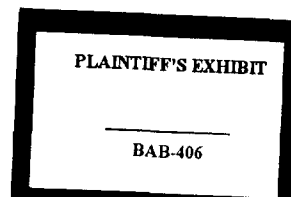


file
Cherokee No 2
Boiler



Purchaser's
Identification:
Order No. NY-771602
Spec. No. PSCC-C2-102-SG
Date of Spec.
- October 1, 1958

Revision Dates:
R1 August 14, 1959
R2
R3

EBASCO SPECIFICATION
SPECIFICATION EBASCO 56-50
STEAM-GENERATING UNITS AND ACCESSORIES

OPERATING COMPANY PUBLIC SERVICE COMPANY OF COLORADO
STATION CHEROKEE STEAM ELECTRIC STATION
PROJECT 1959 - 110 000 KW EXTENSION UNIT NO. 2
LOCATION DENVER, COLORADO (1 mile north of city limits)

SELLER _____

rev.	Prepared by:	Reviewed by:	Pages Affected:
5			
R1			
R2			
R3			

WAD00087

SPECIFICATION, EBASCO
STEAM-GENERATING UNIT AND ACCESSORIES
EXPECTED PERFORMANCE

Purchaser's
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Spec. No. PSCC-C2-102-SG
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Operation At	Limit of Temperature Control		Maximum Load		Limit of Temperature Control		Maximum Load	
	In	Out	In	Out	In	Out	In	Out
Continuous steam output at Secondary Superheater Outlet, M lb/hr	650				650		852	852
Top extraction feed water heater								
Fuel	Lignite	Lignite	Lignite	Lignite	Gas	Gas	Gas	Gas
.8 Heat losses, per cent								
Dry stack gas	6.25		4.85		5.14		4.30	
Hydrogen and water in fuel	6.50		6.34		10.90		10.64	
Moisture in air	0.15		0.12		0.14		0.10	
Unburned Combustible	0.70		0.57		--		--	
Radiation	0.30		0.23		0.30		0.23	
Unaccounted for	1.50		1.50		1.50		1.50	
Total heat loss	15.40		13.61		17.98		16.77	
Efficiency	84.60		86.39*		82.02		83.23	
*Guaranteed performance								
.9 Heat Quantities								
Superheated steam, MK Btu/hr absorbed above feed water	672.5		853.0		672.5		853	
Reheated steam, MK Btu/hr absorbed	112.5		127.5		125.0		117	
Total steam, MK Btu/hr absorbed	785.0		980.5		797.5		970	
Heat release in furnace, KBtu/cu ft/hr	11.65		14.3		12.0		14.65	
Heat available/sq ft effective water cooled furnace surface/hr KB	49.4		60.4		51.7		62.0	

* Temperature depends on setting of proportioning dampers.

SPECIFICATION EBASCO
STEAM-GENERATING UNIT AND ACCESSORIES
EXPECTED PERFORMANCE

Purchaser's
Identification
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Limit of

Operation At	Limit of Temperature Control		Maximum Load		Temperature Control		Maximum Load	
	In	Out	In	Out	In	Out	In	Out
Continuous steam output at Secondary Superheater Outlet, M lb/hr	650		852		650		852	
Top extraction feed water heater								
Fuel	Lignite	Lignite	Lignite	Lignite	Gas	Gas	Gas	Gas

.10 When operating with top extraction high pressure feed water heater out of service and a feed water temperature entering the Economizer of 448 F, etc., unit will be capable of 852 000 lb/hr steam generation without exceeding 1005 F temperature at either the secondary superheater or reheater outlet providing reheat flow is increased to 765 000 #/hr.

Above temperatures estimated where generation is not lower than 90 per cent of maximum guaranteed.

SPECIFICATION EBASCO
STEAM-GENERATING UNIT AND ACCESSORIES

- 9 Tests shall be conducted to satisfaction of Purchaser as follows:

TESTS

- .1 Before construction of setting, Seller shall subject all pressure parts of complete unit to hydrostatic test at 1-1/2 times working pressure, in presence of and to satisfaction of insurance company's boiler inspector and other inspectors if required. Seller shall furnish test pump and Purchaser shall make provisions for water required. Refer to paragraph 37 for water requirements.
- .2 During initial operating period Seller shall take necessary superheater-tube metal temperatures to determine procedure in bringing up pressure and to determine tube temperatures encountered over entire range of steam output. Seller shall furnish and install wire, instruments and thermocouples. Type and location of thermocouples shall be subject to Purchaser's review and approval.
- .3 Tests to demonstrate capacity and guaranteed over-all efficiency of unit shall be conducted by Purchaser using installed plant instruments, after notification to Seller, so that Seller's engineers may be present. In case of failure of unit to meet guarantees, Seller shall take necessary measures to correct conditions, and retesting shall be at Seller's expense.
- .4 Tests to demonstrate guarantees specified herein shall be governed by provisions of ASME Power Test Code for Stationary Steam-Generating Units, latest issue, and other applicable ASME Power Test Codes.

CONSTRUCTION FEATURES

- 10 Steam generator shall be of Babcock & Wilcox manufacture and of reheat, radiant, single drum, divided suction furnace, top fired, outdoor type, and in general shall be in accord with Proposition drawings No. P5-25528-16X0
Final 9029F

GENERAL

- .1 Major physical data shall be as follows:

- | | |
|---|---------------------|
| a Boiler water-heating surface excluding water-cooled furnace surface | <u>11,820 sq ft</u> |
| b Superheating surface | <u>39,306 sq ft</u> |

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STEAM-GENERATING UNIT AND ACCESSORIES

- 11 Boiler drums as listed below shall be in accordance with ASME Boiler Construction Code, fusion-welded and stress-relieved, and with welded seams radiographed as required therein. Drum plates shall be of 70 000 psi tensile strength, specification ASME _____

BOILER DRUMS

Drum No.	Location	Inside Diameter	Over-all Length	Plate Thickness
1	Steam Drum	60"	54'-6"	4-1/4"

- .1 Nozzles shall be provided on drums for connections and services as listed below. All nozzles shall be of sufficient length to permit rewelding.

Drum No.	Service	No. of Nozzles	Size	Type of Connection
1	Main Steam	on Superheater		
1	Feed Water	2	6-5/8"	Welded Thermal Sleeve
1	Safety Valve	3	3"	Flanged
1	Saturated Steam	1	3"	Butt Welded
1	Pressure Gage	2	1"	Socket Welded
1	Water-level recorder	2	1"	Socket Welded
1	Feed Water Regulator	2	1"	Socket Welded
1	Continuous blowdown	1	1-1/2"	Socket Welded
1	Steam Sampling	2	1"	Socket Welded
1	Water Sampling	1	1"	Socket Welded
1	Chemical Feed	1	1"	Socket Welded

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Drum No.	Service	No. of Nozzles	Size	Type of Connection	BOILER DRUMS (Cont'd)
1	Vent	2	1-1/2"	Socket Welded	
1	Gage Glass	4	1-1/2"	Socket Welded	

.2 All flanged nozzles shall be dimensioned in accordance with ASME specifications for 2,500 psig and shall have ring joint facing. Internal piping shall be furnished for feed water, blowoff, boiler-water sampling, chemical feed and continuous blowdown.

.3 Internal surfaces of boiler drums, _____ and Leaders shall be cleaned _____ by Shot blasting

12 Boiler tubes shall be of seamless carbon steel, designed for working pressure of 1725 psig, as follows:

BOILER TUBES

Number	Size	Thickness	Material
216	2-31/32"	.200	SA-210
122	4"	*	SA-210
14	4-1/2"	.480	SA-210
36	5"	.340	SA-210
6	4"	.280	SA-210
24	5.56"	.500	SA-106

* .320" th for connection pass section of 61 inner row tubes.

.280" th for remainder of inner row and complete outer row.

13 Soot-blowing equipment for boiler economizer, superheater reheater and airheater shall be furnished. Soot-blowing equipment shall be Vulcan Soot Blowing Corp manufacture, suitable for outdoor installation. The system shall be automatic, electric sequentially operated, and shall use compressed air as a blowing medium. Blowers shall be driven by electric motors suitable for use with 440 volt, 3 phase, 60 cycle a-c.

SOOT-BLOWERS

SPECIFICATION EBASCO
STEAM-GENERATING UNITS AND ACCESSORIES

Motor starters furnished for these motors shall be combination type with overload protection. Motors shall be in accordance with Ebasco Specification MX-2, revised Nov. 22, 1954; motors for General Service, one copy of which is attached and forms a part of this specification.

SOOT BLOWERS
(Cont'd)

The numbers and types of units which shall be furnished are as follows:

Item 1 - Furnace

- 16 - Model RW-2E, electric motor driven wall blowers complete with two (2) totally enclosed motors, limit switches, NEMA No. 4 local pushbutton stations and size 1 contactors wired to terminal strips in NEMA No. 1A contactor cabinets. Mechanical blowing valve, stainless steel blowing lance, adjustable pressure control included.
- 4 Wall boxes for possible future T-3E Blowers if required.

Item 2 - Reheater and Superheater

- 14 - Model T-3E (4 with 9'-6" travel; 10 with 20'-0" travel) electric driven long retractable units. Each unit complete with alloy lance, stainless steel feed pipe and mechanically operated blowing valve with adjustable pressure control. NEMA No. 4 local pushbutton stations and size 1 contactors wired to terminal strips in NEMA No. 1A contactor cabinets. Two totally enclosed motors and limit switches included.

