



FOSTER WHEELER LIMITED

DESIGNERS - MANUFACTURERS - CONSTRUCTORS

P.O. BOX 3007 - ST. CATHARINES, ONTARIO L2R 7B7

TELEPHONE (416) 684-8321
TELEX - 021-5134
CABLE - REWOP

MONTREAL
TORONTO
CALGARY

DATE: May 16, 1980

In accordance with the Terms, Conditions and Specifications set forth herein Foster Wheeler proposes to furnish:

(hereinafter called the Purchaser)

ONE (1) STEAM GENERATING UNIT capable of producing 300,000 lb. of steam per hour at 1300 psig and 855 Deg. F. at the outlet of the main steam stop non-return valve from deaerated feedwater at 378 Deg. F. when firing 148,000 lbs/hr. of a bark and sludge combination resulting in a 60% moisture content. The unit is also capable of producing 300,000 pph of steam plus 2% blowdown plus soot blowing steam under the same conditions, firing 158,300 lbs/hr.

The unit will also fire No. 6 oil up to a maximum input of 240 million BTU per hour.

When the unit is fired with 50% moisture bark/sludge combination, it has the additional steam capacity to burn the same amount of oven dry fuel as is fired when producing 300,000 lb. per hour steam from 60% moisture fuel, under which conditions the generating capacity shall be 334,000 lbs/hr.

The equipment to be supplied will consist of the following:

- Furnace - including waterwalls, headers, downcomers, releaser tubes, inspection and access doors
- Superheater - including spray header
- Boiler bank - including drums, boiler tubes, inspection and access doors
- Inclined grate - including dampers, steam jets, and dump grate section
- Overfire air system
- Cinder Reinjection System
- Boiler inner casing and penthouse
- Economizer
- Air heater
- Trim and valves
- Oil burners and windbox
- Flues and ducts
- Lagging, insulation and setting

BARK BURNING BOILER
 JOB 259 3
 EQUIP. NO. _____
 FILE NO. 2-076-0324
 P.O. NO. 10040
 DATE 6-3-80

Information in this Proposal is Confidential
See Clause 1 of Terms and Conditions of Sale

SUMMARY PERFORMANCE SHEET — PART ONE

Purchaser _____

Location _____

Design pressure 1550 psig

Dwg. No. CP-785-94

Design Code - A.S.M.E. Power Code Section 1, 1977

Fuel _____	Wood/ Sludge 60% H2O	Wood/ Sludge 60% H2O	Wood/ Sludge 60% H2O	Oil	Wood/ Sludge 53% H2O
Steam _____ M lb/hr	300	300	150	203.3	326.6
Blowdown %	2	1	1	1	1
Pressure NRV outlet _____ psig	1300	1300	1300	1300	1300
Temperature steam NRV outlet _____ F	855	855	822	800	855
Soot blowing steam _____	20				
Pressure boiler drum _____ psig	1410	1397	1324	1345	1415
Reheat steam _____ M lb/hr					
Temperature steam entering reheater _____ F					
Temperature steam leaving reheater _____ F					
Pressure steam entering reheater _____ psig					
Pressure steam leaving reheater _____ psig					
Temp feed entering unit _____ F	378	378	378	378	378
Temp feed leaving econ. _____ F	453	453	450	417	446
Temp air entering unit _____ F	80	80	80	80	80
Temp air leaving air heater _____ F	582	* 575	515	446	569
Temp gas leaving furnace _____ F	1596	1570	1375	1635	1620
Temp gas leaving boiler _____ F	787	773	679	649	777
Temp gas leaving economizer _____ F	654	642	563	516	642
Temp gas leaving air heater _____ F	352	350	301	217	336
Ditto corrected for leakage _____ F					
Excess air leaving boiler _____ %	30	30	43	30	30
Wet gas entering air heater _____ M lb/hr	661.8	631.3	355.8	244.4	611.9
Wet gas leaving air heater _____ M lb/hr	661.8	631.3	355.8	244.4	611.9
Air entering air heater _____ M lb/hr	510.7	478.3	271.3	226.1	479.6
Air leaving air heater _____ M lb/hr	510.7	478.3	271.3	226.1	479.6
Draft in furnace _____ in. H ₂ O	.02	.02	.02	.02	.02
Gas side loss thru boiler _____ in. H ₂ O	.78	.68	.21	.09	.64
Gas side loss thru suptr. & reht. _____ in. H ₂ O	.12	.10	.03	.02	.09
Gas side loss thru economizer _____ in. H ₂ O	1.45	1.27	.40	.19	1.19
Gas side loss thru air heater _____ in. H ₂ O	6.07	5.48	1.63	.66	5.03
Gas side loss thru flues _____ in. H ₂ O	.46	.42	.13	.06	.39
Gas side loss thru dust collector _____ in. H ₂ O					
Air side loss thru air heater _____ in. H ₂ O	4.84	4.27	1.43	.97	4.26
Air side loss thru ducts _____ in. H ₂ O	1.50	1.32	.73	.29	1.32
Air side loss thru burners _____ in. H ₂ O			5.75		
Air side loss, "A. M. & damper" _____ in. H ₂ O	1.75	1.53	.49	1.75	1.54
Air side loss, thru grate _____ in. H ₂ O	3.00	2.63	.85		2.65
Air & gas loss total _____ in. H ₂ O					
Pressure loss _____ to _____ psi					
Fuel fired _____ M lb/hr or cfm	158.3	148.5	79.08	13.1	127.0
Liberation _____ Btu/hr/cu. ft total vol.	21,146	19,777	10,113	9369	19,774
Furn. Cooling Factor _____ net Btu/hr/sq. ft.					
Unit efficiency _____ %	62.51	62.57	61.18	89.50	68.11

