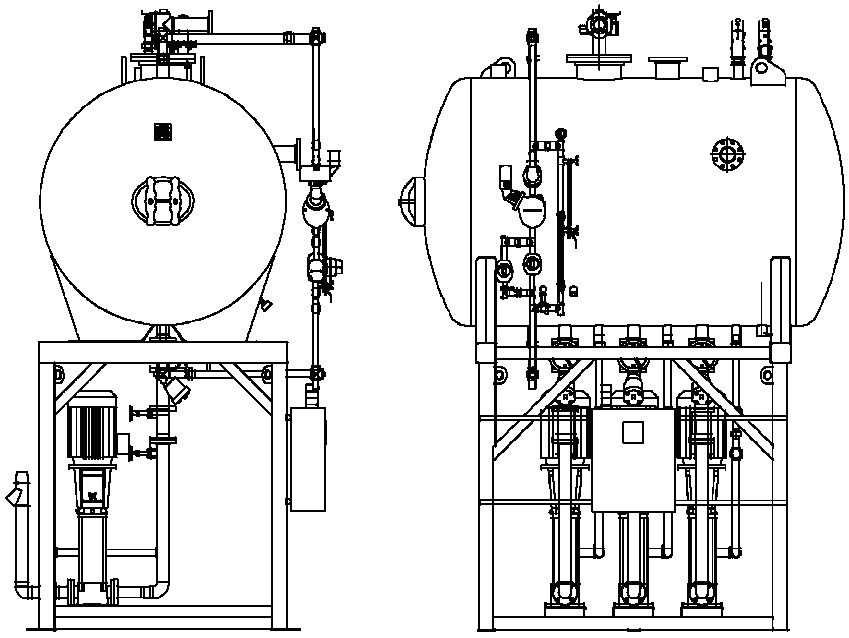
SPRAYMASTER SIGNATURE SERIES DEAERATORS (SINGLE TANK)



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The Cleaver-Brooks designed deaerator assures high purity effluent by removing oxygen and other dissolved gases in boiler feed water. Thus, it is the answer to maintaining long-lasting boiler equipment for industrial and commercial boiler users. The Cleaver-Brooks deaerator is constructed of corrosion-resistant alloys for a long lifetime of service. The deaerator design employs those basic principles of gas removal that have proven to be the most effective and economical means of proper operation. Contact your local Cleaver-Brooks authorized representative for component sizing information.

FEATURES AND BENEFITS

Low Profile Design:

- Low elevation and small footprint allows installation in space restricted areas.

Two-Stage Deaeration in a Common Vessel:

- Recycle pumps are not required.
- Packaged assembly for easy installation and maintenance.

ASME Code Design (Section VIII):

- Assures deaerator vessel quality in materials and fabrication to meet safety requirements.

Internal Stainless Steel Vent Condenser:

- Protects deaerator vessel against corrosive gases while providing a means for removal of these corrosive gases from boiler feedwater.

Self-Cleaning Water Spray Valve:

- Angles associated with the water spray valve assembly and water spray pattern allow deposit-free surfaces to be maintained.
- Reduces maintenance requirements.

Internal Automatic Check Valves Prevent Back Flooding:

- Both the water spray valve and steam atomizing valve are in the normally closed position under no flow conditions.
- Prevents steam back-flow through the water spray valve and water back flow through the steam atomizing valve.

Removable Water Spray Inlet Assembly:

- Flanged assembly allows easy access for maintenance and/or inspections.

Stainless Steel Deaeration Assembly:

- Ensures a longer life of all wetted materials in intimate contact with corrosive liquids and the released corrosive gases.

Pressurized Tank Reduces Flashing and Minimal Venting:

- Recovery of flash steam exhaust and turbine steam.
- Saves BTU's that would normally be exhausted to atmosphere. This in turn improves overall system and plant efficiency.

Auto Vent Valve Eliminates Dissolved Gases at Start-Up:

- Atmospheric contamination virtually eliminated for incoming water.