Item 3 - Airheater Cleaners

- 2 - Model THE electric motor driven, traveling frame air-heater cleaners. Totally enclosed motors, NEMA No. 4 local pushbutton stations, size 1 contactors wired to terminal strips in NEMA No. 1A contactor cabinets, limit switches and low blowing air pressure stop.

Item 4 - Controls for Automatic Sequential Operation

The following controls and indicating devices, to be supplied by Copes-Vulcan and mounted on a panel also supplied by Copes-Vulcan:

- 2 - Electro-controllers mounted in dust-tight boxes and wired to terminal strips.
- 32 - Toggle switches, three positioned (auto-manual-neutral)
- 1 - Master switch, Westinghouse Type W or equal (for electro-controllers.)

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STEAM-GENERATING UNIT AND ACCESSORIES

Item 4 - Controls for Automatic Sequential Operation (Cont'd)

SOOT-BLOWERS
(Cont'd)

- 1 - Low receiver pressure interlock, including pressure switch, light and relay.
- 1 - 4-1/2" Air header pressure gauge.
- 1 - "Low header pressure" interlock including pressure switch, panel mounted warning light and relay (automatically retracts blower in event of low header pressure.)
- 1 - "No blowing air" warning timer relay and panel mounted warning light (automatically retracts, and/or prevents unit from going in furnace without air flowing through lance.)
- 1 - Magnetic overload relay and panel mounted warning light (automatically retracts unit in event of motor overload.)
- 1 - Semi-enclosed, free-standing panel with top, sides or framework, but not including back or doors.
Size approximately 7 ft-6 in. high x 3 ft-0 in. wide.

Item 5 - Piping, Valves and Fittings

- 30 - 2-1/2" branches, Schedule 40 pipe.
- 2 - 4" headers, Schedule 40 pipe.
- 2 - 3/4" Edward drain valves Figure No. 444 Y.
- 1 - 3" - 300 lb standard steel manually operated main snut-off valve.

Necessary pipe hangers and guides

Necessary tubing where required.

Air consumption shall be _____ at 150 and 200 psig, blowing pressure, based on completing one complete blowing cycle in not more than 7 hours. All air piping for soot-blowers integral with and mounted on steam-generating unit shall be furnished by Seller from a single supply connection point. A steel 600 lb standard main shut-off valve at this point, furnished by Seller, shall be Purchaser's connection. Special soot-blowing equipment shall be furnished as follows:

Local pushbuttons shall be for outdoor service and combination motor starters and selectromatic control panel for automatic sequential operation shall be for indoor service.

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SPECIFICATION EBASCO
STEAM-GENERATING UNIT AND ACCESSORIES

- 14 Steam washer or scrubber shall be provided in steam drum of boiler with separators, driers, baffles, hoods, internal feed piping and sampling connections designed to limit the total solids carryover in the steam to 1 ppm.

STEAM WASHER

Arrangement and fabrication of this internal equipment shall be designed to permit removal and replacement through manhole. Drum shall be shipped with internals fully installed.

- 15 Water column equipment shall not be provided. One gauge glass, Diamond Bi-Color with 15 in. vision, with solid tie bars, shall be furnished, for one end of steam drum. One gauge glass, Yarnall-Waring gauge 4190, including Type M illuminator with a mercury vapor lamp shall be furnished on the other end of steam drum. In addition, each side of steam drum shall be connected to a remote level indicator and recorder furnished by Purchaser. All water gauges and instruments shall include internal illumination and necessary shut-off valves. Chain on gauge glass valves shall extend to first platform below steam drum for operation. No vision ducts, mirrors, or floor stands are required. Gauge glass on right side of boiler shall be arranged so as to be suitable for installation of television set. Adequate platform space shall be provided for installation of the television equipment.

WATER COLUMNS

SPECIFICATION EBASCO
STEAM-GENERATING UNIT AND ACCESSORIES

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- 16 Furnace-wall cooling shall consist of surface arranged as shown by Seller's drawing No. Final Drawing 9029F P5-25528-16XD and as scheduled hereinbelow. (Only those tubes exposed to radiant heat of furnace and unscreened by having other tubes between them and furnace shall be considered as contributing to furnace-wall cooling. Method of computing cooling area shall be as set forth in note below.)

FURNACE-WALL
CONSTRUCTION

- .1 Furnace-cooling tubes, as scheduled below, shall be 2-31/32 in. od .200 in. wall thickness, Specification ASME SA-210 Type carbon steel for working pressure of 1725 psig, unless otherwise noted:

<u>Location</u>	<u>Type of Tube and Surface</u>	<u>Number of Tubes</u>	<u>Spacing</u>	<u>Total Linear Ft</u>	<u>Sq Ft Heating Surf*</u>
Front	Bare	160	3"	90	2949
Front					
Side (2)	Bare	198	3"	90	4800
Platten	Bare	182	3"	67	6700
Roof	Full & Flat Stud	80	6"	25	1012
Rear	Bare	158	3"	105	2420
Division	Bare	101	3"	90	4544
Total					23,948

- a Bare tubes spaced to afford substantially tangent contact with each other are based on projected area. Surface of floor tubes in pulverized-fuel furnaces to be included down into ash discharge hopper or sluiceway to point where such tubes become vertical or tangent to a vertical plane.

*Note-Heating surface comprising furnace-cooling areas, if made up of bare tubes or tubes with block or chrome cement facing, shall be computed as follows:

SPECIFICATION EBASCO
STEAM-GENERATING UNIT AND ACCESSORIES

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- b Bare tubes spaced 1-1/2 diameters or more apart and backed by refractory: external surface area per foot of length times total linear feet.
 - c Bare tubes so arranged that gases pass transversely across tubes (as in front bank of boiler tubes): computed as under (b).
 - d Tubes with metal block facing or faced with chrome or cement: computed as under (b).
- .2 Water-wall headers, as scheduled below, shall be designed for working pressure of 1725 psig. Material shall be of Specification ASME SA-106B for lower headers and upper headers.

FURNACE-WALL
CONSTRUCTION
(Cont'd)

<u>Header</u>	<u>Shape of Section</u>	<u>Size</u>	<u>Thickness</u>
<u>Lower Side</u>	<u>Round</u>	<u>14" OD</u>	<u>1-7/8</u>
<u>Conv Pass</u>	<u>Round</u>	<u>11-3/4"OD</u>	<u>1-1/2</u>
<u>Upper Side</u>	<u>Round</u>	<u>14" OD</u>	<u>1-7/8</u>
<u>Lower Front</u>	<u>Round</u>	<u>14" OD</u>	<u>1-7/8</u>
<u>Upper Front</u>	<u>Round</u>	<u>14" OD</u>	<u>1-7/8</u>
<u>Lower Rear</u>	<u>Round</u>	<u>14" OD</u>	<u>1-7/8</u>
<u>Lower Div. Wall</u>	<u>Round</u>	<u>14" OD</u>	<u>1-7/8</u>
<u>Upper Div. Wall</u>	<u>Round</u>	<u>14" OD</u>	<u>1-7/8</u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>
<u> </u>	<u> </u>	<u> </u>	<u> </u>

Handhole covers shall be removable through each individual handhole opening, located to be readily accessible from outside of boiler setting.

- 17 Superheater shall consist of 39,306 sq ft of heating surface and of continuous tube, drainable type. Steam temperature control shall be provided by means of proportioning dampers and gas recirculation. Emergency control shall be by means of spray desuperheater between the primary outlet and secondary inlet. The set point at which the spray will begin to operate is 1005 F Steam Temp

SUPERHEATER

- .1 Superheater tubes as listed below shall be designed for working pressure of 1725 psig.

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STEAM-GENERATING UNIT AND ACCESSORIES

Section	Size Inches OD	Thickness	ASME Spec	Row	SUPERHEATER (Cont'd)
Primary	2-1/4	.18	CR 1/2	1-4	
	2-1/4	.22	SA-210	5-8	
	2-1/4	.20	SA-210	9-14	
	2-1/4	.18	SA-210	15-28	
	2-1/2	.18	SA-210	29-56	
Secondary	2-1/2	.20	CR 1/2	1-3	
	2-1/2	.22	CR 1/2	4-6	
	2-1/2	.23	CR 1/2	7-8	
	2-1/2	.22	CR 1-1/4	9-10	
	2-1/2	.24	CR 1-1/4	11-12	
	2-1/2	.28	CR 1-1/4	13-14	
	2-1/2	.33	3M	15-16	
	2-1/2	.35	3M	17	
	2-1/2	.51	CR 5	18	
	2-1/2	.42	3M	19-20	
	2-1/2	.33	3M	20A	

- .2 Maximum tube skin temperature that will obtain at 852 000 lb per hr steam output shall not exceed:

Specification	Temp Control In Operation	Temp Control Not in Operation
CR 5	1150	1150
3M	1125	1125
CR 1-1/4	1050	1050
CR 1/2	975	975

- .3 Superheater headers shall be as listed below:

Section	Size	Thickness	Specification ASME
Primary Inlet	14" OD	1-3/8	SA-106B
Primary Outlet	14-1/2" OD	1-7/16	SA-335-P-11
Secondary Inlet	15" OD	1-9/16	SA-106C
Secondary Outlet	19" OD	2-5/8 *	SA-335P-11

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STEAM-GENERATING UNIT AND ACCESSORIES

- .4 Superheater headers shall be provided with openings as required for inspection purposes. All openings shall be closed by means of welded caps.