*Note: With economizer by-pass air temperature can go as high as 620 Deg. F.

SUMMARY PERFORMANCE SHEET - PART NO

Purchaser _____

Location _____

	Wood/ Sludge	Wood/ Sludge	Wood/ Sludge	Oil *	Wood/ Sludge
Fuel _____ M lb/hr.	300	300	150	203.3	326.6
Heat Losses					
Dry gas _____ %	6.82	6.76	6.37	3.16	6.36
Hydrogen and moisture in fuel _____ %	27.70	27.68	28.96	5.70	22.58
Moisture in air _____ %	0.16	0.16	0.16	0.08	0.15
Unburned combustible _____ %	1.00	1.00	1.00		1.00
Radiation _____ %	0.31	0.33	0.83	0.56	0.30
Unaccounted _____ %					
Manufacturers margin _____ %	1.50	1.50	1.50	1.00	1.50
Total losses _____ %	37.49	37.43	38.82	10.50	31.89
Efficiency _____ %	62.51	62.57	61.18	89.50	68.11

*Note - Performance based without using steam coil air heater. It is

recommended that a steam coil air heater be used to protect the cold end metal temp. in the A.H. Performance based on fuel specified below:

Kind _____	Wood	Oil	Sludge 1	Sludge 2
Grindability (Hardgrove) _____				
Maximum moisture _____ %				
Surface Moisture _____ %				
Size _____	Not more than 40%			
Gas press. at burner _____	below 1/4"			
	Maximum size allowable 4" x 4" x 4"			

PROXIMATE ANALYSIS

Moisture _____				
Volatile matter _____				
Fixed carbon _____				
Ash _____				
Softening temperature of ash _____				

ULTIMATE ANALYSIS

Per cent by _____	Weight	Weight	Weight	Weight
Ash _____	0.88	0.10	7.70	1.16
S _____		2.30	0.79	0.14
H ₂ _____	2.28	10.50	2.65	3.36
C _____	22.24	85.50	13.25	16.87
CH ₄ _____				
C ₂ H ₄ _____				
C ₂ H ₆ _____				
(O) _____				
(O) ₂ _____				
H ₂ O _____	58.50	0.20	65.00	65.00
N ₂ _____		0.30		
O ₂ _____	16.10	1.00	10.61	13.47
Unaccounted for _____		0.10		
Btu/lb as fired _____	3569	18,300	2161	2940
Btu/cu ft at 60 F-30" Hg _____				