Exceeds ASME Recommendations for Oxygen Level:

- Guaranteed to remove oxygen concentrations to 0.005 cc/liter while operating between 5% and 100% capacity.
- Carbon dioxide concentrations are practically reduced to zero.

Capacity Not Affected by Mixed Inlet Temperature:

- Consistent performance under variable loads and conditions.

Integral Level Control Automatically Introduces Cold Water Make-Up to Supplement Condensate Only When Necessary to Meet Boiler Demand:

- Saves BTU's by accepting condensate before cold make-up water. Maintains a minimal water level within the deaerator vessel to prevent damage to the boiler feedpumps, and to maintain system operation.

Variety of Tank Sizes to Handle Volume-Swings in Condensate Return:

- Provides flexibility for selecting a tank for specific applications, limiting the loss of hot condensate to drain (minimum offering available is 10 minutes of storage).

Packaged Units for Cost Effective Installation:

- Complete packages are pre-fabricated in the manufacturing facility to ensure piping alignment and control wiring function. The unit is partially disassembled, and match marked for efficient field re-assembly.

Available in Horizontal Configuration:

- Provides adaptability for installation in space restricted areas.

Internal Pump Suction Vortex Breakers:

- Eliminates the problems of loss in NPSHA and cavitation associated with the creation of vortices within pump suction piping.

PRODUCT OFFERING

Information in this section applies directly to Cleaver- Brooks packaged Spraymaster Signature Deaerators ranging from 7,000 to 100,000 pounds/hour. For larger capacities contact your local Cleaver-Brooks authorized representative. The product offering for Spraymaster Signature Series Deaerators is shown in Table H1-1.

Table H1-1. Spraymaster Signature Deaerator Product Offering

MODEL NO.	RATING (LBS/H)	Typical TANK CAPACITY	STORAGE CAP. (MIN)
SS-15	15000	415	10
SS- 30	30000	610	10
SS- 45	45000	1105	10
SS -70	70000	1400	10
SS-100	100000	2485	10

NOTE: Model number designation (example, SM-7) is: SS = Spraymaster Signature Series Deaerator. 7 = 7,000 lbs/hr rating.

Storage capacities greater than 10 minutes are available. Please contact your local Cleaver-Books authorized representative.

The Spraymaster Signature Deaerator is a pressurized low-headroom spray-type deaerator system designed to remove dissolved oxygen in boiler feedwater to 0.005 cc per liter, or less, and eliminate carbon dioxide. A typical deaerator package includes the deaerator tank mounted on a stand of appropriate height along with all operating controls, feed pumps assembled and piped (typically knocked down for shipment and field assembly). The tank conforms to section VIII of the ASME code.

The main deaerating portion is located internally and consists of a water collector cone and steam atomizing valve. Built into a flange on top of the tank is a spring loaded water spray nozzle which includes an automatic and manual vent valve.

Packaged Spraymaster Signature Deaerator systems offer substantial advantages through, lower cost installation and simplified operation and maintenance. Spraymaster Signature Spraymaster Signature Deaerators arrive on site ready for installation and hookup to your water, steam, and electric power connections.

The deaerator stand comes with feed pump/motor set mounted on a base. The base is specially reinforced to prevent vibration wear on vital system components. Rugged square structural tubing combines lasting strength with generous working space for inspection or routine servicing.

Control Panel

The control panel, complete with starters, fuse protection, switches, lights and pre- wired terminal blocks is mounted on the stand assembly. Wiring to feed pump motor and all controls is standard.

Deaerator Tank

ASME construction - certified to 50 psig. All tanks provided with manhole, individual pump suction tappings and other openings as required. Legs are standard on all sizes. Storage in the vessels is designed for a minimum of 10 minutes.

Piping

Pump and motor sets are mounted directly on the base channel.

Individual suction piping (including strainer, shutoff valve, flexible connector) is standard and provided for all feed pumps.