SUPERHEATER
(Cont'd)

- 18 Reheater shall consist of 30,120 sq ft of heating surface and of continuous tube, drainable type. Steam temperature control shall be provided by means of proportioning dampers and gas recirculation. Emergency control shall be by means of spray desuperheater in the reheat inlet header.

REHEATER

- .1 Reheater tubes, designed for working pressure of 480 psig shall be as follows:

Reheat Superheater

<u>Row</u>	<u>Thickness</u>	<u>Size OD</u>	<u>Material</u>
1-3	.23	2-1/4	CR 5
4-6	.15	2-1/4	CR 2-1/4
7-9	.12	2-1/4	CR 1-1/4
10-15	.11	2-1/4	CR 1-1/4
16-21	.11	2-1/4	CR 1/2
22-24	.15	2-1/4	SA-210
25-27	.13	2-1/4	SA-210
28-30	.11	2-1/4	SA-210
31-60	.11	2-1/2	SA-210

* Welding detail to be similar to Purchaser's weld end details, which are based on latest Pipe Fabrication Institute standards.

- .2 Reheater headers shall be as follows:

<u>Section</u>	<u>Size</u>	<u>Thickness</u>	<u>Specification ASME</u>
<u>Inlet</u>	<u>16-1/2" OD</u>	<u>7/8</u>	<u>SA 106B</u>
<u>Outlet</u>	<u>19-1/4" OD</u>	<u>1-13/16</u>	<u>SA-335P-11</u>
_____	_____	_____	_____
_____	_____	_____	_____

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SPECIFICATION EBASCO
STEAM-GENERATING UNIT AND ACCESSORIES

- .3 Maximum tube skin temperature expected at 852 000 lb
per hour steam output shall not exceed:

REHEATER
(Cont'd)

Section	Temp Control In Operation	Temp Control Not In Operation
RH	1150	1150

- 19 The complete steam temperature control system shall consist of three elements, namely, gas recirculation, dampers and spray desuperheaters (emergency use only). Remote indicators for damper and desuperheater valve position will be furnished by Purchaser. The gas recirculation feature provides increased volumes of gas flow through the unit at lower loads, by means of fans which take suction from the discharge of the Induced Draft Fans and inject gas into the furnace, near the top. The dampers automatically bypass and proportion gas flow through the secondary and primary superheater and reheater sections. The spray desuperheaters feature provides for water injection in both the superheater and reheater. In the superheater the spray will be located between the primary outlet and the secondary inlet. In the reheater the spray will be located ahead of the reheater inlet on the boiler in Purchaser's piping. Normally the sources of spray water will be boiler feed discharge for superheater and No. 1 high pressure 4th stage extraction feed water heater shell drains for reheater. Alternate source for reheater will be boiler feed discharge.

STEAM
TEMPERATURE
CONTROL

Spray service - the valves for the reheater desuperheater must be capable of taking water from either source and reducing its pressure and also must be capable of automatically shifting from low to high pressure source when spray is required and high pressure heater drains are no longer available.

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Approximate pressures and temperatures of spray water are
as follows:

STEAM
TEMPERATURE
CONTROL
(Cont'd)

Superheater Spray

Reheater Spray

H P Heater No. 1 In Service

1950 psig - 260 F at full load
Pressure increases 10 psi for
each 50,000 lb/hr reduction
in feed water flow. Shut-off
head on boiler feed water
system is 2045 psig.

610 psig - 450 F at full load
Pressure varies directly with
load.

H P Heater No. 1 Out of Service

1950 psig - 260 F at full load
Pressure increases 10 psi for
each 50,000 lb/hr reduction
in feed water flow. Shut-off
head on boiler feed water
system is 2045 psig.

1950 psig - 260 F at full load
Pressure increases 10 psig for
each 50,000 lb/hr reduction
in feed water flow. Shut-off
head on boiler feed water
system is 2045 psig.

The basic control of steam temperature over the range from
650 000 to 852 000 lb/hr of steam will be by gas recirculation.
The surfaces in the unit are proportioned so that at 852 000 lb/hr
of steam no gas recirculation will be required. At 650 000 lb/hr
of steam the quantity of gas recirculated for lignite or gas will
be approximately the same. At 852 000 lb/hr of steam it is probable
that a small quantity of spray desuperheating will be required, but
under normal conditions this will be only in the superheater, since
the proportioning dampers will control the reheater outlet tempera-
ture at the desired level. Under emergency conditions, such as
with top high pressure extraction feed water heater out of service,
full capacity can be obtained by the use of spray desuperheating
in the superheater and reheater. Dampers shall be fabricated of
material suitable for temperatures encountered.

.1 Control shall be designed as specified below:

- a Control range, superheated
steam output (either fuel) 650 000 to 852 000 lb/hr
- b Maximum gas temperature leaving economizer (primary fuel)
664 F
- c Final superheated and re-
heated steam temperatures 1005 F

SPECIFICATION EBASCO
STEAM-GENERATING UNIT AND ACCESSORIES

- .2 Dampers shall be adapted for automatic control to be furnished by Seller. Dampers shall be constructed of Steel. Torque required Varies ft/lb per damper. (See drawings)
- .3 Steam-temperature controller-recorder shall be furnished by Seller and shall be of Bailey Meter Co manufacture, arranged for panel mounting, internally illuminated and provided with standard mounting. Controller shall be provided with remote pushbutton station and damper-position indicator for mounting on BTG Control Board.
- .4 Controls and instruments furnished by Seller shall also include the following:
- 2-WM55A Model E-101, Class QOPA Bailey Meter SH Steam Temp. Recorder-Controller with Resist Element Protecting Well, Connecting Head & Ext Nipple.
- 1-WM55A Model E-101 Class QOPA Bailey Superheater Temperature Recorder-Controller with Resist Element Protecting Well & Conn. Head as follows:
- To - Record Final Superheat Steam Temperature. Establish Superheat Steam Temperature Pneumatic Signal
- 1-Class AP Bailey Boiler Load Index Controller (Steam Flow) for installation in the Steam Flow Meter to be furnished by the Purchaser.
- 1-CE35T Class 1AP16QX Gas Temperature times Totalized Mass Gas Flow Recorder-Controller (two cases), as follows:
- To - Measure and totalize Mass Gas Flow compensated for Flue Gas Temperature variations
- Establish Gas Temperature times Totalized Mass Gas Flow Control Pneumatic Signal
- 1-WM55A Model E-101 Class QOPA Bailey Reheat Steam Temperature Recorder-Controller with Resist Element, Protecting Well, Conn. Head & Ext. Nipple, as follows:
- To - Record Reheat Steam Temperature.
- 1-KM55A, Model E101 Class 8800 Bailey Meter Recorder
- To - Record Final SH Steam Temp. & Reheat Steam Temp.
- 1-Set of required Bailey Mini-Line Control Accessories
- 1-Set of required Bailey Mini-Line Selector Valves
- 2-AS2100 Bailey Mini-Line Superheat Desuperheating Water Flow Manual Loaders

STEAM
TEMPERATURE
CONTROL
(Cont'd)

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STEAM-GENERATING UNIT AND ACCESSORIES

STEAM
TEMPERATURE
CONTROL
(Cont'd)

- 2-YWFS Class 9B Superheat Desuperheating Water Flow Control Valve
- 1-YWFS Class 9B Superheat Desuperheating Water Flow Shut-off Valve
- 1-AC68P Model 300 Bailey Recirculating Gas Flow Damper Control Drives
- 1-AC816P Model 300 Bailey Fan Shut-off Damper Control Drives
- 2-AC816P-300 Bailey Gas Distribution Damper Control Drives
- 2-AS2100 Bailey Mini-Line Reheat Desuperheating Water Flow Manual Loaders
- 2-YWFS Class 9B Bailey Reheat Desuperheating Water Flow Valves
- 1-Bailey 30 CFM Air Filter and Pressure Reducing Valve Set, unassembled, complete with piping
- 2-YWFS Class 9B Bailey Meter Reheat Spray Desuperheater Water Flow Shut-off Valves, one High Pressure & one Low Pressure
- 1-YWFS Class 9B Bailey Meter Reheat Desuperheating Water Flow Valves

.5 Other features of design shall be as described below:

Provisions for sprays, as mutually agreed upon, will be included. The spray equipment shall be designed to handle water from two sources and at various pressures, as specified in Section 20. Equipment shall be Bailey Meter Co manufacture, arranged to automatically operate at a predetermined steam temperature, to inject water into the superheater and reheater to maintain final steam temperatures at 1005 F. Spray valves shall be operated by Air Pressure

- 20 All tube joints for water and steam to drums or headers shall be welded. Rolled joints will not be used. Weld end preparation shall be of the steel backing ring design. Ceramic backing rings to be used in high heat input zone near burners approximately (30 ft).

TUBE JOINTS

- 21 Economizer shall consist of 19,823 sq ft of heating surface and shall be of the continuous tube type.

