSIG
DESIGN TEMPERATURE	170 °F	265	°F

TUBES 43 SS-A268 WELD NO. 384 — O.D. 3/4" — BWG 16 (~~AVG~~) MIN — LENGTH 16'-0" — PITCH 15/16" Δ

SHELL CARBON STEEL — I.D. 21" — SHELL COVER NONE (INTEG)(REMOV)

CHANNEL OR BONNET 410 "S" S.S. CLAD (5/64") — CHANNEL COVER NONE

TUBESHEET - STATIONARY 410 "S" CLAD (TEMA R) — TUBESHEET - FLOATING NONE

BAFFLES - CROSS C-STL — TYPE VERT. SEGM — FLOATING HEAD COVER NONE

BAFFLES - LONG —— | PITCH = 9.5"; H/D = 25% — IMPINGMENT PROTECTION YES

TUBE SUPPORTS

TUBE TO TUBESHEET JOINT EXPANDED

GASKETS

CONNECTIONS - SHELL SIDE — IN 6" — OUT 6" — RATING 150# RF

CONNECTIONS - TUBE SIDE (AXIAL) — IN 14" — OUT 14" — RATING 300# RF

CORROSION ALLOWANCE - SHELL SIDE 1/8 IN. — TUBE SIDE —— IN.

CODE REQUIREMENTS ASME VIII-DIV 1 & SPEC 2200-21A1 — TEMA CLASS R

REMARKS: (1) MOL% NC's → 91.16 CO_2, 5.92 H_2S, 0.91 CO, 0.92 COS, & 1.09 H_2+CH_4+NH_3+N_2

(2) FOR GENERAL NOTES REFER TO REQ'N. 2200-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N

(3) DEW POINT = 120°F; DESUP. DUTY = 4,500,000 BTU/HR; USE S.L. CONDENSING

FORM NO. 135-128 A

MATERIAL REQUISITION

FOSTER WHEELER ENERGY CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N. J.

SHELL & TUBE EXCHANGERS

CONTRACT NO. 15-2235	REQ'N. NO. 2235-1211 F	DATE 10-2-79
CUSTOMERS NAME MLGW / DOE	LOCATION MEMPHIS, TENNESSEE	

SUPERSEDED BY

CHANGE NO.	C-1	C-2	C-3	C-4	C-5	C-6
DATE						

SERVICE OF UNIT RAW GAS COMPRESSOR INTERCOOLER ITEM NO. E-3507

SIZE 45" x 20'-0" TYPE N-E-N SPECIAL (HORIZ) (~~VERT~~) CONNECTED IN —

SQ.FT.SURF./UNIT (~~GROSS~~) (EFF) 5457 SHELLS/UNIT ONE SQ.FT.SURF./SHELL (~~GROSS~~) (EFF) 5457

PERFORMANCE OF ONE UNIT

	SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED	COOLING WATER		RAW GAS	
TOTAL FLUID ENTERING	1,006,000	LB/HR	479,937	LB/HR
VAPOR		LB/HR		LB/HR
LIQUID	1,006,000	LB/HR		LB/HR
STEAM		LB/HR	8,270	LB/HR
NON-CONDENSABLES		LB/HR	471,667	LB/HR
FLUID (VAPORIZED)(CONDENSED)		LB/HR		LB/HR
STEAM CONDENSED		LB/HR	4,176	LB/HR
GRAVITY				
VISCOSITY			0.02	
MOLECULAR WEIGHT			IN: 21.01 ; OUT: 21.04	
SPECIFIC HEAT		BTU/LB-°F	0.361	BTU/LB-°F
THERMAL CONDUCTIVITY		BTU/HR-FT-°F	0.034	BTU/HR-FT-°F
LATENT HEAT		BTU/LB	1024	BTU/LB
TEMPERATURE IN	88	°F	259	°F
TEMPERATURE OUT	118	°F	110	°F
OPERATING PRESSURE, INLET	70	(~~PSIA~~)(PSIG)	129.3	(PSIA)(~~PSIG~~)
NO. PASSES PER SHELL	ONE		ONE	
VELOCITY		FT/SEC		FT/SEC
PRESSURE DROP - ALLOW. / CALC'D.	10 PSI	6.5 PSI	2.3 PSI	2.3 PSI
FOULING RESISTANCE, MIN.	0.001		0.001	

HEAT EXCHANGED - BTU/HR. 30,160,000 MTD CORRECTED-°F 55.4 WTD

TRANSFER RATE - SERVICE 99.8 CLEAN

CONSTRUCTION OF ONE SHELL

DESIGN PRESSURE	100	PSIG	140	PSIG
TEST PRESSURE	PER CODE	PSIG	PER CODE	PSIG
DESIGN TEMPERATURE	170	°F	310	°F

TUBES 430 S.S. A-268 WELD. NO. 1069 O.D. 1" BWG 14 (~~MIN~~) LENGTH 20' PITCH 1¼ Δ

SHELL C.S.	I.D. 45"	SHELL COVER —	(INTEG)(REMOV)
CHANNEL OR BONNET 410"S" S.S. CLAD (5/64")		CHANNEL COVER —	
TUBESHEET - STATIONARY 410"S" S.S. CLAD (TEMA R)		TUBESHEET - FLOATING —	
BAFFLES - CROSS C.S.	TYPE SEGM. VERT CUT	FLOATING HEAD COVER —	
BAFFLES - LONG	TYPE P= 26"; h/D = 0.3	IMPINGMENT PROTECTION YES	

TUBE SUPPORTS C.S.

TUBE TO TUBESHEET JOINT EXPANDED

GASKETS

CONNECTIONS - SHELL SIDE IN 12" OUT 12" RATING 150 # RF

CONNECTIONS - TUBE SIDE IN 30" OUT 30" RATING 150 # RF

CORROSION ALLOWANCE - SHELL SIDE 1/8 IN. TUBE SIDE — IN.

CODE REQUIREMENTS ASME SECT VIII DIV 1 & JOB SPEC 2200-21A1 TEMA CLASS

REMARKS: (1) NOZZLE & SUPPORT LOCATION TO BE AS NOTED ON F.W. STD. 21B11.1

(2) FOR GENERAL NOTES REFER TO REQ'N. 2200-1200A WHICH IS AN INTEGRAL PART OF THIS REQ'N

(3) DEW POINT: 135°F ; DESUPER DUTY = 22,300,000 BTU/HR ; ST. LINE COND.

REQUISITION

FOSTER WHEELER ENERGY CORPORATION

CLIENT Memphis Light, Gas & Water Div	CONTRACT NO. 15-2200	REQUISITION NO.		DATE
SITE Memphis, Tennessee	ITEM NO. C-3501	2235-1321 A		6-14-79
MATERIAL Raw Gas Booster Compressor		C1	C4	
OR		C2	C5	
SERVICE		C3	C6	

I. SCOPE OF SUPPLY

Vendor shall furnish one (1) centrifugal compressor with brushless synchronous motor driver with speed increasing gear, lube and seal oil console and accessory equipment in accordance with this requisition and applicable standards and specifications referenced below.

Vendors scope of supply shall include the following items:

Compressor with driver (as specified)
Console type lube and seal oil system
Fabricated steel baseplate
Local panel
Instrumentation

Anti-surge control will be furnished by others.

II. APPLICABLE STANDARDS AND SPECIFICATIONS

2200-32A1 Centrifugal Compressors
2200-38A4 Special Purpose Gears
2200-38A5 Synchronous Motors
2200-38A7 Medium Voltage Induction Motors
2200-39A2 Lube & Seal Oil Systems
2200-1300A General Notes Requisition

III. DESCRIPTION OF SERVICE

The air compressor and drive will be installed in a coal gasification plant operating in continuous, un-interrupted service. The equipment will be installed outdoors, unprotected from the weather, on a mezzanine type foundation.

IV. COST EVALUATION

Justification of incremental capital cost shall be evaluated on the basis of the following power costs:

Electric Power - $.02/KWH

Plant Payout Period - 20 years at 330 operating days per year

BY WLP	P.O. NO.	SUPPLIER

CHANGE NO. 0	DATE 6-14-79	REQUISITION NO. 2235-1321 A

V. VENDOR DATA REQUIREMENTS

A. Model and type of compressor and driver units.

B. Performance data as noted by (*) on page 3.

C. Typical outline dimensions and weights.

D. Price estimate based on shipment in 1981.

FOSTER WHEELER

MATERIAL REQUISITION

CENTRIFUGAL COMPRESSORS

FOR MEMPHIS, LIGHT, GAS, WATER FW REF. 15-2200
SITE MEMPHIS, TENN.
SERVICE RAW GAS BOOSTER ITEM NO. C-3501
MFR.
SIZE AND TYPE NO. REQD. ONE
DRIVER: ☒ MOTOR, ☐ STEAM TURBINE, ☐

REQUISITION NO.	DATE
2235-1321-A	6/14/79

SUPERSEDED BY

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

SPECIFICATIONS: CENTRIFUGAL COMPRESSORS AND ATTENDENT EQUIPMENT COVERED IN THIS REQUISITION SHALL BE FURNISHED IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS:

☐ API STD 617, ☐ FW STD. 30A1, ☐ FW STD. 30A2,
☒ SEE PAGE 1
☐

INSTALLATION: UNIT WILL BE INSTALLED IN AN
☒ OUTDOORS-UNPROTECTED LOCATION,
☐ ENCL. BLDG., ☐
AT ☐ GRADE, ☒ MEZZANINE LEVEL.
BAROMETER 14.7 Psia. ALTITUDE 263 FT
AMB. TEMP. 100 °F MAX., 17 °F MIN.

CONDITIONS OF SERVICE FOR EACH MACHINE

	RATED			
GAS HANDLED (SEE ANALYSIS BELOW)				
RELATIVE HUMIDITY, %				
MOLECULAR WEIGHT	21.01			
Cp/Cv @ ____ °F	1.36			
COMPRESSIBILITY FACTOR @ INLET Z1	1.0			
COMPRESSIBILITY FACTOR @ DISCH Z2				
SCFM @ 14.7 Psia & 60 °F : ☐ DRY, ☐ WET.				
CFM @ INLET CONDITIONS	36,712			
WEIGHT FLOW, Lb/Min.	7999			
INLET PRESSURE, Psia	63.5			
INLET TEMPERATURE, °F	110			
DISCH. PRESSURE, Psia	207			
* DISCH. TEMPERATURE, °F				
POLYTROPIC HEAD Ft.-Lb/Lb.				
* COMPRESSOR BHP				
* COMPRESSOR RPM				
* BHP REQUIRED AT DRIVER SHAFT				
* DRIVER RATED HP				
EST. SURGE CAPACITY @ RATED RPM, ICFM				
DISCH. TEMP. AT SURGE CAPACITY				
PERFORMANCE CURVE NO.				

* VENDOR TO ADVISE

GAS ANALYSIS

COMPOSITION	MOL. WT.	MOL. %	MOL. %	MOL. %	MOL. %
H_2		39.5			
CO		27.0			
CO_2		24.6			
CH_4		4.9			
H_2O		2.0			
H_2S		1.2			
N_2		0.8			
COS					
NH_3					

COMMENTS REGARDING GAS HANDLED:

FOSTER WHEELER ENERGY CORP.

MATERIAL REQUISITION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N.J.

CENTRIFUGAL COMPRESSORS

FOR MLGW FW REF. 15-2200

SITE MEMPHIS, TENN.

SERVICE RAW GAS BOOSTER ITEM NO. C-3501

MATERIAL

SIZE AND TYPE NO. REQD. ONE

DRIVER: ☒ MOTOR, ☐ STEAM TURBINE, ☐

GENERAL NOTES REQUISITION IS AN INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO.	DATE
2235-1321-A	6/14/79

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, ☐ _____.
DIAPHRAMS: _____. INTERSTAGE LABYRINTHS: _____.
IMPELLERS: _____. SHAFT: _____. SLEEVES: _____.
OTHER: _____.

TEMPERATURE AND PRESSURE LIMITATIONS:

MAX. WORKING TEMP:	SUCTION END	°F.	DISCH. END.	°F.
MIN. WORKING TEMP:	SUCTION END.	°F.	DISCH. END.	°F.
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).
MFR SHALL GUARANTEE ZERO OIL LEAKAGE INTO COMPRESSOR CASING

SEALING MEDIUM: ☒ OIL, ☐ AIR, ☐ INERT GAS, ☐ _____.

BEARINGS: BEARING HOUSING CONSTRUCTION: ☐ INTERNAL, ☒ EXTERNAL.
JOURNAL BEARING TYPE: ☐ BABBITTED SLEEVE, ☒ MFR'S STANDARD.
LUBE: ☒ FORCE FEED, ☐ RING OIL, ☐ _____.
THRUST BEARING TYPE ☐ SINGLE KINGSBURY, ☒ DOUBLE KINGSBURY, ☐ BALL,
☐ ROLLER ☐ _____.
LUBE: ☒ FORCE FEED ☐ RING OIL, ☐ _____.

CASING DRAINS: QUANTITY EACH STAGE SIZE 3/4" MIN.. 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:	HIGH SPEED		LOW SPEED		
MFG:	BENDIX OR EQUAL		KOPPERS		
TYPE:	FLEXIBLE DIAPHRAM		HOLSET		
LUBE:	NONE		NONE		

COUPLING GUARDS: SUPPLIED BY ☒ COMPRESSOR VENDOR, ☐ _____.
TYPE: ☐ SHEET METAL, ☒ NON-SPARKING, ☐ _____.

