

VAPOR/HSI

VAPOR/HSI ELECTRODE BOILERS—

The Industry Standard



HSI HYDRO STEAM INDUSTRIES



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INDUSTRIES

A Vapor Power International Company

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HOW STEAM IS GENERATED BY THE HIGH VOLTAGE "JET FLO[®]" ELECTRODE STEAM BOILER...

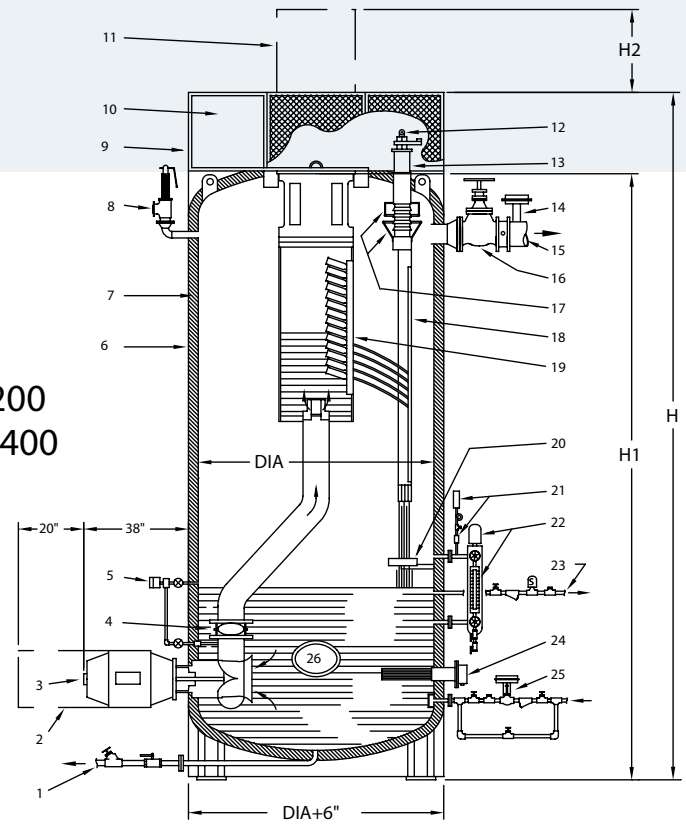
Water from the lower part of the boiler shell is pumped by the internal circulation pump (3) to the nozzle header (19) and flows by gravity through the jets to strike the electrode (18), thus creating a path for the electrical current. As the unevaporated portion of the water flows from electrode (18) to the counter electrode (20), a second path for current is created. Primary voltage connections are made directly to the electrode terminals (12), often eliminating the need for a step-down transformer. At max rated conductivity, approximately 3% of the flowing water is evaporated.

Regulation of the boiler output is accomplished by varying the circulating pump (3) speed, which regulates the amount of water reaching the nozzle header. The pump speed is controlled by the boiler pressure and load control system via a VFD, either to hold the steam pressure constant or to stay within an adjustable KW limit.

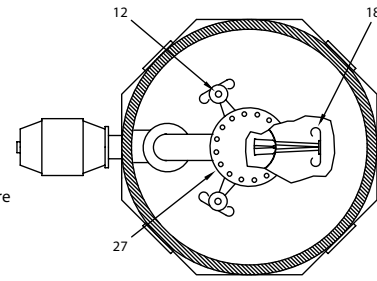
Regulation is stepless between no-load and full-load, so that the boiler output is finitely responsive to demand variation. No load to full load regulation can be accomplished in as little as 5 seconds, although normally this is stretched out to 20-30 seconds.

NOTE: To generate hot water, HSI offers a steam boiler/heat exchanger system consisting of a steam-to-water converter attached directly to the boiler; outputs available range up to 170,000 MBTU/Hr. The advantages of this system is that the condensate from the heat exchanger flows by gravity back to the boiler eliminating the need for a condensate return/deaerator system, which also improves the system efficiency.

BBJ-1200 thru-3400



1. Blowdown Valves
2. Pump Removal Clearance
3. Circulation Pump w/ VFD
4. Check Valve (for 2-pump boilers only)
5. Conductivity Cell
6. Sheet Metal Lagging
7. Insulation
8. Safety Valves (2)
9. Electrode Terminal Enclosure
10. Conduit Entrance Panel
11. Header Removal Clearance
12. Conductor Rod
13. High Voltage Insulators
14. Back Pressure Regulator



15. Steam Outlet
16. Non-Return Valve
17. Insulator Shields
18. Electrode/Strike Plate
19. Nozzle Header
20. Counter Electrode
21. Pressure Manifold & Pressure Gauge
22. Water Column & Sight Gauge
23. Surface Blowoff
24. Standby Heater
25. Feedwater Regulator
26. Manhole
27. Top Cover