ECONOMIZER

.1 Construction features shall be as follows:

- a Type of tubes Seamless
- b Number of tubes wide 120

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c	Number of tubes high	<u>19</u>	ECONOMIZER (Cont'd)
d	Horizontal spacing	<u>4 in.</u>	
e	Vertical spacing	<u>3 in.</u>	
f	Tubes		

Material	<u>SA-210</u>
Diameter, outside	<u>2-1/2 in.</u>
Thickness	<u>.180 in.</u>
Length	<u>14'-0" in.</u>
Design pressure	<u>1800 psig</u>

g Baffling material Enco

- .2 Hinged doors shall be provided for inspection and maintenance. For outdoor service, casing shall be weather-proofed with metal-clad insulation.
- .3 Feed water inlet connection shall be 10 in Sch 120

22 Airheater shall be of tubular type, with 1 gas pass and encased in gas tight insulated steel casing.

AIRHEATER

- .1 Construction features shall be as follows:

a	Tube material	<u>welded elements</u>	
		<u>High Temp Sect</u>	<u>Low Temp Sect</u>
b	Tube size	<u>2 in.</u>	<u>3 in.</u>
c	Tube thickness	<u>14 ga in.</u>	<u>11 ga in.</u>
d	Tube effective length	<u>39 ft</u>	<u>11 ft</u>
e	Number of tubes	<u>11,775</u>	<u>4,785</u>
f	Heating surface	<u>240 000 sq ft</u>	<u>41,330 sq ft</u>
g	Total heating surface		<u>281,330 sq ft</u>
h	Tube sheet material	<u>steel</u>	

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AIRHEATER
(Cont'd)

Pushbutton stations shall be for outdoor service. Motor starters shall be combination type with overload protection, for indoor service. Motors shall be in accordance with Ebasco Specification MX-2, revised Nov. 22, 1954, motors for General Service, one copy of which is attached and forms a part of this specification.

23 Steam coils for preheating forced draft fan discharge air shall be of non-freeze type, manufactured by Westinghouse Electric Corp. Coils shall be designed to maintain air-heater cold end temperature above the dew point over the full range of operation, on the basis of -20F ambient outdoor air temperature and a sulphur content of 2 per cent in the fuel being burned. All control valves for coil steam supply and drain will be furnished by Purchaser.

AIRHEATER
STEAM COILS

- 30 -

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- | | | | |
|-----|---|---|--------------------------------------|
| .8 | Tube design pressure | <u>250</u> psig | AIRHEATER
STEAM COILS
(Cont'd) |
| .9 | Tube design temperature | <u>500</u> F | |
| .10 | Steam supply to tubes | | |
| | Normal | <u>Bleed steam at 38.9 psia & 265.6F;
pressure varies directly with load.</u> | |
| | Alternate | <u>Saturated Steam at 10 psig and 365 F</u> | |
| 24 | Coal-burning equipment shall include twelve multi-tip vertical intertube type pulverized coal burners, each capable of burning <u>8340</u> to <u>10,230</u> lb per hour of coal of characteristics specified in paragraph 6. | | PULVERIZED
COAL
BURNERS |
| | .1 Design of coal burners shall be such as to permit the use of primary air as a small part of total air required, to insure stability of ignition, and to afford control of length and shape of flame. | | |
| 25 | Four No. 550 duplex coal pulverizer mills, manufactured by Riley Stoker Corp, will be furnished by Purchaser. The predicted performance of the mills, in regard to amount and temperature of primary air required, mill discharge temperature, etc, is given below. | | PRIMARY
AIR DATA |

CONSTANT TOTAL MOISTURE OF 24 PER CENT (INCLUDING CONSTANT
SURFACE MOISTURE OF 6 PER CENT) IN COAL ENTERING MILL

	Low range of superheat and reheat temperature control-steaming rate = 650 000 #/hr		Maximum continuous load-steaming rate = 852 000 #/hr	
No. of mills operating	4	3	4	3
#/hr coal to each mill	25,250	33,667	30,675	38,000
#/hr primary air required by each mill	53,000	52,000	52,500	50,000
Temp primary air required at mill-F	534	535	535	535
Temp of coal-air mixture leaving mill-F(from Riley predicted performance curves)	184	168	174	160

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	Low range of superheat and reheat temperature control-steaming rate = 650 000 #/hr		Maximum continuous load-steaming rate = 852 000 #/hr	PRIMARY AIR DATA (Cont'd)
Total moisture evaporated-per cent (from Riley predicted per- formance curves)	13.4	9.8	11.1	8.0
Moisture in coal- air mixture leaving mill-per cent	10.6	14.2	12.9	16.0

PULVERIZER DISCH TEMP VS FEED RATE
WITH VARYING SURFACE MOISTURE -
18 PER CENT CONSTANT INHERENT MOISTURE -
PRIMARY AIR TEMP 535 F

Coal to Mill, #/hr	25,250	30,675	33,667	38,000
-----------------------	--------	--------	--------	--------

Surface Moisture, Per Cent	Approx Disch Temp, F			
7	175	165	160	155
8	165	160	155	150
9	155	150	145	-
10	150	145	140	-
11	145	140	-	-

Primary air pressure at the boiler manufacturer's work
termination point in the ducting will be 4.0 in H₂O.

- 26 Burners shall be of Babcock & Wilcox Co, manufacturer for
burning natural gas. Twelve required for each boiler, in-
cluding windbox. GAS BURNERS

.1 Performance, based on conditions as given in paragraph 5,
shall be as follows:

	Gas
a Capacity, total	<u>1,240</u> Mcf/hr
b Maximum pressure	<u>7.5</u> psig
c Minimum pressure	<u>1.0</u> psig
d Range, each burner without changing tips	<u>85,800 CFH & 103,200 CFH</u>

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- GAS BURNERS
(Cont'd)
- .2 Construction features shall be as follows:
- | | | |
|---|--------------------------|---|
| a | Type of gas burners | <u>Multi-tip vertical intertube</u> |
| b | Arrangement of burners | <u>Two rows of six each</u> |
| c | Windbox, size | <u>To suit</u> |
| d | Windbox, thickness plate | <u>3/16 in.</u> |
| e | Windbox, insulation | <u>3" Thermobestos, applied</u>
<u>internally, and No. 20 U S</u>
<u>S gauge black iron lagging</u> |
- .3 Starting shall be accomplished by means of lighting off torches using natural gas fuel. A maximum fuel quantity of 3180 cu ft* per hr shall be required at 2.5 psig* maximum at lighter.
- .4 Minimum stable pressure .75 psig
- .5
- .6 Gas piping from burner connection shall include flexible metallic piping. Purchaser's piping will be anchored to boiler steel.
- 27 A remote manual gas ignition system shall be furnished, as follows:
- IGNITION
SYSTEM
- | | | |
|----|---|------------------|
| .1 | Number of torches | <u>12</u> |
| .2 | Required input to furnace by each torch to maintain stable lignite flame | <u>3180 cfh*</u> |
| .3 | Capacity each torch | <u>3180 cfh*</u> |
| .4 | Maximum gas pressure | <u>2.5 psig*</u> |
| .5 | Minimum stable gas pressure | <u>7.5 psig*</u> |
| .6 | Accessories: transformers, pushbuttons, contactors, high voltage cable, spark plugs, solenoid operated diaphragm actuated shut-off and vent valves, strainers, pressure switch and pipe hangers. Contactors and solenoid valves operate on 115 volt, 60 cycle a-c. Ignition transformers are 60 cycle a-c, with 115 volt primary and 10 000 volt secondary. | |

* Calculated at atmospheric pressure at 5130 ft elevation above sea level.

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- .7 Torches shall be arranged in groups of three to serve one complete mill. Each group shall have one main solenoid pilot valve to function one air operated shut-off valve and one air operated vent valve. IGNITION SYSTEM (Cont'd)
- 28 Dust separator shall be the mechanical, multi-tubular, Design 512RWS12Wx5-1/3 H (3 x 13) 2496 type, manufactured by The Aerotec Corp. DUST SEPARATOR
- .1 Unit shall be enclosed in a shell of 3/16 in., steel plate reinforced to withstand a maximum negative pressure of 16.0 in. of water.
- .2 Tube size and material 5 in. ID, white cast iron.
- .3 When operating at the maximum continuous steam load of 852 000 lb per hr, unit shall be capable of handling 1,282,000 lb of gas per hour at an inlet gas temperature of 305 F with guaranteed performance as follows:
- a Collection efficiency shall be 87.4% based on a typical dust having the following analysis:

<u>Particle Size,</u> <u>Microns</u>	<u>Average Particle</u> <u>Size, Microns</u>	<u>Amount in Gas</u> <u>Stream, Per Cent</u>
+ 60	60	3
- 60 + 40	50	5
- 40 + 30	35	6
- 30 + 20	25	13
- 20 + 15	17.5	11
- 15 + 10	12.5	20
- 10 + 7.5	8.75	12
- 7.5	3.75	30

- b Draft loss not to exceed 3.0 in. of water.
- .3 When operating under the conditions as specified in paragraph .2 above, expected dust concentration shall be as follows:
- a At inlet to separator 4.14 lb dust per 1000 lb gas
- b At outlet from separator .52 lb dust per 1000 lb gas