COMMENTS REGARDING CONSTRUCTION DETAILS: _____

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

MATERIAL REQUISITION

CENTRIFUGAL COMPRESSORS PAGE 5 OF 10

FOR MLGW FW REF. 15-2200
SITE MEMPHIS, TENN.
SERVICE RAW GAS BOOSTER ITEM NO. C-3501
MATERIAL
SIZE AND TYPE NO. REQD. ONE
DRIVER: ☒ MOTOR, ☐ STEAM TURBINE, ☐
GENERAL NOTES REQUISITION IS AN
INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO. 2235-1321-A DATE 6/14/79
SUPERSEDED BY

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

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 2200-39A2

SEAL & 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, ☐ STEAM HEATER, ☐ INSULATION SUPPORTS AND
☐
MAIN LUBE OIL PUMP: LOCATED ON ☐ BASE,
☒ CONSOLE AND DRIVEN BY ☐ _____ SHAFT,
☒ INDUCTION MOTOR, ☐ STEAM TURBINE.
MFR. IMO . MODEL .
TYPE SCREW . CASE MATL. C.S. .
GPM . RPM . BHP .
AUX. LUBE OIL PUMP: LOCATED ON ☐ BASE,
☒ CONSOLE AND DRIVEN BY ☐ _____ SHAFT,
☒ INDUCTION MOTOR, ☐ STEAM TURBINE.
MFR. IMO . MODEL .
TYPE SCREW . CASE MATL. C.S. .
GPM . RPM . BHP .
RELIEF VALVES: ☐ INTEGRAL, ☒ SEPARATE.
COOLERS: ☒ TWIN, ☐ SINGLE, LOCATED ON
☐ BASE, ☒ CONSOLE, .
MFR. . TYPE SHELL & TUBE .
CODE: ☒ TEMA C, ☐ .
SHELL: OD _____ IN. DES. PRESS. _____ Psig.
TUBES: OD _____ IN. BWG .
MATL: SHELL C.S. . TUBES .
FILTERS: ☒ TWIN, ☐ SINGLE. LOCATED ON
☐ BASE, ☒ CONSOLE, ☐ .
MFR. . MODEL .
CASE MATL. C.S. . MICRON 10 .
ELEMENT: ☐ CLEANABLE, ☐ REPLACEABLE.
TRANSFER VALVES: MFR. KRAISSL .
QUAN. ONE . TYPE . MATL. C.S. .

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, ☐ STEAM HEATER, ☐ 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. .

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, DOWNSTREAM OF FILTERS.
☐ STAINLESS STEEL DRAIN LINES, ☐ _____.
OTHER:

FOSTER WHEELER CORPORATION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N.J.

MATERIAL REQUISITION

CENTRIFUGAL COMPRESSORS PAGE 6 OF 10

FOR MLGW FW REF. 15-2200
SITE MEMPHIS, TENN.
SERVICE RAW GAS BOOSTER ITEM NO. C-3501
MATERIAL
SIZE AND TYPE NO. REQD. ONE
DRIVER: ☒ MOTOR, ☐ STEAM TURBINE, ☐
GENERAL NOTES REQUISITION IS AN INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO.	DATE
2235-1321-A	6/14/79

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.	MFR'S STD.	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:

PRESSURE GAGES:	LOCAL	LOCAL PANEL		LOCAL	LOCAL PANEL
☒ OIL PUMP DISCHARGE	☒	☐	☐ MAIN STEAM INLET	☐	☐
☒ LUBE OIL EACH LEVEL	☐	☒	☐ FIRST STAGE STEAM	☐	☐
☒ SEAL OIL EACH LEVEL	☐	☒	☐ STEAM EXHAUST	☐	☐
☒ SEAL OIL DIFF.	☐	☒	☐	☐	☐
☒ BEFORE/AFTER FILTERS	☒	☐	☐	☐	☐
☐ CONTROL OIL	☐	☐	☐	☐	☐
TEMPERATURE GAGES:					
☒ OIL OUTLET EACH BRG.	☒	☐	☐	☐	☐
☒ OIL OUTLET EACH SEAL	☒	☐	☐	☐	☐
☒ BEFORE/AFTER COOLERS	☒	☐	☐	☐	☐

SWITCHES: (SPDT)	ALARM	TRIP		ALARM	TRIP
☒ LOW LUBE OIL PRESS.	☒	☒	☒ COMP. HIGH DISCH. TEMP.	☒	☐
☒ LOW SEAL OIL PRESS.	☒	☒	☒ LUBE OIL SUPPLY TEMP.	☒	☐
☒ LOW OIL RES. LEVEL	☒	☐	☒ HIGH OIL FILTER ΔP	☒	☐
☐ LOW CONTROL OIL PRESS.	☐	☐	☒ RADIAL VIBRATION	☒	☐
☒ AUX. PUMP START	☒	☐	☒ AXIAL ROTOR DISPL. (B-N SERIES 7200 MONITORS)	☒	☒

OTHER:

☒ REMOTE SHUTDOWN: ☒ ELECTRICAL, ☐ HYDRAULIC, ☐ PNEUMATIC.
☒ SIGHT FLOW EACH BEARING AND SEAL OIL RETURN LINE.
☐ OIL RESERVOIR LEVEL.
☒ RADIAL & THRUST BEARING RTD'S.
☒ ANNUNCIATOR WITH FIRST-OUT SEQUENCE INDICATION
☒ BEARING TEMP. INDICATOR WITH ALARM & TRIP SWITCHES

ALARM CONTACTS SHALL ☐ OPEN, ☐ CLOSE TO SOUND ALARM. SHUTDOWN CONTACTS SHALL ☐ OPEN, ☐ CLOSE TO SHUTDOWN.

~~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: VENDOR SHALL FURNISH FOLLOWING ADDITIONAL INSTRUMENTATION: (1) BENTLY-NEVADA X-Y PROXIMITY TYPE VIBRATION PROBES AT EACH RADIAL BEARING WIRED TO PROXIMATORS MOUNTED IN NEMA 4 ENCLOSURES. (2) TWO B-N AXIAL ROTOR DISPLACEMENT PROBES WITH PROXIMATORS.

OSTER WHEELER ENERGY CORPORATION

MATERIAL REQUISITION

110 SOUTH ORANGE AVENUE, LIVINGSTON, N.J. — CENTRIFUGAL COMPRESSORS — PAGE 7 OF 10

FOR MLGW — FW REF. 15-2200
SITE MEMPHIS, TENN.
SERVICE RAW GAS BOOSTER — ITEM NO. C-3501
MATERIAL
SIZE AND TYPE — NO. REQD. ONE
DRIVER: ☒ MOTOR, ☐ STEAM TURBINE, ☐
GENERAL NOTES REQUISITION IS AN INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO.	DATE
2235-132I-A	6/14/79

SUPERSEDED BY

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

CONTROL

NORMAL OPERATING: CAPACITY TURNDOWN WILL BE ACCOMPLISHED WITH A BY-PASS THROUGH A COOLER TO SUCTION.

SURGE CONTROL: BY-PASS THROUGH A COOLER TO SUCTION. ANTI-SURGE SYSTEM TO BE FURNISHED BY OTHERS

INSPECTION AND TESTING

			WITNESSED:	
COMPRESSOR:	☒	SHOP INSPECTION.	☒ YES	☐ NO
	☒	HYDROSTATIC TEST.	☐ YES	☒ NO
	☒	IMPELLER OVERSPEED ____ % OF ____ RPM.	☐ YES	☒ NO
	☒	DYNAMIC BALANCE OF ROTOR	☐ YES	☒ NO
	☒	MECHANICAL RUN.	☒ YES	☐ NO
	☒	PERFORMANCE TEST PTC-10	☒ YES	☐ NO
	☐		☐ YES	☐ NO
	☐		☐ YES	☐ NO
DRIVER:	☐		☐ YES	☐ NO
	☐		☐ YES	☐ NO
	☐		☐ YES	☐ NO
	☐		☐ YES	☐ NO
CONSOLE:	☒	SHOP INSPECTION.	☒ YES	☐ NO
	☒	RUNNING	☒ 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:

FORM 135-87

ORM 135-50

FOSTER WHEELER CORPORATION — SPECIAL ELECTRICAL MOTORS — PAGE 8 OF 10

F.W.C. CONTRACT 15-2200 | REQUISITION NUMBER 2235-1321-A | DATE 6/14/79

FOR: MLGW | SUPERSEDED BY CHANGE NO:

SITE: MEMPHIS, TENN. | C1 | C3 | C5

MANUFACTURER: | C2 | C4 | C6

APPLICABLE DOCUMENTS:

MOTOR SPECIFICATION: SEE PAGE 1

PREP. FOR SHIPMENT:

GENERAL NOTES:

SITE DATA:

ALTITUDE 263 FT. BAROMETER 14.7

AMBIENT 100 °F. MAX. TO 17 °F. MIN.

ATMOSPHERE:

INSTALLED ☐ INDOOR ☒ OUTDOOR ☐

AREA ☒ CL. 1 -GR. B -DIV. 2. ☐ NON-HAZARDOUS.

ITEM NUMBERS	C-3501
TOTAL QUANTITY	ONE
DRIVEN EQUIPMENT	TURBO-COMPRESSOR
TYPE (IND., SYNCH., ETC.)	SYNCH.
HP NAMEPLATE RATING	
SERVICE FACTOR	
RPM AT FULL LOAD/NO. POLES	/ /
VOLTS/PHASES/HERTZ	13800/3/60
ENCLOSURE	NEMA WPII
°C. RISE AT FULL S.F. LOAD	
TEMP. MEASUREMENT METHOD	
INSULATION CLASS	B
INSUL. SPECIAL TREATMENT	
SPECIAL HARDWARE	
FRAME NUMBER	
MOUNTING ASSEMBLY NUMBER	
ROTATE FROM END OPP. CPLG.	
BEARINGS TYPE	SLEEVE
LUBRICATION	FORCE FEED
END FLOAT (IF APPL.) INS.	
N.E.M.A. DESIGN LETTER	
AMPS.: F.L./LOCKED ROTOR	/
LOCKED ROTOR LIMIT, SECS.	
LB-FT^2 LOAD AT MOTOR SHAFT	
SECONDS TO ACCEL. ON ___ %V.	
NO. ALLOW. STARTS COLD/HOT	/ /
% EFFIC. 100%/75%/50% LOAD	/ /
% P.F. 100%/75%/50% LOAD	/ /
%T. @ F.V. ST/MIN/BREAKDN	/ /
EXCITATION: TYPE	BRUSHLESS
FURNISHED BY	MOTOR VENDOR
ELECT. SUPPLY, REQ'D.	

ITEM NUMBERS ACCESSORIES:	
BASE	BY COMP. VENDOR
STATOR SHIFT	NO
SPACE HEATERS: WATTS	
V/PH/HZ	/ / / /
TEMP. DETECT.: NUMBER	6
TYPE	RTD
AIR FILTERS: TYPE	
ARRANGE FOR FUTURE FILTERS	
MOUNT COUPLING HALF	YES
EXTENDED LEADS, INCHES	
ENCLOSED COLLECTOR RINGS	
REQ'D. PURGE CFM	
C.T. FOR AMMETER BY	VENDOR
MOUNTED BY	VENDOR
C.T. FOR DIFF. PROTECT. BY	VENDOR
MOUNTED BY	VENDOR
NUMBER REQ'D.	
TYPE	
SURGE PROTECTION BY	VENDOR
MOUNTED BY	VENDOR
LIGHTNING ARRESTORS BY	VENDOR
MOUNTED BY	VENDOR
AMMETER FURNISHED BY	PURCHASER
MOUNTED BY	
LOCATION	
TYPE	

TESTS: (W = WITNESSED)

N.E.M.A. STD. COMMERCIAL	(W)
FULL PERFORMANCE	
SHAFT VIBRATION	(W)
TEST CERTIFICATES REQ'D.	YES

WEIGHTS: (LBS)

NET/GROSS	/	/
MAX. ERECTION		
MAX. NORMAL MAINTENANCE		

REQUISITION

FOSTER WHEELER ENERGY CORPORATION

CLIENT MLGW	CONTRACT NO. 15-2200	REQUISITION NO.	DATE
SITE MEMPHIS, TENN.	ITEM NO.	2235-1321-A	6/14/79
MATERIAL SPECIAL PURPOSE GEARS		C1	C4
SERVICE CENTRIF. COMPRESSOR DRIVE	NO. REQ'D. C-3501	C2	C5
MFGR.	MODEL	C3	C6

OPERATING CONDITIONS:

BRIVEN 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

WR^2 OF LOAD: _____ $LB\text{-}FT^2$ REFERRED TO DRIVER SHAFT

LOAD CHARACTER: ☒ SMOOTH ☐ MODERATE SHOCK

☒ BREAK-AWAY TORQUE AT START-UP

DUTY: ☒ CONTINUOUS ☐ _____

MIN. SERVICE FACTOR 1.5 BASED ON MOTOR RATING

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: 100 °F MAX. TO 17 °F MIN.

UNUSUAL CONDITIONS: _____

AREA: ☒ CL. 1 - GR. B - DIV. 2. ☐ NON-HAZARDOUS.

COOLING WATER: TYPE COOLING TOWER

INLET 85 °F, 75 PSIG. OUT 118 °F MAX. & 60 PSIG.