Proposal No. 277-137

SUMMARY PERFORMANCE SHEET — PART ONE

Purchaser _____

Location _____

Design pressure 1550 Dwg. No. _____

Design Code - A.S.M.E. Power Code Section 1, 1977

Fuel	Wood	Comb.	Sludge		
		50% moisture			
Steam _____ M lb/hr		334			
Blowdown % _____		1			
Pressure superheater outlet _____ psig		1,300			
Temperature steam superheater outlet _____ F		855			
Pressure boiler drum _____ psig		1,420			
Reheat steam _____ M lb/hr					
Temperature steam entering reheater _____ F					
Temperature steam leaving reheater _____ F					
Pressure steam entering reheater _____ psig					
Pressure steam leaving reheater _____ psig					
Temp feed entering unit _____ F		378			
Temp feed leaving econ. _____ F		446			
Temp air entering unit _____ F		80			
Temp air leaving air heater _____ F		572			
Temp gas leaving furnace _____ HVT F		1,672			
Temp gas leaving boiler _____ F		789			
Temp gas leaving economizer _____ F		648			
Temp gas leaving air heater _____ F		334			
Ditto corrected for leakage _____ F					
Excess air leaving _____ Boiler %		30			
Wet gas entering air heater _____ M lb/hr		606.7			
Wet gas leaving air heater _____ M lb/hr		606.7			
Air entering air heater _____ M lb/hr		480.6			
Air leaving air heater _____ M lb/hr		480.6			
Draft in furnace _____ in. H ₂ O		.2			
Gas side loss thru boiler _____ in. H ₂ O		.64			
Gas side loss thru suptr. & rehr. _____ in. H ₂ O		.09			
Gas side loss thru economizer _____ in. H ₂ O		1.29			
Gas side loss thru air heater _____ in. H ₂ O		4.93			
Gas side loss thru flues _____ in. H ₂ O		.39			
Gas side loss thru dust collector _____ in. H ₂ O					
Air side loss thru air heater _____ in. H ₂ O		4.29			
Air side loss thru ducts _____ in. H ₂ O		1.32			
Air side loss thru burners _____ in. H ₂ O					
Air side loss, <u>Air Meas + Damper</u> thru Grate _____ in. H ₂ O		1.53			
Air side loss, _____ thru Grate _____ in. H ₂ O		2.64			
Air & gas loss total _____ in. H ₂ O					
Pressure loss _____ to _____ psi					
Fuel fired _____ M lb/hr or cfm	98.1	120.1	22		
Liberation _____ Btu/hr/cu ft total vol.					
Furn. Cooling Factor _____ net Btu/hr/sq. ft.					
Unit efficiency _____ %		69.68			

Added _____

SUMMARY PERFORMANCE SHEET - PART TWO

Purchaser G

Location _____

	Wood	Comb.	Sludge		
Fuel _____					
Steam _____ M lb/hr.		334			
Heat Losses		6.35			
Dry gas _____ %		21.02			
Hydrogen and moisture in fuel _____ %		.15			
Moisture in air _____ %		1.00			
Unburned combustible _____ %		30			
Radiation _____ %		1.50			
Unaccounted _____ %					
Manufacturers margin _____ %					
Total losses _____ %		30.32			
Efficiency _____ %		69.68			

Performance based on fuel specified below:

Kind _____				
Grindability (Hardgrove) _____				
Maximum moisture _____ %				
Surface Moisture _____ %				
Size _____				
Gas press. at burner _____				
PROXIMATE ANALYSIS				
Moisture _____				
Volatile matter _____				
Fixed carbon _____				
Ash _____				
Softening temperature of ash _____				
ULTIMATE ANALYSIS				
Per cent by _____				
Ash _____				
S _____				
H ₂ _____				
C _____				
CH ₄ _____				
C ₂ H ₄ _____				
C ₂ H ₆ _____				
CO _____				
CO ₂ _____				
H ₂ O _____				
N ₂ _____				
O ₂ _____				
Btu/lb as fired _____				
Btu/cu ft at 60 F-30" Hg _____				

BURNER PERFORMANCE

1. UNIT: Model MT26 forced draft, pressurized, insulated register burner.

DRAWING ASS'Y.: C-86962 B-86981

2. COMBUSTION AIR:

Oil Firing: 894,930 SCFH/Burner

Draft Loss @ 446 deg. F. and Sea Level 4.3"W.C.

Draft Loss @ 620 deg. F. and Sea Level 5.1"W.C.