Insulation material
used in construction
of boiler

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- .4 Separator shall be provided with four 3/16 in. steel plate dust hoppers. Each hopper outlet shall be flanged and drilled for connection to Purchaser's ash disposal system. Hoppers shall have a total storage capacity of 1764 cu ft, equivalent to approximately 15 hours operation at full load
- .5 All hoppers shall be provided with one 15 in. by 13 in. insulated cast iron door.
- .6 Supports shall be furnished by Babcock & Wilcox Co
- .7 Unit shall be insulated with 1" 85 per cent magnesia and No. 18 U S S gauge black iron lagging.
- .8 Seller shall incorporate into the design of the dust separator, with the approval of the Purchaser, a sufficient number of test instrument connections properly sized and located in order to test the efficiency of the unit in accordance with the ASME "Test Code for Dust Separating Apparatus," dated December 1941, or latest revision thereof.
- 29 .1 Boiler unit shall be installed outdoors; firing aisle and ends of steam drum shall be housed and top protection from weather shall consist of roof constructed of Flexicore Roof Slabs furnished by Seller. Casing design and details shall be suitable for exposure as determined by conditions of installation specified hereinbefore.
- .2 Steam generator shall be furnished with an insulated steel-encased setting completely enclosing unit of outdoor construction. Refractories and insulation shall be furnished in accordance with subjoined general description.
- a Furnace side and front walls - 1" K-20, and 2-1/2" 85 per cent magnesia.
- b Furnace roof and rear wall - 1" K-20.
- c At burners - 1" K-20 & PCO in full stud area.
- d Side walls, connection section - 1" K-20, and 2-1/2" 85 per cent magnesia.
- e Rear walls, connection section - 1" C Tile, 2" K-20 and 6-1/2" med temperature block.
- f Furnace hoppers - 1" K-20.

DUST
SEPARATOR
(Cont'd)

SETTING

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- SETTING
(Cont'd)
- g Furnace hopper closure - 2-1/2" Mineral wool blanket
 - h Steam drum - 3-1/2" M T Block
 - i Flue, boiler to airheater - 1-1/2" M T Block
- 2" M T Block
 - j Induced draft and gas recirculation fans, dust collector, recirculation flue and flues from airheater to dust collector and from dust collector to induced draft fan - 1" 85 per cent magnesia
 - k Hot air ducts - 3" med temp block
 - l Spray desuperheater piping - 2-1/2" high temperature block, 2" 85 per cent magnesia and Flexstone coating
 - m Saturated steam piping connections - 3" med temp and Flexstone coating
 - n Pulverized coal burner approach piping insulated by Purchaser
 - o Insulated pipe enclosure - 3" mineral wool blanket
- .3 All flat surfaces of setting shall be enclosed in substantially air-tight paneled steel casing of 0.141 in. (No. 10 U S S gauge) steel, to be flanged and welded at joints. Reinforcing buckstays shall be furnished to assure rigidity under all conditions of operation. Flanged panel joints shall be made air-tight through the use of air seal cement and method of bolting panels together. All doors in setting shall be air-tight. Horizontal surfaces shall be crowned to insure drainage.
- .4 All joints between pressure parts and steel casing shall be made tight by means of suitable seals
-
- .5 Where drum ends protrude from casing a seal ring shall be used to permit free longitudinal and lateral movement of drum. All external areas of drums shall be insulated and enclosed in formed steel casing.
- .6 Tile and insulation shall be supported from tubes,
headers or pipe as applicable.
- Type of materials, thicknesses and other details of insulation of casing shall be as shown on Seller's Insulation & Refractory Drawings.

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- SETTING
(Cont'd)
- .7 All refractories shall comply with "Specification for Refractories for Heavy Duty Stationary Boiler Service," ASTM C64-49 or latest revision. All standard fire brick shall be manufactured by Denver Fire Clay Co.
- .8 Asbestos rope packing shall be used where expansion joints are required in setting.
- .9 All setting insulation material shall be as manufactured by Construction Specialties Company
-
- .10 All setting doors called for in setting drawings shall be fitted with insulation and/or refractory lining where required and shall be made tight by means of gaskets or otherwise, in order to minimize gas leakage.
- .11 All baffles shall be constructed as shown on Seller's Drawing No. P5-25528-16X0. (Final Dwg 9029 F)
- .12 Insulation on piping shall be governed by Ebasco insulation specification. If possible, Seller shall use construction similar to other plant piping systems.
- 30 Forced-draft fan, 2 required, shall be of Westinghouse Electric Corp. (Sturtevant Division) manufacture, driven by General Electric Company, 1200 rpm motor, furnished by Purchaser. FORCED-DRAFT
FAN

.1 Performance and conditions shall be as follows:

Fuel	Gas	Coal	
Air ratio	<u>13% Excess</u>	<u>26.5 Excess</u>	<u>Test Block</u>
Steam output	<u>852 000</u>	<u>852 000</u>	-- lb/hr
Air temperature	<u>80</u>	<u>80</u>	<u>105</u> F
Air delivered	<u>126 000</u>	<u>142 000</u>	<u>164 000</u> cfm
	<u>462 500</u>	<u>515 000</u>	<u>592 000</u> lb/hr
Static pressure, at inlet	<u>0.0</u>	<u>0.0</u>	<u>0.0</u> in. water
Static pressure, at outlet	<u>10.2</u>	<u>12.6</u>	<u>16.6</u> in. water

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Margin Capacity	-	-	15	%	FORCED-DRAFT FAN (Cont'd)
Head	-	-	32	%	
Power required		400	550	bhp	
Fan inertia	8360	8360	8360	lb ft sq	
Fan speed	1180	1180	1180	rpm	
Efficiency	77.5	79.8*	80	%	
Motor rating	-	-	600	hp	

.2 Construction features shall be as given below:

Type	Centrifugal, Turbo-Vane, Backwardly Inclined Blades, No. 125 TV-10
Housing, type	Double width, double inlet
Connection	Flexible coupling (Fast) with guard
Damper, type	Design 8 inlet vanes and outlet dampers - type
Dampers, Number	2
Bearings	Self-aligning sleeve bearings, air cooled
Controls	Controls on inlet vanes and outlet dampers
Materials	
Housing	Steel welded 3/16"
Impellers	Steel 1/4" SAE 950
Shaft	Steel SAE 104S
Weight	21,400 lb
Torque required	2450 ft lb/fan @ 1180 rpm

- .3 Inlet vanes or dampers shall be arranged for operation by a single power unit, which shall be assembled and demonstrate its capability for closing off air completely. Torque required is 450 ft lb per fan.

* Maximum efficiency point

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STEAM-GENERATING UNITS AND ACCESSORIES

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.4 Special features: Fans furnished with cleanout doors, inlet flares, inlet screens and motor half couplings. Motors, 2 required, for forced-draft fan shall be of Westinghouse Electric Corp (Sturtevant Div.) manufacture, furnished by Purchaser, indoor drip-proof type, each 600 hp, 1200 rpm, 3 phase, 60 cycle, 4000 volt.

FORCED-DRAFT
FAN
(Cont'd)

31 Induced-draft fan, 2 required, shall be of Westinghouse Electric Corp (Sturtevant Division) manufacture, driven by General Electric Company 1,250 hp, 900 rpm motor, furnished by Purchaser.

INDUCED-DRAFT
FAN

.1 Performance and conditions shall be as follows:

Fuel	Gas	Coal	
Air ratio	13% Excess	26.5% Excess	Test Block
Steam output	852 000	852 000	- lb/hr
Gas temperature	310	355	355 F
Gas delivered	259 000	263 000	304 000 cfm
	640 000	616 000	710 000 lb/hr
Static pressure, at inlet	- 12.8	- 13.5	- 17.8 in. water
Static pressure, at outlet	0.0	0.0	0.0 in. water
Margin			
Capacity	-	-	15 %
Head	-	-	32 %
Power required	-	-	1,250 hp
Fan inertia			lb ft sq
Fan speed	880	880	880 rpm
Efficiency	77.4	77.6*	76 %
Motor rating	-	-	1250 hp

.2 Construction features shall be as given below:

Type	Centrifugal, Turbo-Vane, Backwardly Inclined Blades, No. TV-10
Housing, type	2/3 Double width, double inlet
Connection	Flexible coupling (Fast) with guard

* Maximum efficiency point.

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Dampers, type	Inlet and outlet dampers - type	INDUCED DRAFT FAN (Cont'd)
Dampers, Number	<u>4</u>	
Bearings	Self-aligning sleeve bearings, air cooled	
Control	Control on inlet and outlet dampers	
Materials		
Housing	<u>3/16 Steel SAE-1015</u>	
Impellers	<u>1/4 Steel SAE-950</u>	
Blade liners	<u>Steel SAE-950</u>	
Shaft	<u>Steel SAE-104S</u>	
Scroll liners	<u>Steel SAE</u>	

Weight	<u>32,500</u>	lb
Torque required at 880 rpm	<u>6,650</u>	ft lb/fan

- .3 Inlet dampers or louvers and outlet dampers shall be arranged for operation by a single power unit. Torque required is 865 ft lb per fan.
- .4 Special features: Fans furnished with inlet boxes, clean-out doors, blade liners, 3/8" steel scroll liners, insulation studs and motor half couplings.
- .5 Motors, 2 required, for induced-draft fan shall be of General Electric Company manufacture, constant speed, each 1250 hp, 900 rpm, 3 phase, 60 cycle, 4000 volt and shall be furnished by Purchaser.
- .6 The Induced-Draft Fan shall be designed with an allowance of 0.5 in. H₂O in head for future Electrical Dust Collector.