Standard Equipment

- Spraymaster Signature deaerator.
- Deaerator storage tank.
- Deaerator water inlet atomizing valve.
- Deaerator steam inlet atomizing valve.
- Deaerator manual and automatic vent.
- Gauge glass.
- Steam pressure gauge.
- Water temperature thermometer.
- Required tappings.
- Steam pressure reducing valve.
- Optional three valve bypass and strainer (PRV).
- Water level controller with make-up valve.

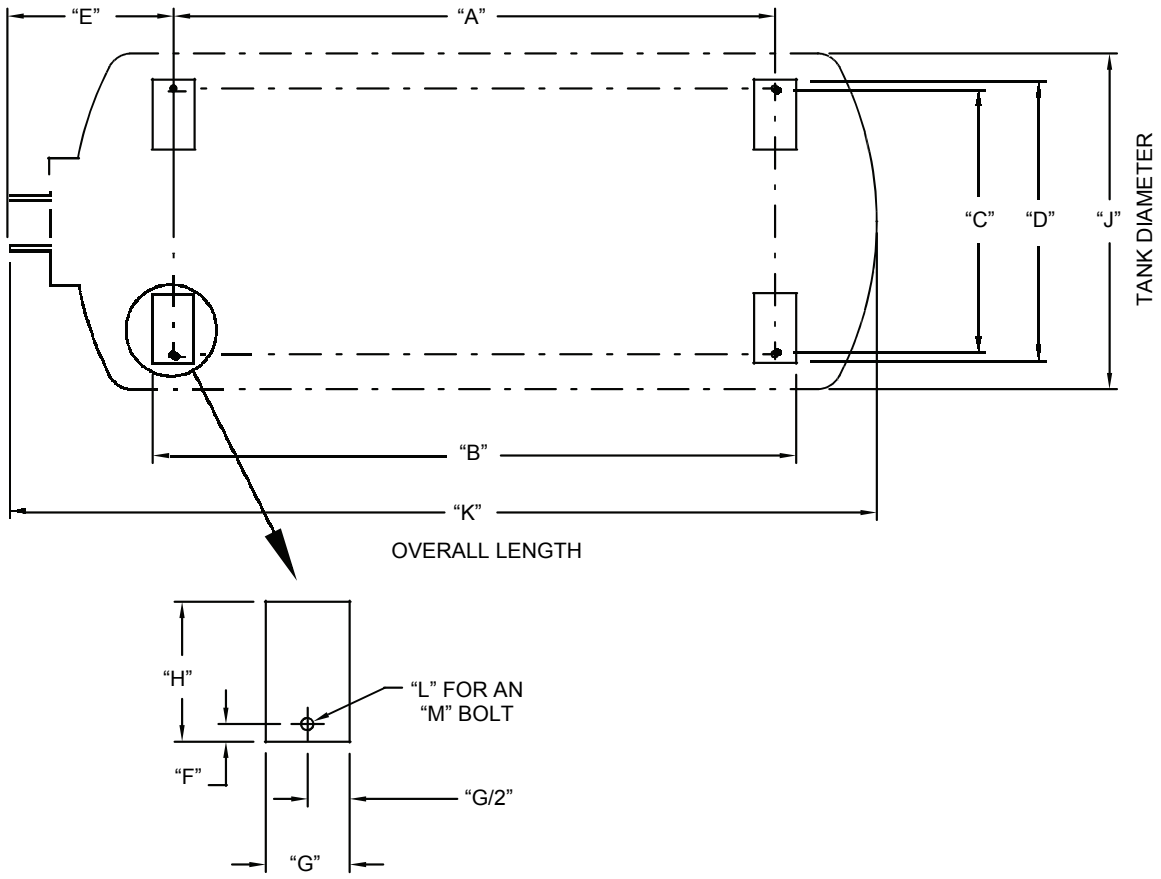
- Optional three valve bypass and strainer (MUV).
- Steam relief valves.
- High water alarm.
- Low water alarm.
- Low water pump cut off.
- Boiler feed pump and motor sets.
- Recirculation orifice.
- Suction shutoff valve.
- Suction strainer.
- Suction flexible fitting.
- Optional discharge check valve.
- Optional discharge shutoff valve.
- Optional discharge pressure gauge.
- Optional discharge manifold.
- Overflow drainer.
- Control panel.
- Optional chemical feed quill.
- Optional vacuum breaker.
- Optional insulation and jacket.
- Sentinel relief valve.
- Optional tank drain valve.
- Optional magnesium anode.
- Stand.