APPLICABLE DOCUMENTS:

SEE PAGE 1

SHOP TESTS:

	REQUIRED	WITNESSED
MECH'L RUN AT PART LOAD	X	X
FULL TORQUE		
SPARE GEAR TRAIN:		
SOUND LEVEL		
DISMANTLE-INSPECT-REASS'Y.		
CERTIFIED COPIES ALL TESTS	X	

COUPLINGS:

	HIGH SPEED	LOW SPEED
MANUFACTURER	BENDIX OR EQ.	KOPPERS
TYPE	FLEX. DIAPHRAM	HOLSET
LUBRICATION	NONE	NONE
FURNISHED BY	COMPRESSOR	VENDOR
MOUNTED BY		
GUARD		

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

WR^2 OF SET: _____ $LB\text{-}FT^2$ 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 _____

BY	P.O. NO.	SUPPLIER

FORM NO. 135-334

FOSTER WHEELER ENERGY CORPORATION

MATERIAL REQUISITION

CENTRIFUGAL COMPRESSORS PAGE 10 OF 10

FOR MLGW FW REF. 15-2200
SITE MEMPHIS, TENN.
SERVICE RAW GAS BOOSTER ITEM NO. C-3501

REQUISITION NO.	DATE
2235-1321-A	6/14/79

SUPERSEDED BY

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

UTILITY DATA

ELECTRICAL:

CLASSIFICATION: ☒ CLASS I - GROUP D ☐ DIV. 1, ☒ DIV. 2, ☐ _____.
MOTORS 150 HP AND BELOW: 460 VOLTS, 3 PHASE, 60 CYCLES.
MOTORS 200 HP THROUGH 6000 HP: 4000 VOLTS, 3 PHASE, 60 CYCLES.
MOTORS 6500 HP AND ABOVE: 13,800 VOLTS, 3 PHASE, 60 CYCLES.
ALARM SWITCHES: ☒ AC, ☐ DC. 110 VOLTS, 1 PHASE, 60 CYCLES.
SHUTDOWN SWITCHES: ☒ AC, ☐ DC 110 VOLTS, 1 PHASE, 60 CYCLES.
SWITCH ENCLOSURE: ☒ EXPLOSION PROOF, ☐ WEATHER PROOF, ☐ _____.

STEAM:

	MAIN COMP. DRIVE			AUX. DRIVES		
	MAX.	NOR.	MIN.	MAX.	NOR.	MIN.
INLET Psig						
INLET TT °F						
EXH. Psig						
In. HG. ABS.						

⊛ DENOTES CONDITIONS AT WHICH STEAM RATE IS TO BE GUARANTEED.

COOLING WATER:

☐ FRESH, ☐ SALT, ☒ COOLING TOWER.
AVAILABLE AT 75 Psig AND 88 °F. FOULING FACTOR .001 (WATER SIDE)
ALLOW TEMP. RISE 30 °F. ALLOW PRESSURE DROP 15 Psi.

INSTRUMENT AIR:

AVAILABLE TO CONTROL DEVICES AT 100 Psig.

DRIVER AND UTILITY SUMMARY

MOTORS:

	QUAN.	MFR.	TYPE	ENCL.	HP	SF	RPM	
☒ COMPRESSOR DRIVE	ONE		SYN	WP II				
☒ LUBE PUMP DRIVE	TWO		IND	EXP. PROOF				
☐ SEAL PUMP DRIVE								
☐ _____								

STEAM TURBINES:

	QUAN.	MFR.	TYPE	STAGES	HP	RPM	WR	
☐ COMPRESSOR DRIVE								
☐ LUBE PUMP DRIVE								
☐ SEAL PUMP DRIVE								
☐ _____								

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

COOLING WATER CONSUMPTION:

LUBE OIL COOLERS	____ GPM	____ °F. RISE.	
SEAL OIL COOLERS	____ GPM	____ °F. RISE.	
INTER COOLERS	____ GPM	____ °F. RISE.	
_____	____ GPM	____ °F. RISE.	
_____	____ GPM	____ °F. RISE.	

STEAM CONSUMPTION:

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

COMMENTS REGARDING UTILITIES: _____

REQUISITION

FOSTER WHEELER ENERGY CORPORATION

CLIENT Memphis Light, Gas & Water Div	CONTRACT NO. 15-2200	REQUISITION NO.		DATE
SITE Memphis, Tennessee	ITEM NO. C-3502 A/B	2235-1322 A		6-28-79
MATERIAL H. P. Recycle Gas Compressors		C1	C4	
OR		C2	C5	
SERVICE		C3	C6	

I. SCOPE OF SUPPLY

Vendor shall furnish two (2) reciprocating gas compressors with synchronous motor drivers and accessory equipment in accordance with this requisition and applicable standards and specifications referenced below.

Vendor's scope of supply shall include the following items for each unit:

Compressor with driver (as specified)
Frame lube and seal oil system
Local panel
Instrumentation

II. APPLICABLE STANDARDS AND SPECIFICATIONS

2200-1300A	General Notes Requisition
2200-32A2	Reciprocating Compressors
2200-38A5	Synchronous Motors
2200-38A7	Medium Voltage Induction Motors

III. DESCRIPTION OF SERVICE

The gas compressors and drives will be installed in a coal gasification plant operating in continuous, un-interrupted service. The equipment will be installed outdoors, unprotected from the weather.

IV. COST EVALUATION

Justification of incremental capital cost shall be evaluated on the basis of the following power costs:

Electric Power	- $.02/KWH
Plant Payout Period	- 20 years at 330 operating days per year

V. VENDOR DATA REQUIREMENTS

A. Model and type of compressor and driver units.

B. Performance data.

C. Typical outline dimensions and weights.

D. Price estimated based on shipment in 1981.

FORM NO. 135-901

BY WLP	P.O. NO.	SUPPLIER

REQUISITION

FOSTER WHEELER ENERGY CORPORATION

CLIENT MEMPHIS LIGHT, GAS & WATER	CONTRACT NO. 15-2200	REQUISITION NO. 2235-1322-A	DATE 6/28/79
SITE MEMPHIS, TENN.	ITEM NO. C-3502 A/B		
MATERIAL RECIPROCATING COMPRESSORS		C1	C4
SERVICE H.P. RECYCLE	NO. REQ'D. TWO	C2	C5
MFGR.	MODEL	C3	C6

APPLICABLE SPECIFICATIONS

RECIPROCATING COMPRESSORS AND ATTENDANT EQUIPMENT COVERED IN THIS REQUISITION SHALL BE FURNISHED IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS:

SEE PAGE 1

INSTALLATION DATA

COMPRESSOR UNIT WILL BE INSTALLED IN AN:

- [X] OUTDOOR UNPROTECTED LOCATION
- [ ] ENCLOSED BUILDING
- [ ]

BAROMETER 14.7 PSIA ALTITUDE 263 FT.

AMBIENT TEMPERATURES: 100 °F MAX. 17 °F MIN.

CONDITIONS OF SERVICE (EACH MACHINE)

SERVICE	RECYCLE				
STAGE	1	2			
GAS COMPRESSED	SEE BELOW				
~~RELATIVE HUMIDITY~~ FLOW, LB/HR	108,170	208,688			
MOL. WEIGHT	42.64	42.79			
Cp/Cv @ SUCTION	1.29	1.29			
Cp/Cv @ DISCHARGE					
COMP. @ SUCTION, Z	1.0	1.0			
COMP. @ DISCHARGE, Z					
SUCTION PRESSURE, PSIA (1)	40.5	102.5			
SUCTION TEMPERATURE, °F	102	102			
DISCHARGE PRESSURE, PSIA (2)	104.5	207.0			
DISCHARGE TEMPERATURE, °F					
SCFM @ 14.7 PSIA & 60°F (DRY)	16,036	30,830			
INLET CFM (CORRECTED)					
BRAKE HORSEPOWER/STAGE					
TOTAL BHP INCL. GEAR LOSS					

(1) UPSTREAM FLANGE OF SUCTION DAMPER

(2) DOWNSTREAM FLANGE OF DISCHARGE DAMPER

GAS ANALYSIS

COMPOSITION	MOL. WGT.	MOL%	MOL%	MOL%	MOL%	MOL%
CO_2		87.5	90.2			
H_2S		8.8	5.9			
H_2O		2.4	1.0			
COS		1.1	0.9			
CH_4		0.2	0.5			
CO			0.9			
H_2			0.6			
NH_3			NEG.			
N_2			NEG.			

REMARKS:

BY WLP | P.O. NO. | SUPPLIER

FORM NO. 135-317

REQUISITION

FOSTER WHEELER ENERGY CORPORATION

CLIENT MLGW	CONTRACT NO. 15-2200	REQUISITION NO.				DATE	
SITE MEMPHIS, TENN.	ITEM NO. C-3502-A/B	2235-1322-A				6/28/79	
MATERIAL RECIPROCATING COMPRESSORS		C1		C4			
SERVICE H.P. RECYCLE	NO. REQ'D. TWO	C2		C5			
MFGR.	MODEL	C3		C6			

SPEED, RPM — RATED	MAX. ALLOWABLE	MIN. ALLOWABLE			
SERVICE					
STAGE	1	2			
NO. OF CYLINDERS/STAGE					
SINGLE/DOUBLE ACTING					
BORE, INCHES					
STROKE, INCHES					
RATED PISTON SPEED, FPM			(MAX 800 FPM)		
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

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

DISTANCE PIECE

- ☐ STANDARD
- ☒ EXTRA LONG SINGLE COMPARTMENT
- ☐ TWO COMPARTMENT

COMPRESSOR PACKING

- ☒ STANDARD FIBRONS OR TEFLON
- ☐ FULL FLOATING VENTED METALLIC
- ☒ FORCE FEED LUBRICATED
- ☐ NON LUBRICATED TYPE

LUBRICATION

FRAME AND RUNNING GEAR (1)

- ☐ SPLASH SYSTEM
- ☒ PRESSURE SYSTEM INCLUDING
  - ☐ SHAFT ☐ MOTOR DRIVEN OIL PUMP
  - ☐ HAND OPERATED OIL PUMP FOR STARTING
  - ☐ STEAM COIL
  - ☒ ELECT. HEATER WITH THERMOSTAT KW
  - ☒ AUX MOTOR DRIVEN ROTARY OIL PUMP

CYLINDERS AND ROD PACKING

DRIVEN BY ☒ COMPRESSOR SHAFT ☐ ELECTRIC MOTOR

- ☐ STEAM COIL
- ☐ ELECT. HEATER WITH THERMOSTAT KW
- ☐ NON LUBE DESIGN

REMARKS: (1) QUOTE AN EXTRA FOR DUAL FILTERS AND COOLERS

BY | P.O. NO. | SUPPLIER

FORM NO. 135-318

REQUISITION

FOSTER WHEELER ENERGY CORPORRTION

CLIENT MLGW	CONTRACT NO. 15-2200	REQUISITION NO.			DATE
SITE MEMPHIS, TENN.	ITEM NO. C-3502 A/B	2235-1322-A			6/28/79
MATERIAL RECIPROCATING COMPRESSORS		C1		C4	
SERVICE H.P. RECYCLE	NO. REQ'D. TWO	C2		C5	
MFGR.	MODEL	C3		C6	

ACCESSORIES

COMPRESSOR MFR SHALL FURNISH:

- [x] DRIVER AS DEFINED ON DRIVER DATA SHEET
- [x] PULSATION (DAMPERS) (VOLUME BOTTLES)
- [ ] ANALOG STUDY
- [ ] INTERSTAGE PIPING
- [ ] INTERCOOLERS
- [ ] MOISTURE SEPARATORS WITH TRAPS
- [ ] AFTERCOOLERS
- [ ] AIR INLET FILTER
- [ ] RECEIVER
- [ ] COOLING WATER PIPING FOR EACH CYLINDER
- [ ] PACKING AND PLUNGER COOLING OIL SYSTEM
- [ ]
- [ ]
- [ ]
- [ ]
- [ ]

COMPRESSOR CONTROL

START UP UNLOADING MANUAL ELECTRO-PNEUMATIC SUCTION VALVE UNLOADERS.

OPERATING CONTROL

ALARMS AND SHUTDOWNS

COMPR. MFR. SHALL FURNISH CONTACTS FOR:

	ALARM	SHUTDOWN
LOW LUBE OIL PRESSURE	☐	☒
LOW LUBRICATOR OIL LEVEL	☒	☐
HIGH ENGINE JKT WATER TEMP.	☐	☐
HIGH DISCH. GAS TEMP	☐	☒
HIGH VIBRATION	☐	☒
	☐	☐
	☐	☐

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

- [x] SHOP INSPECTION BY PURCHASER DURING FABRICATION
- [x] MANUFACTURER'S STANDARD SHOP TESTS
- [x] BARRING OVER TO CHECK CLEARANCES
- [ ] RUNNING TEST WITH SHOP DRIVER
- [x] HYDROSTATIC TEST FOR EACH CYLINDER
- [ ] HELIUM LEAK TEST
- [ ]
- [ ]
- [ ]
- [ ]

PURCHASER RESERVES RIGHT TO WITNESS ANY OR ALL SHOP TESTS AND SHALL HAVE ACCESS TO MFGR'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:

BY	P.O. NO.	SUPPLIER

FORM NO. 135-31

REQUISITION

FOSTER WHEELER ENERGY CORPORATION

CLIENT MLGW	CONTRACT NO. 15-2200	REQUISITION NO.			DATE
SITE MEMPHIS, TENN.	ITEM NO. C-3502-M/B	2235-1322-A			6/28/79
MATERIAL RECIPROCATING COMPRESSORS		C1		C4	
SERVICE H.P. RECYCLE	NO. REQ'D. TWO	C2		C5	
MFGR.	MODEL	C3		C6	

UTILITY DATA

ELECTRICAL

AREA CLASSIFICATION: CL I, GR. B, DIV 2

MOTORS: 6500 HP & OVER 13,800 VOLTS 3 PH. 60 CYC.