Performance Curve No. EO-C5 Rev. A

OIL BURNER DESIGN DATA

Atomizer: Type: ABT Wide Range Mechanical

Dwg: C-30918 X = 69"

Capacity: 4,372 # oil/hr/burner

Oil Pressure @ Burner: 700 psig

Tip: Dwg: E-7321 #1822 (6 slots .075 x .077) .157 orifice

Tip Plug: Dwg. E-7332 #M16 (1/4" Return Hole)

Performance Curve Dwg: CE-20061
CE-30678-A

FUEL OIL

Type: #6 HHV: 18,200 BTU/lb.

Viscosity: 150-200 SSU for mechanical atomizing @ 10% excess air

ELECTRICAL

Supply: 120 Volt 60 Cycle 1 Phase

MISCELLANEOUS

Tile Assembly: Dwg. CO-20-00043

Mat'l. Clipper.

Ignitor: H.E. Type A = 84"

Diffuser: 13" O/D Domino Modified
Dwg. D-87492

DETROIT STOKER COMPANY
MONROE, MICHIGAN

PARTS LIST FOR DETROIT ROTARY SEAL FEEDER

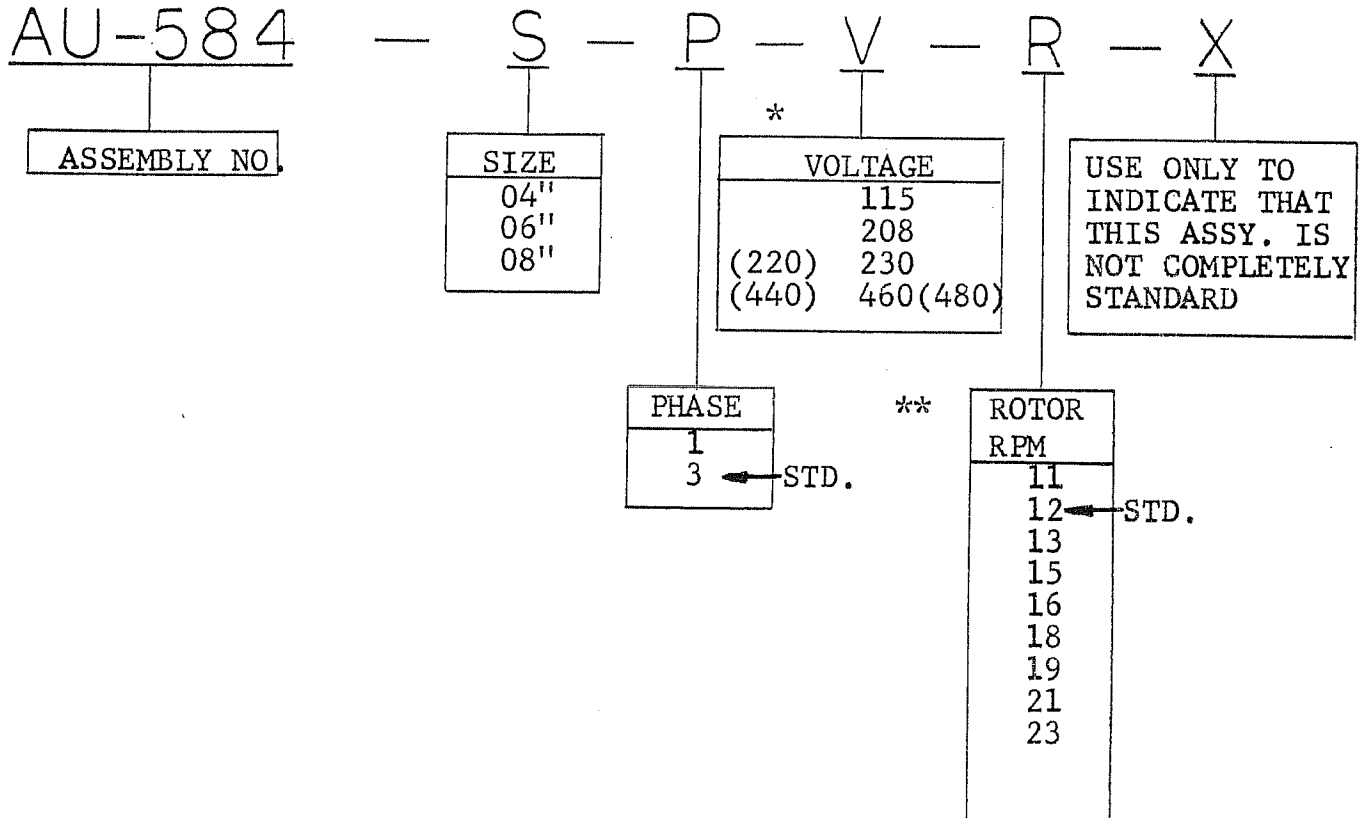
CODE NO. AU-0584-08-3-460-11-X

ITEM NO.	QTY. REQ'D.	PART NO.	DESCRIPTION
1	1	U-8511	Housing
2	1	U-8513	Rotor shoe
3	1	9253-239	Packing
4	1	U-8518	Rotor
5	1	8400-08	Rotor shaft
6	1	U-8512-1	Top cover
7	2	5659	Key
8	1	U-8519-A	End cover
9	2	U-8398	Bearing bracket w/stuffing box
10	1	8516	Packing (6 rings per set)
11	2	U-8517	Packing gland
12	4	1200	Stud
13	2	8510-23	Pillow block
14	2	K-7081	Grease fitting
15	2	8457	Gasket
16	1	8456-08	Gasket
17	1	8455-08	Gasket
18	2	C-4363-G	Gasket
19	2	C-4363	Access cover
20	1	8514	Packing (2 rings per set)
21	2	8515-A	Spring
22	4		3/8" hex nut
23	8		3/8" x 1" hex. hd. cap screw
24	4		1/2" x 2" hex hd. cap screw w/plain washer, lockwasher & hex nut
25	18		1/2" x 1-1/4" hex hd. cap screw
26	2		1/2" x 9 1/2" sq. hd. mach. bolt w/plain washer & 2 jam nuts
27	8		3/4" x 2-1/4" hex hd. cap screw w/hex nut
28	1	SEE AUX. LIST	Motor (3/4 H.P.)