Packaging

- Fully packaged, factory piped and wired.

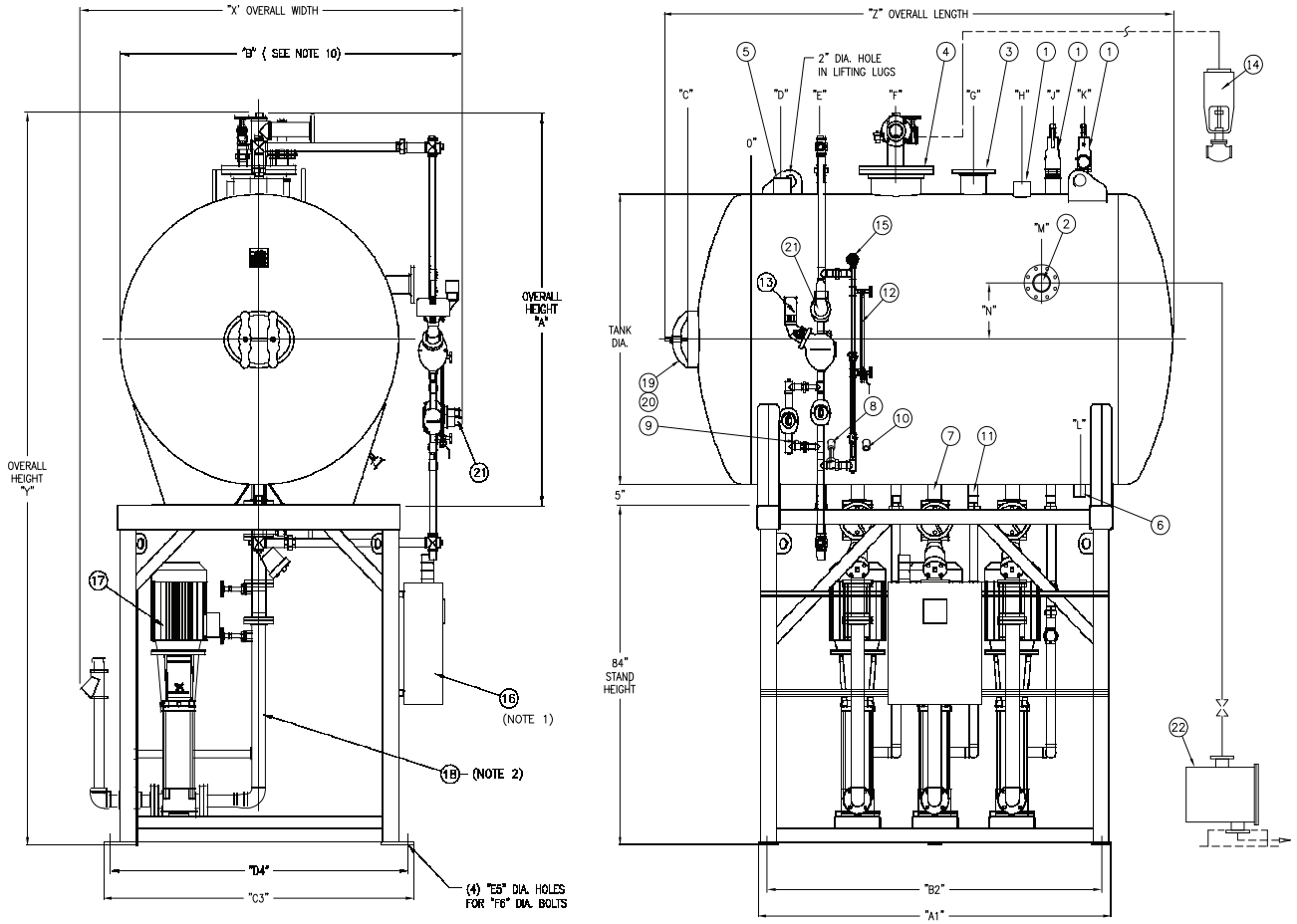
DIMENSIONS AND RATINGS

Dimensions and ratings for Spraymaster Signature Deaerators are shown in Figure H1-1 and Figure H1-2.



TANK CAPACITY (GALLONS)							
	260	**415**	**610**	**840**	**1105**	**1400**	**2485**
A	47	86	86	86	86	86	110
B	53	92	92	92	92	92	116
C	38	38	44.75	44.75	50	52	62
D	40.5	40.5	47.25	48.25	53	55	65.5
E	22.31	22.78	23.59	24.84	25.91	26.78	29.59
F	1.25	1.25	1.25	1.75	1.5	1.5	1.75
G	6	6	6	6	6	6	6
H	10	10	14.37	16	18.25	21.25	23.12
J	48	48	54	60	66	72	84
K	83.31	123.33	124.93	127.36	129.56	131.23	160.58
L	0.87	0.87	0.87	1.12	1.12	1.12	1.12
M	0.75	0.75	0.75	1	1	1	1

Figure H1-1. Spraymaster Signature Series Tank Supports, Details and Dimensions



Note:
1. Packaged units only. Mounted on side stand.
2. Suction piping includes strainer, gate valve and flexible connection.
3. All couplings are 3000# F.S.
4. All flanges are 150# F.F. except as noted.
5. Customer to plug all fittings not being used.
6. Mount tank above pump at elevation necessary for static head including safe allowance for piping friction as approved by pump manufacturer.
7. Deaerator tank is built to SAME Code.
8. Accompanying dimensions, while sufficiently accurate for layout purposes, must be confirmed for construction by certified dimension prints.
9. Add Suffix "P" to Model No. for packaged units (SSP-45).