PARTIAL TOP VIEW

MODEL NUMBERS, RATINGS & DIMENSIONS – INTERNAL PUMP BOILERS

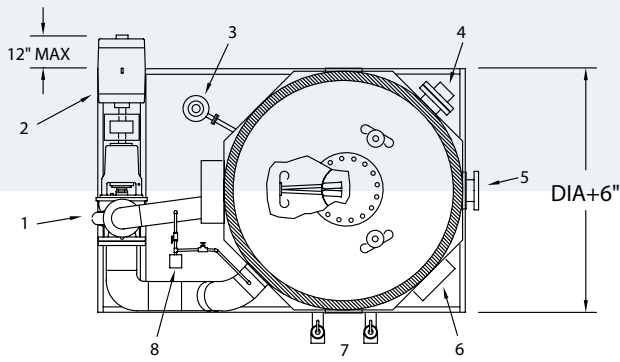
Model Number	Nominal Rating**(KW)			Nominal Rating**(PPH)			Number of Electrodes	Dimensions (inches) @ 13.2KV				Weights (Lbs)***		
	4160V	6.9KV	13.2KV	4160V	6.9KV	13.2KV		Dia	H	H1	H2	Ship	Operate	Flooded
BBJ-1200	3400	6700	12000	11300	22300	40000	6	72	218	194	24	15500	21400	34600
BBJ-1500	3800	7600	15000	12700	25300	50000	6	72	232	208	32	16500	23800	36700
BBJ-1650	4700	9200	16500	15700	30600	55000	6	72	242	218	38	17500	25400	39500
BBJ-1800	5100	10100	18000	17000	33600	60000	9	84	237	210	21	20000	32000	50000
BBJ-2150	6100	12000	21500	20300	40000	72000	9	84	253	226	29	21000	34000	54000
BBJ-2550*	7200	14300	25500	24000	47600	85000	9	84	245	218	35	23000	33000	53000
BBJ-2400*	6800	13400	24000	22600	44600	80000	12	96	236	206	18	24500	40000	67000
BBJ-3000*	8500	16800	30000	28300	55900	100000	12	96	252	222	26	26500	43500	72000
BBJ-3400*	9600	19000	34000	32000	63300	113000	12	102	264	234	32	30000	51500	85000

*These models utilize (2) internal pumps.

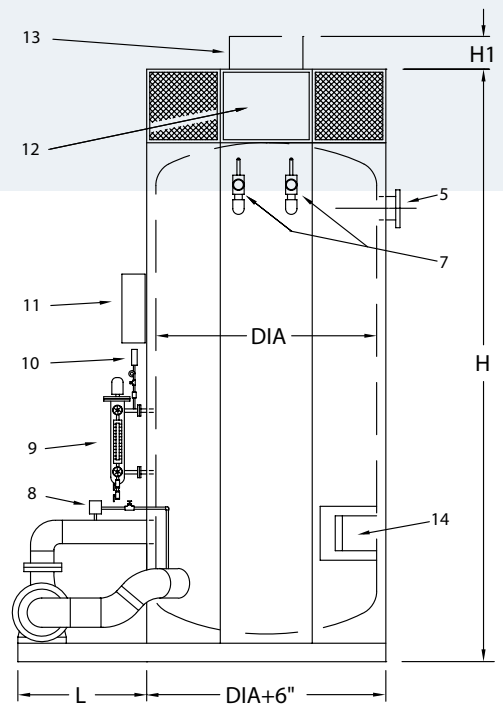
**Ratings are for operation at 150 psi with 220°F feedwater.

***Weights are for 175 psi design pressure.

All models have a turndown ratio of 100:1 and can be limited to a finite maximum KW without decreasing efficiency by more than a fraction of a percent. Normal efficiencies, including pump horsepower loss but excluding blowdown losses, range from 99.5-99.7%.



- 1. Circulation Pump
- 2. Pump Motor w/ VFD
- 3. Water Column
- 4. Standby Heater
- 5. Steam Outlet
- 6. Manhole
- 7. Safety Valves (2)
- 8. Conductivity Cell
- 9. Sight Gauge
- 10. Pressure Controls & Gauge
- 11. I/O Junction Box
- 12. High Voltage Entrance
- 13. Header Removal Clearance
- 14. Manway