32 Gas recirculation fan, 1 required, shall be of Westinghouse Electric Corp (Sturtevant Division) manufacture, driven by General Electric Company, 300 hp, 900 rpm motor, furnished by Purchaser. GAS
RECIRCULATION
FAN

- .1 Performance and conditions shall be as follows:

	Maximum Recirc	Test Block
Gas Temperature	<u>355</u>	<u>355</u> F
Gas delivered	<u>173 000</u>	<u>199 500</u> cfm
	<u>405 000</u>	<u>466 000</u> lb/hr
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	Maximum Recirc.	Test Block	GAS RECIRCULATION FAN (Cont'd)
Static pressure at inlet	<u>0</u>	<u>0</u> in. water	
Static pressure at outlet	<u>5.0</u>	<u>6.6</u> in. water	
Margin	<u>-</u>	<u>15</u> %	
Capacity	<u>-</u>	<u>32</u> %	
Head	<u>-</u>	<u>32</u> %	
Power required	<u>309</u>	<u>307</u> hp	
Fan inertia	<u></u>	<u></u> lb ft sq	
Fan speed	<u>880</u>	<u>880</u> rpm	
Efficiency	<u>76.5*</u>	<u>68</u> %	
Motor rating	<u>300</u>	<u></u> hp	

.2 Construction features shall be as given below:

Type	Centrifugal, Turbo-Vane Backwardly Inclined Blades No. TV-10
Housing, type	Single width, single inlet
Connection	Flexible coupling, (Fast) with guard
Dampers, type	Outlet dampers - type
Dampers, Number	<u>(1)</u>
Bearings	Self-aligning sleeve bearings, air cooled
Control	Controls on outlet dampers
Materials	
Housing	<u>3/16" Steel SAE-101S</u>
Impellers	<u>5/16" Steel SAE-950</u>
Blade Liners	<u></u>
Shaft	<u>Steel SAE-104S</u>
Scroll Liners	<u>Steel</u>
Weight	<u>16 000</u> lb
Torque required	<u>1850 ft lb/fan @ 880 rpm</u>

* Maximum efficiency point

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- .3 Inlet dampers or louvers and outlet dampers shall be arranged for operation by a single power unit. Torque required is 285 ft lb per fan. GAS RECIRCULATION FAN (Cont'd)
- .4 Special features: Fans shall be furnished with inlet boxes, blade liners, 1/2" steel scroll liners, insulation studs and motor half couplings.
- .5 Motor for gas recirculation fan shall be of Westinghouse Electric Corp (Sturtevant Div) manufacture, constant speed, 300 hp, 900 rpm, 3 phase, 60 cycle, 4160 volt, and shall be furnished by Purchaser.
- 33 System of duct work shall be furnished of subjoined general description; arrangement details shall be in accordance with Babcock & Wilcox Flue and Duct Drawings. DUCT WORK
- .1 Ducts shall be designed for pressures given below:
- | | |
|---------------------------------|--------------------|
| a Cool-air | 16.6 in. water pos |
| b Hot-air | 16.6 in. water pos |
| c Gas to economizer | 9.0 in. water neg |
| d Gas from economizer to ID fan | 11.0 in. water neg |
- Note: Where provision is made for future installation of dust separator equipment, duct design shall be based upon the negative pressure which will then prevail.
- .2 All ducts shall be stiffened and reinforced to withstand positive and negative pressures indicated. Top of ducts shall be crowned to insure drainage. Velocities shall not exceed 3000 fpm at the maximum continuous boiler capacity equal to 852 000 lb steam per hour.
- .3 Shut-off dampers, Automatic type regulating dampers and expansion joints shall be furnished as required. Except for access, duct joints will be welded.
- .4 All duct work shall be insulated with 85% magnesia block insulation, over appropriate layer of med temperature insulation where necessary. Outer covering on boiler breeching is to consist of No. 18 U S S gauge black iron sheet metal attached securely with sheet metal screws, and with joints locked or otherwise arranged to provide a

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weatherproof covering. Necessary stop angles or plates are to be furnished for insulation adjacent to the breeching support structure and access doors.

DUCT WORK
(Cont'd)

- .5 Heat insulation shall be applied to outside of ducts carrying gas and ducts carrying hot air.

- 34 Structural system shall be in general according to Babcock & Wilcox Co Drawing Nos. P5-25528-16X0 and will be completely erected on Purchaser's foundations by Purchaser. Structural steel and structural system shall conform to the following requirements.

STRUCTURAL
AND SUPPORT-
ING STEEL

Design shall be entirely substantial and adequate to take load of all piping in connection with boiler supplied by Purchaser.

- .1 Walkways and stairways shall be provided for access to all parts of steam generator required for operation, inspection and maintenance including the following:
 - a Airheater access platform
 - b Superheater platforms, each side
 - c Main-steam-drum platform, each side
 - d Intermediate platforms, each side, two or more required
 - e Safety valve platform
- .2 Due regard to safety of operation shall be incorporated in design of all structural and supporting steel.
- .3 No field welding shall be allowed unless specifically approved by Purchaser.
- .4 No members shall be designed having rivets in tension, unless approved by Purchaser.
- .5 Working points on trusses, beams, bracing and columns should be concentric.
- .6 Leveling bolts and nuts shall be provided for all column base plates.
- .7 No shear plates or shims on column bases will be permitted.
- .8 Holes for pipe hanger supports shall be shop punched whenever possible.

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- .9 Curb plates and angles shall be furnished and fabricated with the main steel. Field drilling and welding shall be eliminated wherever possible.
- .10 13/16" Diameter holes shall be provided in both flanges of all columns in groups of six holes above each platform (on outboard side of columns only) approximately 12" on center, bottom hole approximately 3" up from platform level and two holes below each platform approximately 1' below steel.
- .11 No diagonal brackets for supporting platforms will be permitted.
- .12 Structural steel for steam-generating unit shall be designed with no increase in allowable unit stresses due to wind loads.
- .13 Design shall be entirely substantial and adequate to take load of all piping in connection with boiler supplied by Purchaser, in addition to vertical gravity loads imposed at connections to Purchaser's station building, elevator structure and louvered fan enclosure plus horizontal wind loads delivered from the station building to the boiler structure, generally in a fore-aft direction.
- .14 All drawings and tracings made by the Seller for the execution of his work shall remain his property except the Purchaser shall have the right to use prints of Seller's design drawings, shop detail drawings and bills of materials for subsequent work or any other work not covered by these specifications.
- .15 In addition to shop detail drawings, Seller shall prepare erection plans which shall show location and erection mark of each member. He shall prepare bills of materials giving number, erection mark and total weight of each assembled member subdivided to show number, size, length, weight and assembly mark of each component part and rivets, bolts and weld metal making up member.
- .16 Certified copies of foundry test reports showing characteristics of material in castings shall be furnished to Purchaser.
- .17 Seller shall make proper arrangements with mills which will roll the material so that Purchaser's inspector may witness rolling of the material, chemical and

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physical tests, and have satisfactory opportunity for thorough surface inspection and gauging of each piece of material after it comes from the mills and prior to loading.

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(Cont'd)

- .18 Seller shall provide, without charge, facilities for Purchaser's inspector to inspect materials and workmanship in Seller's shop.
- .19 When material is erected by other than Seller or his subcontractor and errors by Seller are encountered during erection, Purchaser will correct such errors at Seller's expense. The amount of such back charges, because of defective work, shall be limited to actual labor and material costs and rental charges for equipment used specifically for correcting such defects.

Design, fabrication and erection of all structural steel shall be in accordance with "American Standard Specification for the Design, Fabrication and Erection of Structural Steel for Buildings," ASA A57.1, latest revision, except as noted below:

Seller shall furnish Purchaser with copies of design drawings for structural steel framing and Purchaser's approval must be obtained before design is released for detailing. Seller shall furnish Purchaser with copies of erection drawings for main steel and Purchaser's approval must be obtained before details are released for fabrication.

Seller shall furnish Purchaser with duplicate copies of mill orders for structural steel for the order and these copies shall be forwarded to Purchaser when originals are sent to mill.

Certified copies of mill test reports of each melt of steel shall be furnished to Purchaser before any fabrication is started on the material covered by the report. Acceptance of the reports by Purchaser shall not constitute a final acceptance of the materials, the quality of which these tests are intended to indicate.

All structural steel shall be of riveted construction unless welded construction is specifically agreed to in writing by Purchaser.

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All field connections shall be riveted, except that bolting will be allowed for girts and door and window framing.

All welding, where approved, shall be in accordance with applicable American Welding Society Code.

Design wind load shall be 30 psf, unless otherwise specified.

Structural steel preferably shall be arranged so that temperature of steel is kept below 200 F.

Columns shall be detailed to provide solid bearing at base plates and splices.

Column base plates shall be designed with adequate provision for transferring horizontal shear to foundations.

Walkways shall be not less than 3'-0" wide and stairs shall be not less than 2'-6" wide, except where interference of equipment makes this impracticable. Purchaser's approval of exceptions is required.

Unless otherwise specified, all walkways and platforms shall be of rectangular, welded, non-reversible type grating with 3/16" thick bearing bars spaced 1-3/16 in. center to center and with cross bars spaced not more than 4 in. center to center.