200 TO 6000 HP 4000 VOLTS 3 PH. 60 CYC.

150 HP & LESS 460 VOLTS 3 PH. 60 CYC.

AUX. MOTOR ENCLOSURE:

INSULATION TYPE: TEMP. RISE:

ALARM SWITCHES: ☒ AC ☐ DC VOLTS 110 PH. 1 CYC. 60

TRIP SWITCHES: ☒ AC ☐ DC VOLTS 110 PH. 1 CYC 60

SWITCH ENCLOSURE EXPLOSION PROOF

ELECT. HEATERS: VOLTS PH. CYC.

COOLING WATER

SUPPLY: PRESSURE 75 PSIG TEMP. 88 °F

RETURN: PRESSURE 60 PSIG TEMP. 118 °F, MAX.

SOURCE COOLING TOWER FOULING FACTOR .001

STEAM

	MAX.	NORM.	MIN.
INLET PRESS., PSIG			
INLET TEMP. °F			
EXH PRESS.			

LOW PRESS STEAM AVAIL @ PSIG °F

FUEL GAS

SEE ENGINE DATA SHEET FOR GAS ANALYSIS

AVAIL. PRESSURE PSIG @ °F

HEATING VALVE, BTU/CU.FT. LHV HHV

INSTRUMENT AIR SUPPLY PSIG

UTILITY SUMMARY

ELECTRIC	HP	LOCKED ROTOR AMPS	FULL LOAD AMPS
MAIN DRIVER			
MAIN LUBE OIL PUMP			
M-G SET			
MECH. LUBRICATOR			
STARTING AIR COMPR.			
LUBRICATOR HEATER	WATTS		
FRAME HEATER	WATTS		

STEAM

MAIN DRIVER #/HR.

LUBE DRIVER #/HR.

FUEL GAS

	100	75
RATED RPM %		
BTU/HP/HR		
TOTAL BTU/HR		

COOLING WATER

	GPM	INLET °F	OUTLET °F	ΔP
COMPR. CYLINDERS				
LUBE OIL COOLER				
TURB. CHG. COOLER				
ENGINE JACKETS				
ENG. JKT. COOLER				

REMARKS:

BY	P.O. NO.	SUPPLIER

FORM NO. 135-320

ORM 135-50

FOSTER WHEELER CORPORATION — SPECIAL ELECTRICAL MOTORS — PAGE 6 OF 6

REQUISITION NUMBER	DATE
2235-132-B	6/2/79

F.W.C. CONTRACT 15-2200

SUPERSEDED BY CHANGE NO:

C1	C3	C5
C2	C4	C6

FOR: MLGW

SITE: MEMPHIS, TENN.

MANUFACTURER:

APPLICABLE DOCUMENTS:

MOTOR SPECIFICATION: SEE PAGE 1

PREP. FOR SHIPMENT:

GENERAL NOTES:

SITE DATA:

ALTITUDE 263 FT. BAROMETER 14.7

AMBIENT 100 °F. MAX. TO 17 °F. MIN.

ATMOSPHERE:

INSTALLED ☐ INDOOR ☒ OUTDOOR ☐

AREA ☒ CL. 1 -GR. B -DIV. 2. ☐ NON-HAZARDOUS.

ITEM NUMBERS	C-3502 A/B
TOTAL QUANTITY	TWO
DRIVEN EQUIPMENT	RECIP. COMPRESSOR
TYPE (IND., SYNCH., ETC.)	SYNCH
HP NAMEPLATE RATING	
SERVICE FACTOR	
RPM AT FULL LOAD/NO. POLES	/
VOLTS/PHASES/HERTZ	4000 / 3 / 60 / /
ENCLOSURE	NEMA WP II
°C. RISE AT FULL S.F. LOAD	
TEMP. MEASUREMENT METHOD	
INSULATION CLASS	B
INSUL. SPECIAL TREATMENT	
SPECIAL HARDWARE	
FRAME NUMBER	
MOUNTING ASSEMBLY NUMBER	
ROTATE FROM END OPP. CPLG.	
BEARINGS TYPE	SLEEVE
LUBRICATION	FORCE FEED
END FLOAT (IF APPL.) INS.	
N.E.M.A. DESIGN LETTER	
AMPS.: F.L./LOCKED ROTOR	/
LOCKED ROTOR LIMIT, SECS.	
LB-FT² LOAD AT MOTOR SHAFT	
SECONDS TO ACCEL. ON ___ %V.	
NO. ALLOW. STARTS COLD/HOT	/
% EFFIC. 100%/75%/50% LOAD	/ /
% P.F. 100%/75%/50% LOAD	/ /
%T. @ F.V. ST/MIN/BREAKDN	/ /
EXCITATION: TYPE	
FURNISHED BY	
ELECT. SUPPLY, REQ'D.	

ITEM NUMBERS ACCESSORIES:		
BASE	BY COMP.	VENDOR
STATOR SHIFT	—	
SPACE HEATERS: WATTS		
V/PH/HZ	/ /	/ /
TEMP. DETECT.: NUMBER	6	
TYPE	RTD	
AIR FILTERS: TYPE		
ARRANGE FOR FUTURE FILTERS		
MOUNT COUPLING HALF	YES	
EXTENDED LEADS, INCHES		
ENCLOSED COLLECTOR RINGS		
REQ'D. PURGE CFM		
C.T. FOR AMMETER BY	VENDOR	
MOUNTED BY	VENDOR	
C.T. FOR DIFF. PROTECT. BY	VENDOR	
MOUNTED BY	VENDOR	
NUMBER REQ'D.		
TYPE		
SURGE PROTECTION BY	VENDOR	
MOUNTED BY	VENDOR	
LIGHTNING ARRESTORS BY	VENDOR	
MOUNTED BY	VENDOR	
AMMETER FURNISHED BY	PURCHASER	
MOUNTED BY		
LOCATION		
TYPE		

TESTS: (W = WITNESSED)	
N.E.M.A. STD. COMMERCIAL	(W)
FULL PERFORMANCE	
SHAFT VIBRATION	(W)
TEST CERTIFICATES REQ'D.	YES

WEIGHTS: (LBS)		
NET/GROSS	/	/
MAX. ERECTION		
MAX. NORMAL MAINTENANCE		

REQUISITION

FOSTER WHEELER ENERGY CORPORATION

CLIENT Memphis Light, Gas & Water Div	CONTRACT NO. 15-2200	REQUISITION NO.			DATE
SITE Memphis, Tennessee	ITEM NO. C-3503 A/B	2235-1323-A			22 June 79
MATERIAL L. P. Recycle Gas Compressor		C1		C4	
OR		C2		C5	
SERVICE		C3		C6	

I. SCOPE OF SUPPLY

Vendor shall furnish two (2) lube type reciprocating compressors, each direct driven by induction motor, each compressor unit shall have a complete lube oil system for compressor frame, local control panel, instrumentation and all necessary accessories.

The equipment shall be furnished in accordance with the attached data sheets, standards and specifications listed below.

II. APPLICABLE STANDARDS AND SPECIFICATIONS

2200-32A2 Reciprocating Compressors
2200-38A7 Medium Voltage Induction Motors
2200-38A6 Low Voltage Induction Motors
2200-1300A General Notes Requisition

III. DESCRIPTION OF SERVICE

The compressors will be installed outside, unprotected. One unit will operate continuously, the second unit will operate when process load exceeds one compressor capacity. Due to 20 year payout period and energy cost of $.02/KWH the compressor efficiency must be high.

IV. VENDOR DATA REQUIREMENTS

A. Model and type of compressor

B. Performance data

C. Typical outline dimensions and weight

D. Price and delivery

V. ALTERNATE COMPRESSOR DESIGN

Vendor may also quote on a rotary sliding vane compressor. A by-pass will be provided by purchaser for compressor capacity control.

FORM NO. 135-901

BY SJ	P.O. NO.	SUPPLIER

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

RECIPROCATING COMPRESSOR DATA SHEET
MATERIAL REQUISITION PAGE 2 OF 6

FOR M L G W	F.W. REF. 15-2200
SITE MEMPHIS, TENN.	
SERVICE L.P. RECYCLE GAS COMPRESSOR	ITEM NO. C-3503 A/B
MANUFACTURER	
SIZE AND TYPE	NO. REQ'D. 2
DRIVER ☒ MOTOR ☐ GAS ENGINE ☐	
GENERAL NOTES REQUISITION 1300-A IS AN INTEGRAL PART OF THIS REQUISITION.	

REQUISITION NO.	DATE
2235-1323-A	22 June 79

SUPERSEDED BY

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

APPLICABLE SPECIFICATIONS

RECIPROCATING COMPRESSORS AND ATTENDANT EQUIPMENT COVERED IN THIS REQUISITION SHALL BE FURNISHED IN ACCORDANCE WITH THE FOLLOWING SPECIFICATIONS: SEE PAGE 1

INSTALLATION DATA

COMPRESSOR UNIT WILL BE INSTALLED IN AN:

☒ OUTDOOR UNPROTECTED LOCATION

☐ ENCLOSED BUILDING

☐

BAROMETER 14.7 PSIA ALTITUDE 263 FT.

AMBIENT TEMPERATURES: 100 °F MAX. 17 °F MIN.

CONDITIONS OF SERVICE (EACH MACHINE)

SERVICE	DESIGN				
STAGE					
GAS COMPRESSED	L.P. RECYCLE				
RELATIVE HUMIDITY					
MOL. WEIGHT	31.49				
Cp/Cv @ SUCTION	1.29				
Cp/Cv @ DISCHARGE					
COMP. @ SUCTION, Z	1.0				
COMP. @ DISCHARGE, Z					
SUCTION PRESSURE, PSIA	25.5				
SUCTION TEMPERATURE, °F	240				
DISCHARGE PRESSURE, PSIA	44.5				
DISCHARGE TEMPERATURE, °F MAX 360					
MASS FLOW, LB/HR	16187				
INLET CFM (CORRECTED)	2522				
BRAKE HORSEPOWER/STAGE					
TOTAL BHP INCL. GEAR LOSS					

GAS ANALYSIS

COMPOSITION	MOL. WGT.	MOL%	MOL%	MOL%	MOL%	MOL%
H_2O		48.2				
CO_2		44.8				
H_2S		6.0				
COS		0.6				
CH_4						
CO						
NH_3		0.4				
SELEXOL						
H_2						

REMARKS:

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

RECIPROCATING COMPRESSOR DATA SHEET
MATERIAL REQUISITION PAGE 3 OF 6

FOR M L G W F.W. REF. 15-2200
SITE MEMPHIS, TENN.
SERVICE L.P. RECYCLE GAS COMPRESSOR ITEM NO. C-3503 A/B
MANUFACTURER
SIZE AND TYPE NO. REQ'D. 2
DRIVER ☐ MOTOR ☐ GAS ENGINE ☐
GENERAL NOTES REQUISITION 1300-A IS AN INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO.	DATE
2235-1323-A	22 June 79

SUPERSEDED BY

CHG.		CHG.	
C1		C4	
C2		C5	
C3		C6	

SPEED, RPM	RATED	MAX. ALLOWABLE		MIN. ALLOWABLE	
SERVICE	DESIGN				
STAGE					
NO. OF CYLINDERS/STAGE					
SINGLE/DOUBLE ACTING					
BORE, INCHES					
STROKE, INCHES					
RATED PISTON SPEED, FPM (MAX. 800)					
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

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

DISTANCE PIECE

☐ STANDARD
☒ EXTRA LONG SINGLE COMPARTMENT
☐ TWO COMPARTMENT

COMPRESSOR PACKING

☒ STANDARD FIBRONS OR TEFLON
☐ FULL FLOATING VENTED METALLIC
☒ FORCE FEED LUBRICATED
☐ NON LUBRICATED TYPE

LUBRICATION

FRAME AND RUNNING GEAR 1)
☐ SPLASH SYSTEM
☒ PRESSURE SYSTEM INCLUDING
☐ SHAFT ☐ MOTOR DRIVEN OIL PUMP
☐ HAND OPERATED OIL PUMP FOR STARTING
☐ STEAM COIL
☒ ELECT. HEATER WITH THERMOSTAT KW
AUXILIARY MOTOR DRIVEN ROTARY OIL PUMP

CYLINDERS AND ROD PACKING
DRIVEN BY ☒ COMPRESSOR SHAFT
☐ ELECTRIC MOTOR
☐ STEAM COIL
☐ ELECT. HEATER WITH THERMOSTAT KW
☐ NON LUBE DESIGN

REMARKS: 1) QUOTE AN EXTRA FOR DUAL FILTERS AND COOLERS

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

RECIPROCATING COMPRESSOR DATA SHEET

MATERIAL REQUISITION PAGE 4 OF 6

FOR M L G W F.W. REF. 15-2200
SITE MEMPHIS, TENN.
SERVICE L.P. RECYCLE GAS COMPRESSOR ITEM NO. C-3503 A/B
MANUFACTURER
SIZE AND TYPE NO. REQ'D. 2
DRIVER ☐ MOTOR ☐ GAS ENGINE ☐
GENERAL NOTES REQUISITION 1300-A IS AN INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO.	DATE
2235-1323-A	22 June 79

SUPERSEDED BY

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

ACCESSORIES

COMPRESSOR MFR SHALL FURNISH:

- ☒ DRIVER AS DEFINED ON DRIVER DATA SHEET
- ☒ PULSATION (DAMPERS) (VOLUME BOTTLES)
- ☐ ANALOG STUDY
- ☐ INTERSTAGE PIPING
- ☐ INTERCOOLERS
- ☐ MOISTURE SEPARATORS WITH TRAPS
- ☐ AFTERCOOLERS
- ☐ AIR INLET FILTER
- ☐ RECEIVER
- ☐ COOLING WATER PIPING FOR EACH CYLINDER
- ☐ PACKING AND PLUNGER COOLING OIL SYSTEM
- ☐
- ☐
- ☐
- ☐
- ☐

COMPRESSOR CONTROL

START UP UNLOADING MANUAL ELECTRO-PNEUMATIC INLET VALVE UNLOADERS.