BBJ-300 thru-1200L

MODEL NUMBERS, RATINGS & DIMENSIONS – EXTERNAL PUMP BOILERS

Model Number*	Nominal Rating***(KW)			Nominal Rating***(PPH)			Number of Electrodes	Dimensions (inches) @ 13.2KV				Weights (Lbs)****		
	4160V	6.9KV	13.2KV	4160V	6.9KV	13.2KV		Dia	H	H1	L	Ship	Operate	Flooded
BBJ-300	800	1700	3000	2700	5700	10000	3	60	152	6	30	8500	11300	19700
BBJ-450	1300	2500	4500	4300	8300	15000	3	60	172	16	30	9700	13000	22400
BBJ-600L**	1700	3400	6000	5700	11300	20000	3	60	168	24	66	10300	13600	23400
BBJ-600	1700	3400	6000	5700	11300	20000	3	60	186	24	30	10800	14300	24100
BBJ-750L**	2100	4200	7500	7000	14000	25000	3	60	186	32	84	11300	14800	25500
BBJ-750	2100	4200	7500	7000	14000	25000	3	60	200	32	36	11700	15400	26100
BBJ-840L**	2400	4700	8400	8000	15700	28000	3	60	194	38	84	11900	15800	27300
BBJ-840	2400	4700	8400	8000	15700	28000	3	60	210	38	36	12400	16500	28000
BBJ-1050L**	3000	5900	10500	10000	19600	35000	6	66	180	20	84	12700	17800	30600
BBJ-1200L**	3400	6700	12000	11300	22300	40000	6	66	186	24	84	13200	18300	31000

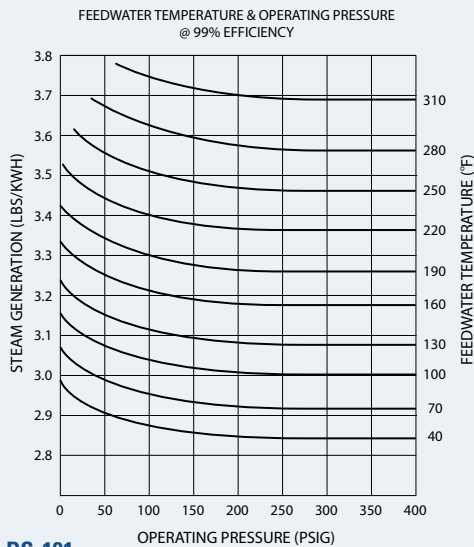
*All of these models utilize external ANSI standard circulation pumps.

***Ratings are for operation at 150 psi with 220°F feedwater.

**Low headroom application, at a premium price – two circ. pumps provided, side by side.

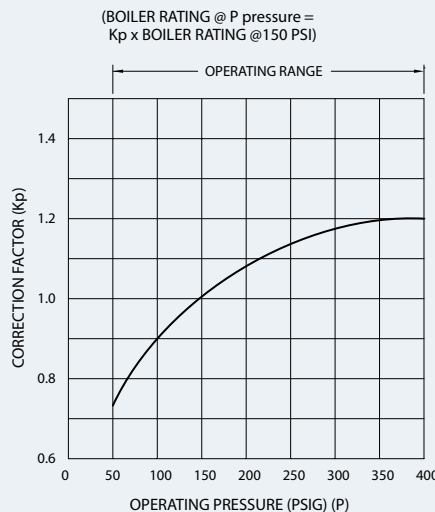
****Weights are for 175 psi design pressure.

STEAM OUTPUT



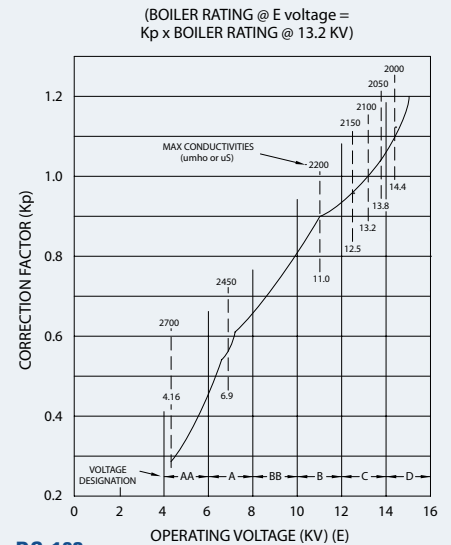
DS-101

PRESSURE CORRECTION FACTOR



DS-102

VOLTAGE CORRECTION FACTOR



DS-103

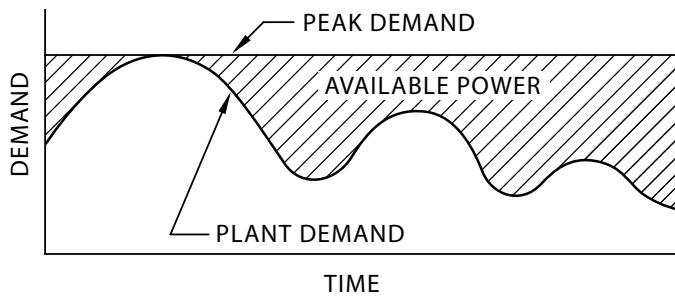
The boiler output for a given installation is dependent on actual feedwater temperature, efficiency (i.e., thermal losses), operating pressure, and supply voltage. The above curves show the effect of these parameters on boiler output and sizing. Continuous output significantly less than rated output is normally achieved by decreasing boiler water conductivity below the max level upon which curve DS-103 is based.