29	1	8945-1	Drive guard
30	1	8048-19-184	Drive sprocket (19T.)
31	1	8599-60-3	Driven sprocket (60T.)
32	58"	696-RB	Roller chain
33	1	697-RC	Roller chain connecting link
34	1	643	Key
35	1	U-8478-235-3	Shear pin hub
36	1	5041	Set collar
37	2		5/16" x 1/2" soc. hd. cup pt. set screw
38	2	5404	Shear pin bushing
39	6	5403	Shear pin (1/4" diameter) 5-Extra
40	1	480	Shear pin retainer clip
41	1	10313	Grease fitting
42	1		1/4" x 1/2" rd. hd. mach. screw
43	4		3/8" x 1-1/4" hex hd. cap screw w/plain washer & lockwasher
44	1	8978	Name plate
45	2		#7 x 3/8" drive screw
46	1	9141	Right angle gear reductor

DETROIT STOKER COMPANY
MONROE, MICHIGAN

DETROIT ROTARY SEAL FEEDER
"A" TYPE (WITH DRIVE)

HOW TO ORDER BY CODE NO.



* (a) VOLTAGE - Single phase drive motors are dual wound for 115/230 volts. Three phase motors are wound for 208, 220/440, 230/460 volts.

(b) DRIVE MOTOR - Standard drive motors are TEFC single reductor, right angle worm gear motors suitable for 60 cycle current and rated for 40°C ambient with a temperature rise of 55°C. Motors suitable for 50 cycle current or with Class "B" insulation for a temperature rise to 75°C can be furnished on special order.

** (c) ROTOR RPM - Standard 12 RPM Rotary Seal Feeders are recommended and will be furnished when the RPM is not specified. For maximum efficiency and life of seal feeder components it is recommended that seal feeders be sized to limit the required operating RPM to 23. Slower RPMs will result in longer component life. Rotary Seal Feeders for slower or faster RPMs from those indicated can be furnished on special order.

Enerex Inc.