OPERATING CONTROL MANUAL ELETRO-PNEUMATIC INLET VALVE UNLOADERS FOR 0, 25, 50, 75 AND 100% OF DESIGN CAPACITY.

ALARMS AND SHUTDOWNS

COMPR. MFR. SHALL FURNISH CONTACTS FOR:

	ALARM	SHUTDOWN
LOW LUBE OIL PRESSURE	☐	☒
LOW LUBRICATOR OIL LEVEL	☐	☐
HIGH ENGINE JKT WATER TEMP.	☐	☒
HIGH DISCH. GAS TEMP	☐	☒
HIGH VIBRATION	☐	☒
LOW OIL PRESSURE	☐	☒
	☐	☐

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 MFGR'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:

JRM 135-50

FOSTER WHEELER CORPORATION — SPECIAL ELECTRICAL MOTORS —

REQUISITION NUMBER	DATE
2235-1323-A	22 JUNE 79

F.W.C. CONTRACT 15-2255

FOR: M L G W — ITEM: C-3503 A/B

SUPERSEDED BY CHANGE NO:

C1		C3		C5	
C2		C4		C6	

SITE: MEMPHIS, TENN.

MANUFACTURER:

APPLICABLE DOCUMENTS:

MOTOR SPECIFICATION

PREP. FOR SHIPMENT

GENERAL NOTES

SITE DATA:

ALTITUDE 263 FT. BAROMETER 14.7 PSIA

AMBIENT 100 °F. MAX. TO 17 °F. MIN.

ATMOSPHERE

INSTALLED ☐ INDOOR ☒ OUTDOOR ☐

AREA ☒ CL. 1 -GR. B&D -DIV. 2. ☐ NON-HAZARDOUS.

ITEM NUMBERS	C-3503	
TOTAL QUANTITY		
DRIVEN EQUIPMENT		
TYPE (IND., SYNCH., ETC.)	IND.	
HP NAMEPLATE RATING		
SERVICE FACTOR		
RPM AT FULL LOAD/NO. POLES	/	/
VOLTS/PHASES/HERTZ	4000/3/60	/ /
ENCLOSURE	WP II	
°C. RISE AT FULL S.F. LOAD		
TEMP. MEASUREMENT METHOD		
INSULATION CLASS	B	
INSUL. SPECIAL TREATMENT		
SPECIAL HARDWARE		
FRAME NUMBER		
MOUNTING ASSEMBLY NUMBER		
ROTATE FROM END OPP. CPLG.		
BEARINGS TYPE	SLEEVE	
LUBRICATION	OIL	
END FLOAT (IF APPL.) INS.		
N.E.M.A. DESIGN LETTER		
AMPS.: F.L./LOCKED ROTOR	/	/
LOCKED ROTOR LIMIT, SECS.		
LB-FT^2 LOAD AT MOTOR SHAFT		
SECONDS TO ACCEL. ON ___ %V.		
NO. ALLOW. STARTS COLD/HOT	/	/
% EFFIC. 100%/75%/50% LOAD	/ /	
% P.F. 100%/75%/50% LOAD	/ /	
%T. @ F.V. ST/MIN/BREAKDN	/ /	
EXCITATION: TYPE		
FURNISHED BY		
ELECT. SUPPLY, REQ'D.		

ITEM NUMBERS		
ACCESSORIES:		
BASE	VENDOR	
STATOR SHIFT		
SPACE HEATERS: WATTS		
V/PH/HZ	/ /	/ /
TEMP. DETECT.: NUMBER	6	
TYPE	RTD	
AIR FILTERS: TYPE		
ARRANGE FOR FUTURE FILTERS		
MOUNT COUPLING HALF	YES	
EXTENDED LEADS, INCHES		
ENCLOSED COLLECTOR RINGS		
REQ'D. PURGE CFM		
C.T. FOR AMMETER BY	VENDOR	
MOUNTED BY	VENDOR	
C.T. FOR DIFF. PROTECT. BY	VENDOR	
MOUNTED BY	VENDOR	
NUMBER REQ'D.		
TYPE		
SURGE PROTECTION BY	VENDOR	
MOUNTED BY	VENDOR	
LIGHTNING ARRESTORS BY	VENDOR	
MOUNTED BY	VENDOR	
AMMETER FURNISHED BY	PURCHASER	
MOUNTED BY		
LOCATION		
TYPE		
TESTS: (W = WITNESSED)		
N.E.M.A. STD. COMMERCIAL		
FULL PERFORMANCE		
TEST CERTIFICATES REQ'D.	YES	
WEIGHTS: (LBS)		
NET/GROSS	/	/
MAX. ERECTION		
MAX. NORMAL MAINTENANCE		

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

RECIPROCATING COMPRESSOR DATA SHEET

MATERIAL REQUISITION PAGE 6 OF 6

FOR MLGW F.W. REF. 15-2200
SITE MEMPHIS, TENN.
SERVICE L.P. RECYCLE GAS COMPRESSOR ITEM NO. C-3503
MANUFACTURER
SIZE AND TYPE NO. REQ'D. 2
DRIVER ☐ MOTOR ☐ GAS ENGINE ☐
GENERAL NOTES REQUISITION IS AN INTEGRAL PART OF THIS REQUISITION.

REQUISITION NO.	DATE
2235-1323-A	22 June 79

SUPERSEDED BY

CHG.		CHG.	
C1		C4	
C2		C5	
C3		C6	

UTILITY DATA

ELECTRICAL
AREA CLASSIFICATION: CL. I, GR. B & D, DIV. 2
MOTORS: 6500 HP & OVER 13800 VOLTS 3 PH. 60 CYC.
200 TO 6000 HP 4000 VOLTS 3 PH. 60 CYC.
150 HP & LESS 460 VOLTS 3 PH. 60 CYC.
AUX. MOTOR ENCLOSURE:
INSULATION TYPE: TEMP. RISE:
ALARM SWITCHES: ☒ AC ☐ DC 120 VOLTS 1 PH. 60 CYC.
TRIP SWITCHES: ☒ AC ☐ DC 120 VOLTS 1 PH. 60 CYC.
SWITCH ENCLOSURE EXPLOSION PROOF
ELECT. HEATERS: VOLTS PH. CYC.

COOLING WATER
SUPPLY: PRESSURE 75 PSIG TEMP. 88 °F
RETURN: PRESSURE 60 PSIG TEMP. 118 °F, MAX.
SOURCE COOLING TOWER FOULING FACTOR .001

STEAM

	MAX.	NORM.	MIN.
INLET PRESS., PSIG			
INLET TEMP. °F			
EXH PRESS.			

LOW PRESS STEAM AVAIL @ PSIG °F

FUEL GAS
SEE ENGINE DATA SHEET FOR GAS ANALYSIS
AVAIL. PRESSURE PSIG @ °F
HEATING VALVE, BTU/CU. FT. LHV HHV

INSTRUMENT AIR SUPPLY PSIG

UTILITY SUMMARY

ELECTRIC

	HP	LOCKED ROTOR AMPS	FULL LOAD AMPS
MAIN DRIVER			
MAIN LUBE OIL PUMP			
M-G SET			
MECH. LUBRICATOR			
STARTING AIR COMPR.			
LUBRICATOR HEATER		WATTS	
FRAME HEATER		WATTS	

STEAM
MAIN DRIVER #/HR.
LUBE DRIVER #/HR.

FUEL GAS

	100	75	
RATED RPM %			
BTU/HP/HR			
TOTAL BTU/HR			

COOLING WATER

	GPM	INLET °F	OUTLET °F	AP PSI
COMPR. CYLINDERS				
LUBE OIL COOLER				
TURB. CHG. COOLER				
ENGINE JACKETS				
ENG. JKT. COOLER				

REMARKS:

REQUISITION

FOSTER WHEELER ENERGY CORPORATION

PAGE OF

CLIENT MEMPHIS LIGHT, GAS & WATER DIV.	CONTRACT NO. 15-2200	REQUISITION NO. 2235-1311-A / DATE 6/4/79
SITE MEMPHIS, TENN.	ITEM NO. P-3501 A/B	
MATERIAL CENTRIFUGAL PUMP	NO. REQ'D. TWO (2)	C1 C4 C2 C5 C3 C6
SERVICE SOUR CONDENSATE		
MFR.	MODEL / SIZE	

1	OPERATING CONDITIONS, EACH PUMP			PERFORMANCE	
2	LIQUID SOUR CONDENSATE	U. S. GPM RATED	600	PROPOSAL CURVE NO.	
3	PUMPING TEMP DEG F 110	U. S. GPM NORMAL	542	SPEED RPM	NO. STAGES
4	MAX. P T, DEG F 110	MAX SUCTION PSIG	81.8	NPSHR, FT (H_2O)	MIN CONT. GPM
5	S. G. AT P T 0.98	DISCH. PRESS. PSIG	95	SHUTOFF HD. FT	% EFF. @ RATED GPM
6	VAP. PRESS., PSIA @ P T 1.3	SUCT. PRESS., PSIG	52.2	BHP @ RATED GPM	MAX BHP
7	VISC. @ PT, CP	DIFF. PRESS., PSI	42.8	IMPELLER DIA. IN	RATED / MAX / MIN
8	CORR./ EROS. FROM SAT.	DIFF. HEAD, FT	100.9	MAX. ALLOW. CASING PSIG/DEG F	/
9	W/ H_2S, NH_3	NPSH AVAIL, FT	25	HYDROSTATIC TEST PRESS. PSIG	
10	PCT & SIZE SOLIDS	(MEAS. TO ☒ ℄ PUMP ☐ ℄ SUCT.FLG		MAX POSSIBLE DISCH. PRESS. PSIG	
11	CONSTRUCTION			ROTATION FACING COUPLING ☐ CW ☐ CCW	
12	CASING SPLIT	☐ AXIAL ☒ RADIAL		CONNECTIONS	SUCTION / DISCHARGE
13	CASING VOLUTE	☒ SINGLE ☐ DOUBLE ☐ DIFFUSER		SIZE, INCHES	
14	CASING SUPPORT	☒ FOOT ☐ CENTERLINE		RATING/FACING	
15		☒ BRACKET ☐ VERTICAL IN-LINE		LOCATION	
16	CASING CONNS. ☒ VENT	☒ DRAIN(1) ☐ GAUGE ☐		DRIVER	
17	IMPELLER TYPE CLOSED			FURNISHED BY	☒ PUMP MFR ☐ OTHERS
18	IMPELLER MTG. ☐ BETWEEN BRGS	☒ OVERHUNG		MOUNTED BY	☒ PUMP MFR ☐ OTHERS
19	WEAR RINGS ☒ CASING	☒ IMPELLER ☐ INLET ☐ BACK		☒ MOTOR: ITEM NO.	TYPE INDUCTION
20	BEARINGS-TYPE: RADIAL BALL	THRUST BALL		HP / RPM / FRAME NO.	
21	BEARINGS-LUBE: ☒ RING	☐ FLOOD ☐ FLINGER		ENCL. / INSUL. / S. F.	
22		☐ OIL MIST ☐ PRESSURE LUBE		MFR V 460 PH 3 HZ 60	
23	COUPLING: MFR THOMAS	TYPE SS. DISC GUARD TYPE		FLA / LRA / LUBE	
24	DRIVER HALF MTD BY ☒ PUMP MFR	☐ DRIVER MFR ☐ OTHERS		THRUST (VERT) LB / UP / DOWN	
25	SHAFT SEAL TYPE ☐ PACKING	☐ MECHANICAL		☐ TURBINE: ITEM NO.	MFR.
26	PACKING MFR, TYPE	SIZE / NO. RINGS		REFER TO PAGE , ATTACHED	
27	SEAL MFR, MODEL J. CRANE	TYPE 9B		TESTS	REQUIRED / WITNESSED / CERTIFIED
28	MFR, CODE QF-101	API CODE BSTGL		SHOP INSPECT	☒
29	BASEPLATE ☒ EXTENDED FOR DRIVER	☒ DRAIN RIM		PERFORMANCE	☒ / ☐ / ☒
30				NPSHR	☐ / ☐ / ☐
31	WATER COOLING & SEAL FLUSH PIPING			HYDROTEST	☒ / ☐ / ☒
32	WATER COOLED ☐	BEARINGS ☐ STUFFING BOX JACKET			☐ / ☐ / ☐
33		☐ GLAND ☐ PEDESTALS		MATERIALS -API CLASS-	
34	C. W., PLAN , WITH ☐ CS	☐ SS ☐ TUBING ☐ PIPE		CASING C. STEEL	IMPELLER 316 S.S.
35	TOTAL COOLING WATER REQUIRED, GPM			SHAFT 17-4 PH	SLEEVE 316 S.S.
36	SEAL FLUSH, PLAN 11, WITH ☒ CS	☐ SS ☒ TUBING ☐ PIPE		WEAR RINGS *	GLAND
37	EXT. FLUSH, LIQUID @	DEG F GPM PSIG		HARDFACED 316 S.S.	
38	AUX. SEAL PLAN 61 C.S. PIPE PLUG			BASEPLATE FAB. STEEL	
39	ACCESSORIES FURNISHED BY PUMP MFR			WEIGHTS, LBS EACH	
40	☒ SEAL FLUSH PIPING	☐ STEAM JACKETING		PUMP	BASEPLATE
41	☐ COOLING WATER PIPING	☐		MOTOR	TURBINE
42	☐ OIL PIPING	☐		SITE & UTILITIES	
43	☐ MINIMUM FLOW ORIFICE	☐		☐ INDOORS	☒ OUTDOORS
44	NOTES: (1) THREADED & PLUGGED			AMBIENT 98	DEG F MAX TO 17 DEG F MIN
45				CL I GR B	DIV 2 ☐ NON-HAZARDOUS
46				ALT. FT 100	COOLING WATER SOURCE
47				DEG F: IN,	OUT: PSIG IN, OUT
48					
49				DOCUMENTS	
50				☒ 2200-1300A	☒ 2200-38A6
51				☒ 2200-31A3	☐

BY G. J. B. | P. O. NO. | VENDOR

FORM NO. 135-302

6.0 INSTRUMENT DATA

This section includes a tabulation of main control instrument data for this unit and an index of process fluid types.