Walkways and platforms shall be designed for a live load of 100 lb per sq ft.

Deflection of grating shall be limited to 1/500 span.

Grating panels shall be removable. Each panel shall be anchored at each supporting member with two (2) anchoring devices. Each device shall consist of a welding stud bolt with hex nut and a steel clip. The stud bolt shall be 1/4" diameter with ordered length equal to depth of grating, flux-filled, and shall be furnished complete with a hex nut. The clip shall be bent steel of 10 ga. thickness, 1" wide and U-shaped to fit between two adjacent bearing bars. The ends of the "U" shall be extended and bent over the top of the bearing bars and down the other sides. Depth of depression shall be approximately 3/4" and depressed portion shall have a 5/16" hole. All bolts, nuts and clips shall be bonderized and painted, and shall be furnished by the grating supplier.

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Grating around columns, major equipment and pipes shall be neatly cut and banded in the shop with bars the same size as longitudinal bars. Banding shall be securely welded to longitudinal bars and there shall be one inch clear distance between banding and columns or equipment. Abrasive nosing shall be provided on grating at head of all stairs.

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(Cont'd)

Stairs shall preferably have a slope of not more than 38 degrees from the horizontal and in no case shall slope exceed 42 degrees. Stair treads shall be grating treads with abrasive nosing.

All grating and stair treads shall be bonderized and painted.

Checkered plates shall be two way safety tread. Provide two 1-1/4 in. diameter lifting holes per plate. Each plate shall be fastened with 1/2 in. diameter countersunk flat head bronze tap bolts spaced not more than 2'-6" on centers. A minimum of four bolts shall be provided.

All handrailing for platforms and stairs shall be fabricated from 1-1/4 in. diameter black iron standard pipe with neatly finished welded joints. Corners shall be bent and not mitered. For horizontal runs intermediate rail shall be 1'-10" above floor level and top rail shall be 3'-4" above floor level. Rails for stair handrail shall be parallel to and located 1'-5" and 2'-9" vertically from nosing line. Vertical posts shall be spaced not more than 6'-0" apart. Handrailing shall be fabricated in panels.

Ladders shall be provided only where access is seldom required or where congestion makes it impossible to use stairs. Ladder side rails shall be 2 in. by 3/8 in. spaced 15 in. apart and rungs shall be 3/4 in. diameter solid rounds spaced 12 in. apart.

Toe guards shall be provided at the edges of all platforms and at openings in platform larger than 12 in. in diameter. Toe guards shall be of steel at least 1/4 in. thick and unless otherwise specified shall extend 5 in. above platform level or to conform to any applicable state or local codes. Curb plates and curb angles shall be neatly finished at corners and ends and shall be shop assembled and attached to supporting steel members wherever practicable.

The Erector will furnish the temporary or fitting-up bolts.

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The Erector will do the touch-up painting but the field painting shall be provided by Purchaser.

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Correction of minor misfits and a reasonable amount of reaming and cutting of excess stock from rivets shall be considered as a legitimate part of erection. Any error in shop work which prevents proper assembling and fitting-up of STRUCTURAL STEEL by moderate use of drive pins and by a moderate amount of reaming and slight chipping or cutting, shall be immediately reported to Purchaser or his representative and approval of correction method obtained before proceeding.

Members shall be erected to a tolerance not exceeding 1 to 1000 with a maximum of 1 in. at the member centerline.

A concrete brick lined stack for Units 1 and 2, 300 ft high above grade and 16 ft inside diameter at the top, will be furnished by Purchaser.

- 35 .1 Piping systems and manifolds shall be supplied for services listed below; if installation is outdoors, protection shall be provided against freezing.
- a All safety-valve relief systems, including drip pan elbows. Piping shall extend upward to an elevation 10 ft above the boiler steel, and shall terminate with 300 lb standard steel flanges to receive Purchaser's mufflers of MM and M or equal design, furnished by B & W.
 - b Power-control-valve relief system, including drip pan elbows. Piping shall extend upward to an elevation 10 ft above the boiler steel, and shall terminate with a 300 lb standard steel flange to receive muffler of MM and M or equal design by B & W.
 - c Boiler to blow-off valves.
 - d Boiler to gauge glasses
 - e Drains from gauge glasses to operating floor.
 - *f Steam drum to sampling coil (steam sampling).
 - g Steam drum to sampling coil (water sampling).
 - h Superheated steam header to sampling coil.

PIPING VALVES
AND FITTINGS

* Stainless steel tubing 1/2" OD x 0.095 in. wall thickness.

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- i Economizer to boiler drum.
- j Soot blower piping system on boiler. Main lines will be brought together at a single point along side of boiler. This single point will be Purchaser's connection.

PIPING VALVES
AND FITTINGS
(Cont'd)

35.2 Miscellaneous valves

	<u>Service</u>	<u>No.</u>	<u>Size</u>	<u>Mfr's Designation</u>
a	Feed valves			
	Globe (angle)	<u>1</u>	<u>10"</u>	<u>Edward 7517Y</u>
	Check (lift)	<u>1</u>	<u>10"</u>	<u>Edward 7594Y</u>
b	Power-control shut-off	<u>1</u>	<u>3"</u>	<u>*Chapman</u> (inlet end butt welded and outlet end flanged)
c	Chemical feed stop	<u>1</u>	<u>1"</u>	<u>Powell 1331 SWE</u>
d	Gauge glass shut-off	<u>4</u>	<u>1-1/2"</u>	<u>Vogt SW-1037</u> (lock type valve)
f	Steam gauge	<u>4</u>	<u>1"</u>	<u>Edward 9484</u>
g	Blowdown			
	Continuous (shut-off)	<u>1</u>	<u>1-1/2"</u>	<u>Edward 948Y</u>
	Continuous (regulating)	<u>1</u>	<u>1-1/2"</u>	<u>Hancock 7105 W</u>
h	Drain			
	Superheater			
		<u>4</u>	<u>1-1/2"</u>	<u>Edward 3924</u>
		<u>4</u>	<u>1"</u>	<u>Edward 948Y</u>
	Gauge glass	<u>4</u>	<u>1"</u>	<u>Edward 944Y</u>
	Water walls	<u>7 sets</u>	<u>1-1/2"</u>	<u>Yarway 3981-3981</u>
	Economizer	<u>1 set</u>	<u>1-1/2"</u>	<u>Yarway 3981-3981</u>
	Reheater	<u>2</u>	<u>1-1/2"</u>	<u>Edward 448Y</u>
	* Pressure seal bonnet.	<u>2</u>	<u>1-1/2"</u>	<u>Edward 2224</u>

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	<u>Service</u>	<u>No.</u>	<u>Size</u>	<u>Mfr's Designation</u>	PIPING VALVES AND FITTINGS (Cont'd)
i	Vent				
	Drum	<u>4</u>	<u>1-1/2"</u>	<u>Edward 948Y</u>	
	Superheater				
	Reheater				
j	Sampling				
	Drum water	<u>2</u>	<u>1"</u>	<u>Edward 948Y</u>	
	Drum steam	<u>3</u>	<u>1"</u>	<u>Edward 948Y</u>	
	steam				
	steam				
k	Fuel gas	<u>12</u>	<u>4"</u>	<u>Nordstrum</u>	
l	Soot blowing air main shut-off	<u>1</u>	<u>3"</u>	<u>Edward 311y</u>	

35.3 Safety valves, as follows, shall be furnished with mufflers.

a	Manufacturer	<u>Consolidated Safety Valve Div of MM&M</u>		
b	For drum			
	Number	<u>3</u>		
	Size	<u>3</u> in.		
	Fittings	<u>Drip pan elbows and gags</u>		
	Fig. No.	<u>1758A (Maxiflow)</u>		
	Setting	<u>1725</u>	<u>1740</u>	<u>1760</u> psig
	Relieving capacity	<u>269,800</u>	<u>272,100</u>	<u>275,200</u> lb/hr
	Type ends	<u>Butt welded</u>		
c	For superheater			
	Number	<u>1"</u>		
	Size	<u>3</u> in.		
	Fittings	<u>Drip pan elbows and gags</u>		
	Fig. No.	<u>(Maxiflow) 1758WD</u>		
	Setting	<u>1630</u>		psig
	Relieving capacity	<u>199,000</u>		lb/hr
	Type ends	<u>Butt welded</u>		

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d For reheater	<u>Inlet</u>	<u>Outlet</u>	PIPING VALVES AND FITTINGS (Cont'd)
Number	<u>4</u>	<u>1</u>	
Size	<u>4</u>	<u>4</u> in.	
Fig. No.	<u>1775WB</u>	<u>1775WE</u>	
Fittings	<u>Drip pan elbows and gags</u>		
Setting	<u>450,455</u>	<u>460,460</u> <u>395</u> psig	
Relieving capacity	<u>758,200</u>	<u>143 000</u> lb/hr	
Type ends	Butt welded		

35.4 Power control valve shall be mounted on superheater outlet header preceded by gate valve and shall be furnished with muffler, as follows:

a Manufacturer	<u>Consolidated Safety Valve Div of MM&M</u>	
b Size	<u>2-1/2</u>	in.
c Setting	<u>1575</u>	psig
d Capacity	<u>125,000</u>	lb/hr
e Switchboard type (remote manual control)		
f Operation on <u>125</u> volt <u>d-c</u>		
g Fig. No.	<u>15,380</u>	
h Type ends	<u>Flanged</u>	