GENERAL SPECIFICATIONS – The HSI High Voltage “Jet Flo” Electrode Steam Boiler consists of a fiberglass-insulated pressure vessel constructed in compliance with Section I of the ASME Code. The vessel, registered with the National Board and furnished with a manufacturer’s Data Report, is fully enclosed in 18 gauge enameled steel panels secured to the boiler by supports welded to the vessel.

All necessary trim and controls are included to provide a complete packaged boiler designed in accordance with ASME, ANSI, NEC, state and local codes. The majority of controls are contained in a Factory-wired floor-standing Nema 12 control cabinet. The basic control system shall incorporate a PLC and HMI, and shall be wired with 16 gauge color-coded stranded copper wire.

HELP SOLVE THE ENERGY PROBLEM BY COUPLING AN ELECTRIC BOILER WITH FOSSIL-FUELED BOILERS AND USING AVAILABLE POWER!

With the electric boiler set at a slightly higher pressure than parallel fossil-fueled boilers, sensing plant demand, and limited to a maximum plant demand set point, competitively priced AVAILABLE POWER can be consumed to effect a flat demand curve.



By using a 2-element control system, the electric boiler would either generate as much steam as allowed by the demand control system or, when steam demand is below what the electric boiler is allowed to generate, be limited by the steam pressure control to a preset steam pressure.

MARKETING FEATURES AND ADVANTAGES

- Power factor correction because of a unity power factor contribution to the plant electrical load.
- Reliable source of steam for areas affected by oil and/or gas shortages, or where coal is either low grade or not available.
- Lower capital investment as compared to oil-fired (75% of installation cost) or coal-fired (10% of installation cost).
- Eliminates need for special boiler room, fuel handling and storage equipment, air handling equipment, preheaters and/or economizers, stacks, flues and emission control equipment, ash handling and disposal facilities, combustion safety systems, noise abatement equipment, plus space and installation costs associated with aforementioned equipment.
- Electric boilers in most states are classified as “unfired steam generators” and as such do not require full operator attendance, thus enabling substantial labor savings.

REFERENCE DATA

10KW = 1.02 BHP = 34 Lbs. Stm/Hr = 34,120 BTU/hr
 1 Gal Water at 62° F = 8.34 Lbs.
 1 Cu Ft Water at 62° F = 62.4 Lbs.
 1 Cu Ft = 7.48 Gal
 1 Ft Water = 0.435 psi
 $KW = \frac{GPH \times \Delta T (^{\circ}F)}{410} = \frac{LPH \times \Delta T (^{\circ}C)}{862}$
 $Amps (3ph) = \frac{Watts}{Volts \times 1.73}$
 Enthalpy of water = Temp (°F) - 32 BTU/LB

Saturated Steam: Pressure vs Temperature

0 psig = 0 KPa = 212°F	125 psig = 862 KPa = 353°F
8 psig = 55 KPa = 235°F	150 psig = 1034 KPa = 366°F
15 psig = 103 KPa = 250°F	200 psig = 1379 KPa = 388°F
30 psig = 207 KPa = 274°F	225 psig = 1551 KPa = 397°F
50 psig = 345 KPa = 298°F	250 psig = 1724 KPa = 406°F
80 psig = 552 KPa = 324°F	300 psig = 2068 KPa = 422°F
100 psig = 690 KPa = 338°F	350 psig = 2413 KPa = 436°F

NOTE: In pursuing our policy of continuous development, we reserve the right to vary any detail shown in this bulletin without notice.

NOTE: Consult local representative or Factory for other Vapor/HSI products, including:
 Electric (resistance element) steam and hot water boilers
 Condensate return systems
 Thermal fluid heaters
 Circulation heaters
 Superheaters

GUARANTEE

Vapor/HSI guarantees all components, except pilot lights, fuses, gaskets and mechanical seals, if found defective in workmanship or material while under normal use and service within the first year of operation or until 18 months after shipment from the Factory, whichever occurs first, after authorized return by purchaser to Vapor/ HSI (at purchaser’s expense) and after examination discloses to Vapor/HSI’s reasonable satisfaction to be defective. The repair or replacement of defective parts will be made by HSI without charge. The pressure vessel, however, is guaranteed for 5 years after shipment. Vapor/ HSI shall not be held responsible for any field charges in connection with the removal or replacement of allegedly defective parts, nor for incidental or consequential damages. This guarantee does not include failure resulting from unsuitable water.

Manufactured by:



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 Franklin Park, IL 60131