FOSTER WHEELER ENERGY CORPORATION
INSTRUMENT PROCESS DATA

SECTION 350

Rev. 1 Oct. 8, 1979 RC

JOB NO. 15-2203
PAGE 1 OF 4
REVISION 0
DATE Aug. 7, 1979
PREPARED BY R. Chan

ENG. FLOWSHEET NO. 2203-1-50-35001

(1) ITEM NUMBER OR SERVICE	(2) NOM LINE SIZE	(3) FLUID TYPE AND STATE	(4) NORMAL #/HR.	FLOW # (5) MAX.	(6) MIN.	SP.GR.AT (7) 60°F	(8) COND.	(9) MOL. WT.	(10) VISC. CPS. TEMP.	(11) LIQ. VAPOR PRESS. PSIA	(12) LIQ. CRITICAL PRESS. PSIA	(13) VAPOR COMP. FACTOR	(14) VAPOR Cp/Cv	(15) NORM. OP TEMP. °F	PRESSURES AT NORM.FLOW (16a) UPSTREAM PSIA	(17a) DOWNSTREAM PSIA	PRESSURES AT MAX. FLOW (16b) UPSTREAM PSIA	(17b) DOWNSTREAM PSIA	PRESSURES AT MIN.FLOW (16c) UPSTREAM PSIA	(17c) DOWNSTREAM PSIA	(18) DOWNSTREAM FLASHING	(19) TIGHT SHUTOFF	(20) AIR FAILURE	(21) REMARKS AND/OR ALARM AND SHUTDOWN SETTINGS	(22) REVISION
Temperature Instruments																									
TT, TIC 026	36"	11, V												133											0
TCV 026																								For 16 Bays of Air Finned Cooler	0
TY 026																									0
Flow Instruments																									
FT, FIC, FR 035	30"	11, V	447362	120	75			20.64	0.017			0.995	1.36	110	64										0
FSL, FAL 035	30"	11, V	447362	120	75			20.64	0.017			0.995	1.36	110	64									Set Point determined by C-3501 Vendor	0
FCV 035	18"	11, V	447362	120	75			20.64	0.017			0.995	1.36	110	202.7	74					NO	YES	FOL	To be Reviewed Upon Final Design of C-3501	1
Pressure Instruments																									
PT 027	24"	11, V												217	207										1
PAL, PSL 027	24"	11, V												217	207									Set @ 200 PSIA	1

FORM NO. 1110)-250

INSTRUMENT PROCESS DATA

SECTION 350

PAGE ____ of ____

REVISION 0

DATE Aug. 7, 1979

PREPARED BY R. Chan

ENG. FLOWSHEET NO. 2203-1-50-35001

(1) ITEM NUMBER OR SERVICE	(2) NOM LINE SIZE	(3) FLUID TYPE AND STATE	(4) NORMAL #/HR.	FLOW # (5) MAX.	FLOW # (6) MIN.	SP.GR.AT (7) 60°F	SP.GR.AT (8) COND.	(9) MOL. WT.	(10) VISC. CPS. TEMP.	(11) LIQ. VAPOR PRESS. PSIA	(12) LIQ. CRITICAL PRESS. PSIA	(13) VAPOR COMP. FACTOR	(14) VAPOR Cp/Cv	(15) NORM. OP TEMP. °F	PRESSURES AT NORM.FLOW (16a) UPSTREAM PSIA	PRESSURES AT NORM.FLOW (17a) DOWNSTREAM PSIA	PRESSURES AT MAX FLOW (16b) UPSTREAM PSIA	PRESSURES AT MAX FLOW (17b) DOWNSTREAM PSIA	PRESSURES AT MIN.FLOW (16c) UPSTREAM PSIA	PRESSURES AT MIN.FLOW (17c) DOWNSTREAM PSIA	(18) DOWNSTREAM FLASHING	(19) TIGHT SHUTOFF	(20) AIR FAILURE	(21) REMARKS AND/OR ALARM AND SHUTDOWN SETTINGS	(22) REVISION
Level Instruments																									
LT, LIC 021		1.3 Sour Water				1.0	1.0							110	64										0
LSL, LAL 021		1.3 Sour Water				1.0	1.0							110	64									Set @ 20%	0
LSH, LAH 021		1.3 Sour Water				1.0	1.0							110	64									Set @ 80%	0
LCV 021	6"	1.3 Sour Water	77009	120	20	1.0	1.0							110	110	75				NO	YES	FC	Use H2O Physical Properties		1
LT, LIC 031		1.3 Sour Water				1.0	1.0							110	201										0
LAL, LSL 031		1.3 Sour Water				1.0	1.0							110	201									Set @ 20%	0
LAH, LSH 031		1.3 Sour Water				1.0	1.0							110	201									Set @ 80%	0
LCV 031	1½"	1.3 Sour Water	1462	120	20	1.0	1.0							110	201	75				NO	YES	FC	Use H2O Physical Properties		1
LY 031																									
LSHH, LAHH 033		1.3 Sour Water				1.0	1.0							110	64									Set @ 100% (To be confirmed by C-3501 Vendor)	0
LT, LIC } Compressor		1.3 Sour Water																							1
LAL, LSL } Intercooler		"																							1
LAH, LSH } K.O. Drum		"																							1
LCV	1½"	"	4176	120	20	1.0	1.0							110	127	75				NO	YES	FC	Use H2O Physical Properties		1

FORM NO. 1110)-25B

FOSTER WHEELER ENERGY CORPORATION

INSTRUMENT PROCESS DATA

SECTION 350

JOB NO. 15-2203
PAGE 3 OF 4
REVISION 1
DATE Oct. 8, 1979
PREPARED BY R. Chan

ENG. FLOWSHEET NO. 2203-1-50-35002

(1) ITEM NUMBER OR SERVICE	(2) NOM LINE SIZE	(3) FLUID TYPE AND STATE	(4) NORMAL #/HR.	FLOW # (5) MAX.	(6) MIN.	SP.GR.AT (7) 60°F	(8) COND.	(9) MOL. WT.	(10) VISC. CPS. TEMP.	(11) LIQ. VAPOR PRESS. PSIA	(12) LIQ. CRITICAL PRESS. PSIA	(13) VAPOR COMP. FACTOR	(14) VAPOR Cp/Cv	(15) NORM. OP TEMP. °F	PRESSURES AT NORM.FLOW (16a) UPSTREAM PSIA	(17a) DOWNSTREAM PSIA	PRESSURES AT MAX FLOW (16b) UPSTREAM PSIA	(17b) DOWNSTREAM PSIA	PRESSURES AT MIN.FLOW (16c) UPSTREAM PSIA	(17c) DOWNSTREAM PSIA	(18) DOWNSTREAM FLASHING	(19) TIGHT SHUTOFF	(20) AIR FAILURE	(21) REMARKS AND/OR ALARM AND SHUTDOWN SETTINGS	(22) REVISION
Flow Instruments																									
Pressure Instruments																									
PT, PIC 101	6"	9, 11												102	102.5										1
PSL, PAL 101														102	102.5									Set @ 92.5 PSIA	1
PSH, PAH 101														102	102.5									Set @ 112.5 PSIA	1
PCV 101	6"	9, 11	51882	120	20	42.79	0.018					1.0	1.27	211	207	104					NO	YES	FOL		1
PSL, PAL 102	12"	9, 11												211	207										1
PT, PIC 125	18"	9, 11												102	40.5										1
PSH, PAH 125														102	40.5									Set @ 44.5 PSIA	1
PSL, PAL 125														102	40.5									Set @ 36.5 PSIA	1
PCV 125	6"	9, 11	27050	120	20	42.64	0.016					1.0	1.27	102	102.5	40.5					NO	YES	FOL		1

FORM NO. (110)-25B

FOSTER WHEELER ENERGY CORPORATION

INSTRUMENT PROCESS DATA

SECTION 350

JOB NO. 15-2203
PAGE 4 OF 4
REVISION 1
DATE Oct. 8, 1979
PREPARED BY R. Chan

ENG. FLOWSHEET NO. 2203-1-50-35003

(1) ITEM NUMBER OR SERVICE	(2) NOM LINE SIZE	(3) FLUID TYPE AND STATE	(4) NORMAL #/HR.	FLOW # (5) MAX.	(6) MIN.	SP.GR.AT (7) 60°F	(8) COND.	(9) MOL. WT.	(10) VISC. CPS. TEMP.	(11) LIQ. VAPOR PRESS. PSIA	(12) LIQ. CRITICAL PRESS. PSIA	(13) VAPOR COMP. FACTOR	(14) VAPOR Cp/Cv	(15) NORM. OP TEMP. °F	PRESSURES AT NORM.FLOW (16a) UPSTREAM PSIA	(17a) DOWNSTREAM PSIA	PRESSURES AT MAX FLOW (16b) UPSTREAM PSIA	(17b) DOWNSTREAM PSIA	PRESSURES AT MIN.FLOW (16c) UPSTREAM PSIA	(17c) DOWNSTREAM PSIA	(18) DOWNSTREAM FLASHING	(19) TIGHT SHUTOFF	(20) AIR FAILURE	(21) REMARKS AND/OR ALARM AND SHUTDOWN SETTINGS	(22) REVISION
Pressure Instruments																									
PT, PIC 223	8"	9, 11												240	25.5										1
PSL, PAL 223														240	25.5									Set @ 23 PSIA	1
PSH, PAH 223														240	25.5									Set @ 28 PSIA	1
PCV 223	6"	9, 11	16187	120	20			31.49	0.016			1.0	1.29	102	40.5	25.5					NO	YES	FOL		1
PSL, PAL 206	8"	9, 11												360	44.5									Set @ 40 PSIA	1
PSL, PAL 216	8"	9, 11												360	44.5									Set @ 40 PSIA	1

FORM NO. 1110I-25B

LISTING OF PROCESS FLUID TYPES

Type Fluid	Fluid Definition or Property
1	Water and water solution having a freezing point of approximately 32°F.
2	Water which could accumulate in lead lines due to gravity separation (not because of steam out operations).
3	Corrosion liquids.
4	Liquids whose pour points are above the design or lowest average ambient temperature.
5	Liquids which may change in chemical composition due to a decrease in temperature from operating to design or lowest average ambient temperature.
6	Liquids which could vaporize at an operating pressure and at ambient temperature conditions.
7	Liquids which contain solids.
8	Steam
9	Corrosive vapors and gases.
10	Air, vapors and gases containing solids.
11	Wet Gas.
12	Dowtherm "A" Vapor.
13	Dowtherm "A" Liquid.
14	No Protection Required.*

*(For fluids such as dry gas, hydrocarbon gas, etc.)

SECTION 7.0

UNIT DESCRIPTION - GAS TREATING

The function of this section is the removal of almost all the sulfur compounds and some of the CO_2 from the raw gas. The removal of some of the CO_2 provides a means of controlling the product gas BTU value.

Compressed raw gas reporting from the Gas Compression (Section 350) is cooled in the Feed Product Exchanger (E-3601). Condensed process water removed from the raw gas stream in the H_2S Absorber K.O. Drum (D-3601) is split with part being delivered to the H_2S Stripper (T-3602) for maintaining water balance and the remainder being sent to Sour Water Stripping (Section 370).

The raw gas leaving the H_2S Absorber K.O. Drum enters H_2S Absorber (T-3601) where cold lean Selexol solvent physically absorbs essentially all of the H_2S as well as most of the COS and some CO_2. The resulting product gas meets the required sulfur specifications. Absorber overhead gas after exchanging heat with the incoming raw gas and recycle gas in Feed Product Exchanger (E-3601) and Recycle Product Exchanger (E-3602), passes to the CO_2 Absorber (T-3603) for the removal of sufficient CO_2 to maintain a HHV of 300 BTU/SCF in the IFG product.

The cold rich solvent from the bottom of the H_2S Absorber passes through 3 stages of preheating and flashing in order to provide an acid gas with sufficient concentration of H_2S for treatment by Sulfur Recovery (Section 380). Preheating is effected by countercurrent heat exchange with hot lean solvent in H_2S High Pressure Flash Preheater (E-3605), H_2S Medium Pressure Flash Preheater (E-3606) and H_2S Stripper Feed Preheater (E-3607).

Preheating and flashing also provides for the recovery of co-absorbed fuel gases and for savings in utilities.