.5 Coils, for cooling samples of boiler water and condensing steam samples shall be supplied as follows:

a Manufacturer	<u>Bailey Meter Company</u>	
b Type and Number	<u>195531A1-Size 8-16-12-x</u>	
c Size	<u>Outer coil 1 in. - inner coil 1/2 in. OD</u>	

.6 One steam gauge shall be provided with snubbers, syphons, shut-off and drain valves, as follows:

a Manufacturer	<u>Ashcroft Gage Division of MM&M</u>	
b Size	<u>12</u>	in.
c Range	<u>0</u> to <u>3500</u>	psig
d Fig. No.	<u>2079-D</u>	

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- 36 The following instrument connections shall be provided
by the Seller with approval of location by the Purchaser:

INSTRUMENT
CONNECTIONS

- .1 Permanent connections, which shall include a test
connection, shall be as follows:

- a Drum pressure
- b Superheater outlet header pressure
- c Furnace draft
- d Draft entering secondary superheater
- e Draft leaving secondary superheater
- f Draft leaving primary superheater and reheater
- g Draft at boiler outlet
- h Draft at economizer inlet
- i Draft at economizer outlet
- * j Draft at induced-draft fan outlet
- k Draft at airheater outlet
- l Draft at dust collector outlet
- m Pressure at forced-draft fan outlet
- n Pressure before airheater steam coils
- o Pressure after airheater steam coils
- p Pressure at windbox
- q Pressure at airheater outlet
- * r Pressure at reheater inlet
- * s Pressure at reheater outlet
- t CO₂ at boiler outlet
- u O₂ at economizer outlet
- * v Temperature feed water to economizer
(thermocouple type)
- w Temperature of feed leaving economizer
(thermocouple type)
- x Temperature secondary superheater inlet steam
(2 thermocouple test and permanent wells)
- y Temperature secondary superheater outlet steam
(2 thermocouple test and permanent wells)
- * z Temperature reheater inlet steam
(2 thermocouple test and permanent wells)

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INSTRUMENT
CONNECTIONS
(Cont'd)

- aa Temperature reheater outlet steam
(2 thermocouple test and permanent wells)
- * bb Temperature steam entering airheater steam coils
- * cc Temperature drains leaving airheater steam coils
- dd Temperature gas at economizer outlet
(thermocouple type)
- ee Temperature gas at boiler outlet
(thermocouple type)
- ff Temperature gas at airheater outlet
(thermocouple type)
- gg Temperature gas across superheater
- hh Temperature air entering airheater steam coils
- ii Temperature air entering airheater steam coils
- jj Temperature air leaving airheater
(thermocouple type)
- kk Temperature in primary air duct before tempering
- * ll Temperature in primary air duct after tempering
- mm Air flow through boiler (2 required)
- nn Gas mass flow

36.2 Test connections as follows shall be provided for taking gas samples:

- a CO₂ at top of first pass
- b CO₂ at boiler outlet
- c CO₂ at airheater outlet
- d O₂ at economizer outlet

37 After thorough cleaning, Seller shall paint all exposed surfaces of boiler drums, headers, tubes, ducts, structural steel, casings, fans, dust separator, airheater and all other parts requiring paint with one priming shop coat of paint as follows:

PAINTING

* Instrument connections in Purchaser's equipment

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<u>Temperatures Involved</u>	<u>Priming Coat Specifications</u>	<u>PAINTING (Cont'd)</u>
Up to 200 F	Federal Specification TT-P-86 (a) Type II red lead paint	
200 to 400 F	Cheeseman-Elliott Co. No. 357 Heat Resisting Gray Primer	
400 to 1000 F	Cheeseman-Elliott Co Hi-Degree Gray Coating	

Before painting, surfaces shall be thoroughly cleaned of all oil, grease, and loose mill scale and rust. Paint shall be applied by brush or spray to surfaces at temperatures of not less than 40 F.

All parts that will be inaccessible after erection shall receive two coats of shop paint.

- | | | |
|----|---|-------------|
| 38 | Sole plates, shims, wedges and leveling steel work on Purchaser's foundations shall be furnished by Seller. Purchaser shall provide and set foundation bolts in accordance with drawings that Seller shall furnish. | SOLE PLATES |
| 39 | Approximate net weight of equipment and accessories shall be as follows, in pounds: | WEIGHTS |

Each drum	<u>186,000</u>
Front water wall	<u>139,777</u>
Rear Water wall	<u>199,187</u>
Side water walls	<u>195,145</u>
Division Wall	<u>110,160</u>
Roof	<u>59,340</u>
Boiler tubes	<u>20,320</u>
Downcomer system	<u>15,560</u>
Airheater	<u>1,491,450</u>
Superheater	<u>428,000</u>
Reheater	<u>184,000</u>
Economizer	<u>257,000</u>
Dust separator	<u>113,000</u>
Total weight of the steam-generating unit (including the above, plus all piping, miscellaneous valves and fittings-excluding operating water)	<u>6,455,000lb</u>

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- 40 Water contents shall be as follows: WATER CONTENTS
- .1 Boiler water, operating at normal drum level 312,000 lb
- .2 Boiler water, flooded for hydrostatic test (cold) 447,000 lb

PROCEDURES

- 41 Seller shall furnish two copies of standard Manufacturer's Data Report covering fabrication of all pressure parts in Seller's and/or Subseller's shops. MANUFACTURER'S DATA REPORTS AND CERTIFICATES

Prior to shipment and following inspection in Seller's Shop of all pressure parts by Hartford Steam Boiler Inspection and Insurance Company's inspectors, who shall be certified by National Board of Boiler and Pressure Vessel Inspectors, Seller shall furnish two copies of Certificate of Inspection. Manufacturer's Data Reports and Certificate of Shop Inspection shall certify that all pressure parts of Steam-Generating Units have been constructed in strict accordance with requirements stated in paragraph 3 hereof, and that inspections made by representative of Hartford Steam Boiler Inspection and Insurance Company discloses that material and workmanship of all pressure parts are in accordance with aforesaid requirements and have the approval of National Board of Boiler and Pressure Vessel Inspectors and Hartford Steam Boiler Inspection and Insurance Company.

- 42 Prints of Seller's drawings listed in part as follows and specified by Character, Number and Date shall be considered a part of these specifications: DRAWINGS

<u>Character of Drawing</u>	<u>Number</u>	<u>Date</u>
Steam generator, side view	<u>9029F</u>	<u> </u>
Steam generator, front view	<u>9026F, 7F, 8F</u>	<u> </u>
Plan section through furnace	<u>9030F, 9031F</u>	<u> </u>

- 43 All flanges, openings and nozzles shall be adequately protected during shipment to prevent corrosion and the entrance of foreign matter. SHIPPING PROTECTION
- 44 Nameplate showing pertinent data concerning steam-generating units shall be furnished, after approval by Purchaser. NAMEPLATES

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45 The following tools shall be furnished:

TOOLS

Wrenches for manhole nuts.

Gags for all safety valves shall be furnished with
the boiler.

Hydrostatic test pump.

EBASCO SPECIFICATION MX-2
Revised November 22, 1954
MOTORS FOR GENERAL SERVICE

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Spec. No. PSCC-C2-102-SG
Date of Spec
October 1, 1958

1. Operating Company PUBLIC SERVICE COMPANY OF COLORADO PROJECT
Station and Project CHEROKEE STEAM ELECTRIC STATION -
1959 - 110,000 KW EXTENSION - UNIT NO. 2
BABCOCK & WILCOX CO
2. This specification covers production line type motors for SCOPE
applications requiring little or no deviation from manufacturers'
regular designs in fractional and integral horsepower sizes.
3. All motors supplied shall be in accordance with this speci- STANDARDS
fication and the applicable Standards of ASA, AIEE and National Board
of Fire Underwriters Rules and in accordance with all state laws and
local ordinances of the place of installation. NEMA standards shall
be conformed to when not in conflict with the foregoing.
4. The Seller shall supply the following information for each SELLER'S
motor included in the "List of Motors" below, plus any motors not listed DATA
which Seller intends to furnish as part of this order.
.1 Name of motor manufacturer
.2 Nameplate data (as stated in NEMA Standard MG1-1949)
5. Data for all motors required shall be as follows: LIST OF
MOTORS

Item No.	** Quan- tity	Service	Loca- tion	** HP	Volt- age	Freq- Phase	** Synch Speed	Enclo- sure*
1		Soot blower element rotating and/or retracting motors	OD		440	60/3		TE

** This information to be completed by Seller and transmitted to Purchaser as
soon as possible.

*Abbreviations: TE - Totally Enclosed; DP - Drip-proof; WP - Weather Protected

6. The above motors shall be supplied in accordance with the APPLICATION
following specific requirements: REQUIREMENTS
- .1 Single phase motors shall have built in thermal protection.
 - .2 Motors rated 440 volts shall have Class A, powerhouse insu-
lation; motors rated 120 volts shall have Manufacturer's
standard Class A insulation.
 - .3 Seller shall supply terminal connectors, Burndy type YAV or
equal, for motor internal leads.
 - .4 Seller shall submit, for Purchaser's approval, 9 copies of
preliminary outline drawings and 13 final approved drawings.

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