1918 EAST 51st STREET, SUITE 7 EAST

TULSA, OKLAHOMA 74105

(918) 749-4661

ECONOMIZER SPECIFICATIONS

1	CUSTOMER	FOSTER WHEELER LTD.		INQUIRY NO	2551	
2	ADDRESS	ST. CATHARINES, ONTARIO		DATE	2/22/79 BY	
3	USER			PROPOSAL NO.	9851	
4	PLANT LOCATION			UNITS REQUIRED	1	
5	PERFORMANCE			GENERAL		
7	CUSTOMER ITEM NO.			1. BWG STEEL CASING WITH STEEL TUBE		
8	HEAT EXCHANGED	BTU/HR	25124040.	SUPPORTS AND HEAVY STEEL STRUCTURE		
9	U EXTENDED	BTU/HR/SQ FT/°F	9.5	DESIGNED FOR 25 PSF WIND LOADING AND		
10	U BARE	BTU/HR/SQ FT/°F	9.5	NOMINAL EXTERNAL LOADING.		
11	LMTD	°F	300.7			
12	TOTAL HEATING SURFACE	SQ FT	8768.	2. ONE PIECE CONSTRUCTION.		
13	BARE TUBE SURFACE	SQ FT	8768.			
14		Tube Side	Gas Side	3. FLANGED GAS CONNECTIONS FOR WELDED		
15	FLUID CIRCULATED	WATER	FLUE GAS	OR BOLTED INSTALLATION.		
16	DIRECTION OF FLOW	UP	DOWN			
17	FLOW RATE	LB/HR	303030.	630917.	4. FULL X-RAY 10% OF TUBE WELDS.	
18	TEMPERATURE IN	°F	378.	795.		
19	TEMPERATURE OUT	°F	454.	642.	5. 1 - 18" SOOT BLOWER LANE (S).	
20	PRESSURE INLET	PSIA	1000. 1425	4-SOOT BLOWER(S) SUGGESTED.		
21	PRESSURE DROP	PSI-IN H ₂ O	6.5	1.81	6. EST. WEIGHT: DRY 68078 +LBS.	
22	VELOCITY	FPS-LB/SQ FT/HR	3.3	6149.	WET 83105 +LBS.	
23	DENSITY	LB/CU FT	53.2			
24	SPECIFIC HEAT	BTU/LB/°F	1.084	0.263		
25	FOULING RESISTANCE	HR-SQ FT-°F/BTU	0.0010	0.010		
26	CONSTRUCTION					
28	DESIGN PRESSURE	PSI	1550.			
29	TEST PRESSURE	PSI	CODE			
30	DESIGN TEMPERATURE	°F	700			
31	CODE	SECTION I				
32	NUMBER OF TUBES	510				
33	NUMBER OF ROWS	17				
34	TUBES/ROW	30				
35	STREAMS FEEDING	30				
36	TUBE PITCH	HORIZ X VERT	3.25 X 3.00			
37	TUBES:					
38	OD X THICKNESS	IN	2.000 X 0.150			
39	EFFECTIVE LENGTH	FT	32.833			
40	MATERIAL	SA-178-A				
41	FINS:					
42	HEIGHT X THICK X FINS/INCH	0.000 X 0.000 X 0.0		GL 32.833 GW 8.125		
43	MATERIAL	C. STEEL		OL 36.833 OW 9.125		
44	HEADERS - SIZE/MATERIAL	8 S 160 SA-106-B		OH 7.250 CT 17.417		
45	TERMINALS - NO./TYPE	2 / BUTT WELD		TT 1.000 BT 6.250		
46	TERMINALS - SIZE/RATING	6 / BUTT WELD		HW 4.563 TW 5.896		
47	FITTINGS			HL 18.417		
48	NOTES:					
49	1. NUMBER TUBE SHEETS REQUIRED - 4					
50	2. HOT FORGED BENDS - NO THIN OUT - MINIMIZES STRESS CORROSION					
51	ZERO QUALITY - DIMENSIONALLY CORRECT					
52						
53						
54						
55						

enerex

TULSA, OKLAHOMA

SERIAL NO.

T-189

BUILT

1980

CODE

ASME

DESIGN PSI

1550

SERVICE

BOILER ECONOMIZER

DESIGN °F

700

FOR FOSTER WHEELER LTD. FOR

[REDACTED]