Preflahsed solvent is further stripped in the H_2S stripper (T-3602) by vapors generated from H_2S Stripper Reboiler (E-3604). Overhead steam from the H_2S Stripper is condensed in H_2S Stripper Condenser (E-3603) and returned to the H_2S Stripper while the acid gas goes to Sulfur Recovery (Section 380).

Hot lean solvent from the bottom of the H_2S Stripper is cooled in heat exchangers with the cold rich solvent after which it is further chilled by Solvent Refrigeration Unit (A-3601). Chilled lean solvent is fed to the top tray of the H_2S Absorber. The lean solvent is filtered by H_2S solution Filter (F-3601).

To conserve solvent and prevent pollution, solvent drains are sent to Solvent Sump (TK-3602), from which drains solvent is returned to the unit.

Rich solvent from the bottom of CO_2 Absorber (T-3603) is regenerated in CO_2 stripper (T-3604) using carrier gas consisting of bone dry nitrogen delivered from Air Separation (Section 310) to the bottom of the CO_2 stripper by means of Nitrogen Compressor (C-3601).

A slip stream of lean solvent is filtered by CO_2 Lean Solution Filter (F-3602).

Make up to the system is by way of the Solvent Sump (TK-3601).

8.0 DRAWINGS

This section includes drawings as listed below, to further define the scope of this project.

Drawings	Number of Drawings
Symbol Drawing	1
Engineering Flow Diagrams	4
Materials of Construction	2
Line List	5
Piping Material Specification List*	1

*Note: This list identifies the piping materials specified on the Engineering Flow Diagrams.

INSTRUMENT AND CONTROL SYMBOLS

FOR I&C SYMBOLS NOT SHOWN SEE FWEC STD. 60A3

- LOCALLY MOUNTED
- (V) INDICATES VENDOR-SUPPLIED INSTR.
- MOUNTED ON MAIN CONTROL PANEL
- MOUNTED ON LOCAL PANEL
- MOUNTED BEHIND THE MAIN PANEL OR OTHER CONTROL ROOM LOCATION
- MOUNTED BEHIND LOCAL PANEL
- IN-LINE ROTAMETER TYPE FLOW METER
- TWO INSTRUMENT FUNCTIONS IN A COMMON ENCLOSURE
- IN-LINE TYPE FLOWMETER OTHER THAN ROTAMETER
- ELECTROPNEUMATIC POSITIONER OR TRANSDUCER ON A CONTROL VALVE

CONTROL LOOP NO. 126

1. FLANGED ORIFICE FLOW SENSOR NO. 126
2. STEAM TRACED LINE TO TRANSMITTER
3. FLOW TRANSMITTER NO. 126
4. ELECTRICAL INSTRUMENT SIGNALS.
5. FLOW INDICATING CONTROLLER NO. 126
6. DIAPHRAGM OPERATED GLOBE VALVE (FAIL CLOSED TYPE)

- COMPUTER INPUT
- INTERLOCK
- RESET FOR LATCH TYPE ACTUATOR
- PURGE
- SCREWED RESTRICTION ORIFICE
- PRESSURE RELIEF VALVE (PSV- — VALVE NUMBER; -PSIG — SET PRESSURE; — SIZE: INLET/ORIFICE/OUTLET)
- PRESSURE REDUCING VALVE WITH EXTERNAL PRESSURE TAP
- BACKPRESSURE VALVE WITH EXTERNAL PRESSURE TAP
- VACUUM RELIEF VALVE (PSV- — VALVE NUMBER; "Hg — VACUUM RELIEF; — SIZE: INLET/ORIFICE/OUTLET)
- SOLENOID VALVE (4 WAY)
- TWO-WAY CONTROL VALVE FAILURE MODE: FC-FAIL CLOSED, FO-FAIL OPENED, FL-FAIL LOCKED
- ANGLE VALVE: PRESSURE UNDER SEAT; PRESSURE OVER SEAT
- 3-WAY CONTROL VALVE DIRECTION AND FAILURE MODE AS SHOWN ABOVE
- RUPTURE DISKS: PRESSURE; VACUUM
- DIAPHRAGM-OPERATED CONTROL VALVE WITH SIDE-MOUNTED HANDWHEEL
- PRESSURE AND VACUUM RELIEF VALVE (DUAL SERVICE) (VAC / PRESS)
- DIAPHRAGM-OPERATED BUTTERFLY VALVE, DAMPER OR LOUVER.
- CHEMICAL SEAL
- CYLINDER-OPERATED VALVE
- SOLENOID-OPERATED VALVE
- SOLENOID VALVE (3-WAY) WITH MANUAL RESET SHOWING DE-ENERGIZED POSITION (DE-EN)
- PITOT TUBE OR ANNUBAR
- VENTURI TUBE OR FLOW NOZZLE
- FLANGED ORIFICE PRIMARY ELEMENT
- PRESSURE REDUCING VALVE (SELF CONTAINED)
- BACKPRESSURE VALVE (SELF CONTAINED)
- HAND CONTROL VALVE (HCV)
- KNIFE EDGED VALVE
- SLIDE VALVE

CONTROL VALVE BYPASS STATION

NOTES

1. CONTROL VALVE SIZE AND TYPE SHALL BE SHOWN.
2. BYPASS SIZE AND TYPE (GLOBE, GATE, ETC). SHALL BE INDICATED. GLOBE TYPE SHOWN ABOVE
3. UNLESS NOTED, BLOCK VALVES AND BYPASS VALVES SHALL BE UPSTREAM SPEC.
4. DRAIN VALVE, ALTHOUGH NOT SHOWN ON EFD'S IS 3/4" WITH UPSTREAM SPEC.
5. BLOCK AND BYPASS VALVES & SIZES SHALL BE PER THE CHART BELOW.

CONTROL VALVE BLOCK BYPASS VALVES

LINE SIZE:	1/2		3/4		1	
CONTROL VALVE SIZE	VALVE BLOCK	BYPASS (GLOBE)	VALVE BLOCK	BYPASS (GLOBE)	VALVE BLOCK	BYPASS (GLOBE)
1/2	1/2	1/2	3/4	3/4	1	1
3/4	-	-	3/4	3/4	1	1
1	-	-	-	-	1	1

LINE SIZE:	1 1/2		2		3		4	
CONTROL VALVE SIZE	VALVE BLOCK	BYPASS (GLOBE)	VALVE BLOCK	BYPASS (GLOBE)	VALVE BLOCK	BYPASS (GLOBE)	VALVE BLOCK	BYPASS (GLOBE)
1/2	1 1/2	1 1/2	-	-	-	-	-	-
3/4	1 1/2	1 1/2	2	2	-	-	-	-
1	1 1/2	1 1/2	2	2	2	2	-	-
1 1/2	1 1/2	1 1/2	2	2	2	2	3	3
2	-	-	2	2	3	2	3	3
3	-	-	-	-	3	3	4	3
4	-	-	-	-	-	-	4	4

LINE SIZE:	6		8		10		12	
CONTROL VALVE SIZE	VALVE BLOCK	BYPASS (4 GLOBE) (6 GATE)	VALVE BLOCK	BYPASS (GATE)	VALVE BLOCK	BYPASS (GATE)	VALVE BLOCK	BYPASS (GATE)
2	4	4	-	-	-	-	-	-
3	4	4	6	6	-	-	-	-
4	6	4	6	6	8	8	-	-
6	6	6	8	6	8	8	10	10
8	-	-	8	8	10	8	10	10
10	-	-	-	-	10	10	12	10
12	-	-	-	-	-	-	12	12

NOTES:

a. ALL SIZES IN INCHES.
b. BLOCK AND BYPASS VALVES AND MANIFOLDS SHALL NOT BE LARGER THAN MAIN LINE SIZE.
c. INCREASE BYPASS VALVE BODY SIZE ONE SIZE WHERE CONTROL VALVE BODY IS BUTTERFLY DESIGN (ONLY WHEN GLOBE VALVES ARE USED AS BYPASS).
d. ON FLASHING SERVICE OR WHERE THE CONTROL VALVE OUTLET LINE SIZE IS GREATER THAN *THE CONTROL VALVE INLET LINE SIZE, THE OUTLET PIPING FROM BOTH THE CONTROL VALVE* AND BYPASS VALVE, AND THE DOWNSTREAM BLOCK VALVE ITSELF, SHALL BE NO SMALLER THAN ONE SIZE LESS THAN OUTLET LINE SIZE.

GENERAL PIPING SYMBOLS

VALVES

- GATE
- GLOBE
- PLUG
- BALL
- NEEDLE (NV)
- BUTTERFLY
- 4-WAY
- 3-WAY (INDICATE FLOW DIRECTION)
- CHECK
- NON-RETURN (SCREW-DOWN TYPE)
- CAR SEAL OPEN (CSO)
- CAR SEAL CLOSED (CSC)
- SLIDE GATE
- GEAR OPERATED (GO)
- NORMALLY CLOSED (TYP.) (N.C.)
- HANDOPERATED SLIDEGATE VALVE
- DIVERTER VALVE
- LINE EJECTOR

OTHER

- DUST SUPPRESSION NOZZLE
- UNION
- SWING ELBOW
- STEAM TRAP
- INCREASER OR REDUCER
- FIGURE 8 BLIND
- PADDLE BLIND
- QUICK-ACTING BLIND
- "Y" STRAINER
- HOSE CONNECTION
- FLEXIBLE HOSE
- SAMPLE CONNECTION
- SAMPLE COOLER
- EXPANSION JOINT
- CAPPED PIPE AT HUB
- SULFUR SEAL LEG
- DUST COLLECTION PICK-UP

GENERAL NOTES

1. ENGINEERING FLOW DIAGRAMS (EFD'S) DO NOT SHOW HIGH POINT VENTS, LOW POINT DRAINS, LOW POINT TRAPS, INSTRUMENT BLOCK VALVES ETC. REQUIREMENTS FOR THESE APPEAR IN THE JOB SPECIFICATIONS. ONLY PROCESS RELATED VENTS, DRAINS, TRAPS, ETC. ARE SHOWN.
2. DRAIN, VENT AND SAMPLE CONNECTIONS SHALL BE 3/4" UNLESS OTHERWISE NOTED.
3. CHANGES IN LINE SPEC AND/OR INSULATION SHALL BE INDICATED BY A PERPENDICULAR BREAKLINE WITH THE SPEC. NOTED ON EACH SIDE. (SEE EXAMPLES BELOW)
4. UNLESS OTHERWISE NOTED ALL VESSEL CONNECTIONS TO PIPING SHALL BE LINE SIZE AND SHALL MATCH THE PIPE SPEC.
5. ELECTRICAL SYMBOLS ARE NOT SHOWN ON THIS DWG. SEE JOB SPEC-2200-73B20.1 TO 73B20.4
6. CONTROL VALVES SHALL BE FLANGED WITH FACE TO FACE DIMENSIONS PER I.S.A.R.P 4.1 WHEREVER PRACTICABLE.

LINE TYPES USED FOR FLOW DIAGRAMS

- MAIN PROCESS PIPING (CROSSOVER)
- EQUIPMENT OUTLINES, INSTRUMENTS, OTHER PROCESS OR UTILITY PIPING, MECHANICAL LINKS, ETC.
- PNEUMATIC INSTRUMENT SIGNAL
- INSTRUMENT CAPILLARY TUBING (FILLED SYSTEM)
- ELECTRICAL INSTRUMENT SIGNAL (CROSSOVER)
- EQUIPMENT BY OTHERS (NOT FWEC/MLGW PROCUREMENT)
- EXTENT OF PACKAGE SUPPLY
- LOCATED ON ANOTHER DIAGRAM. NOTE: PLANT IS GRASS ROOTS. THERE IS NO EXISTING PIPING OR EQUIPMENT.
- ELECTROMAGNETIC, NUCLEAR, OR SONIC SIGNAL
- HYDRAULIC SIGNAL

INSULATION DESIGNATIONS

DESIGNATION	DESCRIPTION
AS	ANTI-SWEAT
CC	COLD CONSERVATION
CW	COATED & WRAPPED
ET	ELECTRICALLY TRACED
HC	HEAT CONSERVATION
LT	LIQUID TRACED
NI	NOT INSULATED
PP	PERSONNEL PROTECTION
PS	PROCESS STABILIZATION
SJ	STEAM JACKETED
ST	STEAM TRACED

EXAMPLES OF SPEC BREAK

(SEE GENERAL NOTE 3)

HC | NI (SEE ABOVE)

B2 | A2 (SEE JOB SPEC. NO. 2200 -50A10.1)

TRACING SYMBOLS

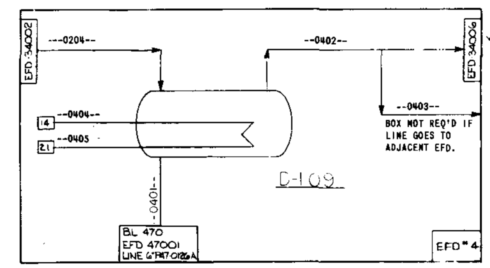
- STEAM TRACING — "T" REPRESENTS HEAT TRANSFER CEMENT REQUIRED (TYPICAL)
- LIQUID TRACING (LT)
- STEAM JACKETING (SJ)
- ELECTRIC TRACING (ET)

NOTES: 1. THE NORMAL TRACING MEDIUM FOR THIS CONTRACT IS: STEAM (REF: FWEC ENGG STD 56A1)

LINE AND HEADER DESIGNATIONS

DESIGNATION	DESCRIPTION
A	PROCESS AIR
BD	BLOWDOWN
BH	BOILER FEED WATER (HP)
BL	BOILER FEED WATER (LP)
C	CONDENSATE
CA	CHEMICAL ADDITIVE
CH	CONDENSATE, HIGH PRESSURE
CK	COKE
CL	CONDENSATE, LOW PRESSURE
CM	CONDENSATE, MEDIUM PRESSURE
CO	COAL
CS	CARBONATE SOLUTION
CW	COOLING WATER
D	DRAIN
DW	DRINKING (POTABLE) WATER
FA	FLYASH
FG	FUEL GAS
FL	FLUSHING OIL
FO	FUEL OIL
FW	FIRE WATER
G	CARBONATE VAPOR + STEAM
GW	TEMPERED WATER
GX	GASEOUS OXYGEN
IN	INSTRUMENT NITROGEN
LO	LUBE OIL
LN	LIQUID NITROGEN
LX	LIQUID OXYGEN
N	INERT GAS (NITROGEN)
NG	NATURAL GAS
P	PROCESS FLUID (GAS, VAPOR, OR LIQUID)
PO	PUMP OUT
PS	PROCESS FLUID WITH SOLIDS
R	RELIEF VALVE DISCHARGE
RF	REFRIGERANT FLUID (LIQUID OR VAPOR)
RW	REFRIGERATED WATER
SH	900 PSIG STEAM
SL	85 PSIG STEAM
SM	125 PSIG STEAM
SO	SEAL OIL
SS	SELEXOL SOLUTION
SW	SERVICE WATER
SX	50 PSIG STEAM
TW	TREATED WATER
V	VENT
W	WASTEWATER
WC	CITY WATER
WS	WASTEWATER WITH SOLIDS
PA	PLANT AIR

LINE NUMBERING SEQUENCE



LINE NUMBERING SEQUENCE ON EFD'S SHALL BE FROM LEFT TO RIGHT AND LINES CONTINUING TO OTHER EFD'S SHALL TERMINATE ALONG SIDES AS INDICATED ABOVE. LINES CROSSING TO UNIT BATTERY LIMIT SHALL TERMINATE IN A "BL" BOX AT THE BOTTOM (PREFERRED LOCATION) OR TOP. THE BOX SHALL DESIGNATE AT WHICH UNIT LIMIT THE LINE ENTERS OR LEAVES THE UNIT AND ALSO IDENTIFY THE CONNECTING FLOW DIAGRAM AND LINE NUMBER. SEE LINE NUMBERING CODE BELOW FOR EXPLANATION.

LINE NUMBERING CODE

4" P 38-12 01 A2
(400°F-HC)(750°F-REGENERATION)

- 4" — LINE SIZE
- P — LINE SERVICE DESIGNATION *
- 38 — FIRST TWO DIGITS UNIT NUMBER
- 12 — NUMBER OF EFD WHERE LINE ORIGINATES *
- 01 — SEQUENTIAL LINE NUMBER *
- A2 — PIPING MATERIAL SPECIFICATION (JOB SPEC NO. 2200-50A10.1)
- (750°F-REGENERATION) — INDICATE ANY ALTERNATE TEMPERATURE TO BE CONSIDERED
- HC — INSULATION DESIGNATION *
- 400°F — MAXIMUM NORMAL OPERATING TEMP.

* SEE NOTES ON THIS DRAWING.

EQUIPMENT DESIGNATIONS

A	PACKAGE ITEM OR SYSTEM
B	BLOWER, FAN
BD	BLENDER
BR	BURNER
BV	SOLIDS DISCHARGER
C	COMPRESSOR
CL	CLARIFIER
CR	CONVEYOR
CT	COOLING TOWER
D	DRUM
DC	DUST COLLECTOR
DH	DEAERATOR
DP	DUST SUPPRESSOR
DR	DRYER
DS	DESUPERHEATER
DV	DIVERTING VALVE
E	HEAT EXCHANGER
EL	ELEVATOR (PASSENGER, SERVICE)
F	FILTER
FD	FEEDER
FL	FLARE
H	HEATER, FURNACE
HM	HOISTING MACHINE
J	EDUCTOR, EJECTOR
KT	SAMPLE CUTTER
LA	LOADING ARM
M	MIXER
P	PUMP
R	REACTOR
S	SEPARATOR, SCRUBBER, CYCLONE
SG	STEAM GENERATOR, BOILER
SK	SOLIDS STACKER
SL	SILENCER
SR	SIZE REDUCTION EQUIPMENT
SS	SAMPLING SYSTEM
T	TOWER
TK	TANK, SILO, HOPPER
UD	SOLIDS UNLOADER
WS	WEIGH SCALE

EQUIPMENT SYMBOLS

(NOT SHOWN TO SIZE FOR EFDS)

- PACKAGE UNIT
- CENTRIFUGAL PUMP (MOTOR DRIVE)
- PROPORTIONING PUMP (MOTOR DRIVE)
- CENTRIFUGAL BLOWER (STEAM TURBINE DRIVE)
- TWO CASING CENTRIFUGAL COMPRESSOR (MOTOR DRIVE)
- HEAT EXCHANGER (SHELL: PROCESS STREAM, TUBE: C.W.)
- KNOCKOUT DRUM
- AIRCOOLER
- BELT CONVEYOR
- DRUM (INLETS AND OUTLETS SHOWN)
- ROTARY FEEDER
- SCREW CONVEYOR
- BRAZED ALUMINUM CORE EXCHANGERS
- SILENCER
- INLET AIR FILTER
- OR CONFIGURATION SKETCH — OTHER EQUIPMENT (SPECIFICALLY IDENTIFIED BY NAME AND NUMBER)
- RECIPROCATING COMPPRESSOR — FRAME; CYLINDER; CONNECTION TO DRIVER (ELECTRIC MOTOR SHOWN) (SHOW ACTUAL NUMBER OF CYLINDERS)
- ROTARY OR SCREW TYPE COMPRESSOR — CONNECTION TO DRIVER (ELECTRIC MOTOR SHOWN)

REFERENCES JOB SPECS-2200

50 B 12.1	"PIPING SYMBOLS, VALVES, AND ACCESSORIES"
60 A 1	"INSTRUMENTATION"
60 A3	"INSTRUMENTATION SYMBOLS AND IDENTIFICATION"
73 B 20.1 - 4	"ELECTRICAL POWER SYMBOLS"
50 A 10.1	"PIPING MATERIAL SPEC. INDEX"
56 A 1	"STEAM TRACING STANDARD FOR PIPING, VESSELS, AND EQUIPMENT"
78 A 3	"ELECTRICAL HEAT TRACING FOR PIPING INSTRUMENTS AND EQUIPMENT"

SELECTED PROJECT DOCUMENTS

1. "THE DEMONSTRATION PLANT DESIGN BASIS"
2. "BASIC ENGINEERING DATA FOR DEMONSTRATION PLANT
3. TASK I FINAL REPORT, "CONCEPTUAL DESIGN AND EVALUATION OF COMMERCIAL PLANT" VOL I - IV
4. FWEC DWG. 2201-1-50-00103, PLANT BLOCK FLOW DIAGRAM FOR COMMERCIAL PLANT.
5. FWEC DWG. 2201-1-01-1, KEY PLOT PLAN FOR COMMERCIAL PLANT.

UNIT NAMES AND NUMBERS

PROCESS UNITS

SECTION NUMBER	DESCRIPTION
310	AIR SEPARATION
320	COAL/COKE TREATING AND FEED
330	COAL GASIFICATION
340	GAS COOLING AND SCRUBBING
350	GAS COMPRESSION (RAW/RECYCLE GAS)
360	GAS TREATING
370	SOUR WATER STRIPPING
380	SULFUR RECOVERY
390	TAIL GAS TREATING
220	CREDIT GENERATION

SUPPORT FACILITIES

410	COAL/COKE HANDLING
420	ASH TREATMENT
430	UTILITY AREA: STEAM GENERATION; CITY WATER STORAGE; BFW TREATMENT
440	WASTE WATER TREATMENT
450	COOLING TOWER
460	FLARE
470	GENERAL FACILITIES: LONG TERM COAL STORAGE; LONG TERM ASH AND SOLID WASTE STORAGE; INTERCONNECTING PIPING; ROADS AND FENCES; FIREWATER SYSTEMS; POWER LIGHTING; COMMUNICATION AND SEWERS
480	BUILDINGS
490	DOCK FACILITIES

UNIT ENGINEERING FLOW DIAGRAM INDEX

(LATER)

REV	DESCRIPTION	DATE	FWEC	MLGW	DOE
B	FINAL ISSUE - PHASE I, TASK II	10-16-79			
A	INITIAL ISSUE	8-31-79			

INDUSTRIAL FUEL GAS DEMONSTRATION PLANT
MEMPHIS, TENN.
CONTRACT No. ET 77C-01-2582

MEMPHIS LIGHT, GAS AND WATER DIVISION, MEMPHIS, TENN.

DEPARTMENT OF ENERGY, COAL CONVERSION DIVISION, WASHINGTON, D.C.

TASK II 15-2202 DEMO. PLANT PROCESS DESIGN
TASK III 15-2203 DEMO PLANT PROCESS & MECH. DESIGN
UNIT NAMES AND NUMBERS (SEE ABOVE)

ENGINEERING FLOW DIAGRAM
GENERAL NOTES, SYMBOLS AND DETAILS

EST. NO | DRAWN BY | 5-21-79 | SH. 1 OF 1
CONTRACT NUMBER 2203 | DWG. NO 2203-1-50-1 | B

THIS DRAWING SUPERSEDES 135-949-M REV. B
THIS DRAWING SUPERSEDED BY

PIPING MATERIAL SPECIFICATION LISTING

Pipe Spec	Service	Class	Material	Ca
A	General Service	150	CS	.050
A2	General Service	150	CS*	.050
Ad	Corrosive Service	150	CS	.125
Ad2	Corrosive Service	150	CS*	.125
Ae	Corrosive Service	150	CS/SS	.250/.030
Ae2	Corrosive Service	150	CS*/SS	.250/.030
Ae3	Corrosive Service	150	CS**/SS	.250/.030
Af	Steam	150	CS	.050
Af1	Power Piping Code	150	CS	.050
Ak	Fuel Gas, Non-Corr. Gases	150	CS	.050
An	Corrosive Services	150	CS	.1875
An2	Corrosive Services	150	CS**	.1875
Ar	Gasifier Effluent	150	Refrac. Lined	-
Ax	Sulfur	150	-	.125
Ay	Corrosive Service	150	CS-Polypro. Lined	-
Bb	Steam	300	CS	.125
Bb1	Power Piping Code	300	CS	.125
Bc	Gasifier Effluent	300	1¼Cr-½MO, Incoloy Clad.	-
Bd	Corrosive Service	300	CS	.125
Bf	Corrosive Service	300	C - ½MO	.125
Bf2	Corrosive Service	300	C - ½MO	.125
Bk	Fuel Gas, Non-Corr. Gases	300	CS	.050
Bn	Corrosive Service	300	1¼Cr-½MO	.125
Bn2	Corrosive Service	300	1¼Cr-½MO	.125
Db	Steam	600	CS	.125
Db1	Power Piping Code	600	CS	.125
Dc	Gasifier Effluent	600	1¼Cr-½MO, Incoloy Clad.	-

PIPING MATERIAL SPECIFICATION LISTING (Cont'd.)

Pipe Spec	Service	Class	Material	Ca
Fb	Steam	1500	CS	.125
L	Category D	125	CS	.050
La	Drinking Water	125	Galv Steel	.050
Lc	Water	125	CS	.050
Lf	Firewater	125&175	CS	.063
Ra	Oxygen - Gaseous	150	304L	.030
Rh	General Service	150	304L	.030
Rn	Nitrogen - Liquid	150	304L	.030
Ro	Oxygen - Liquid	150	304L	.030
Rc	Corrosive Service	150	304	.030
Sh	General Services	300	304L	.030
Uc	Chemical Injection	600	304L	.030
Eb	Steam	900	CS	.125
Eb1	Power Piping Code	900	1¼Cr-½MO	.125
P	Chlorine Water Soln	Special	PVC	—

* Killed
**Killed W.316 Trim

9.0 EQUIPMENT LIST

Attached is a tabulation listing the equipment included in this unit. The item number corresponds to that called out on the Engineering Flow Diagram. The number shown under Engineering Flow Diagram (EFD) is the last digit of the appropriate EFD for reference.

10.0 EQUIPMENT AND MECHANICAL SPECIFICATION

This section contains equipment and mechanical specifications (requisitions) for items employed within this unit. Refer to the appropriate Equipment List for a complete cross reference of:

Class (type of equipment)
Item Number (indicated on Engineering Flow Diagram)
Description
Engineering Flow Diagram
Requisition Number

11.0 INSTRUMENT DATA

This section includes a tabulation of main control instrument data for this unit and an index of process fluid types.

LISTING OF PROCESS FLUID TYPES

Type Fluid	Fluid Definition or Property
1	Water and water solution having a freezing point of approximately 32°F.
2	Water which could accumulate in lead lines due to gravity separation (not because of steam out operations).
3	Corrosion liquids.
4	Liquids whose pour points are above the design or lowest average ambient temperature.
5	Liquids which may change in chemical composition due to a decrease in temperature from operating to design or lowest average ambient temperature.
6	Liquids which could vaporize at an operating pressure and at ambient temperature conditions.
7	Liquids which contain solids.
8	Steam
9	Corrosive vapors and gases.
10	Air, vapors and gases containing solids.
11	Wet Gas.
12	Dowtherm "A" Vapor.
13	Dowtherm "A" Liquid.
14	No Protection Required.*

*(For fluids such as dry gas, hydrocarbon gas, etc.)