10. Dimension "B" will change depending on controls required - contact your local Cleaver-Brooks authorized representative.
11. No interconnecting piping or wiring furnished on non-packaged units unless specified, contact your local Cleaver-Brooks representative for specific piping or wiring furnished on packaged assemblies.
12. Weights shown are without controls or packaging - contact your local Cleaver-Brooks representative for additions.
13. Capacities other than shown as standard available by proper selection of controls - contact your local Cleaver-Brooks authorized representative.
14 Optional tank sizes and ratings available - contact your local authorized Cleaver-Brooks representative.
15. Lifting lugs are for lifting EMPTY tanks only.
16. For zone IIB Stand dimensions - contact your local Cleaver-Brooks representative.

RATINGS	TANK SIZES							Manual Vent Valve Size	
Capacity (Gal. to Overflow)	260	415	610	840	1105	1400	2485	SS7	0.75
Tank Size (Dia x Length)	48 x 75	48 x 115	54 x 117	60 x 119	66 x 121	72 x 123	84 x 152	SS15	0.75
Tank Weight (Dry) (lb)	1400	1800	2100	2400	2900	3200	4200	SS30	0.75
Package Weight (Total Dry)(lb)	4500	5600	6750	7200	7600	8100	11,100	SS45	0.75
Package Weight (Total Flooded) (lb)	6900	9250	12050	14,450	17,100	20,000	29,700	SS70	1
								SS100	1.5

RATINGS FOR SPRAYMASTER MODEL	Conn. 3 Steam Inlet	Conn. 4 Water Inlet
SS-7	6"-150# FF Flg	1" NPT.
SS-15	6"-150# FF Flg	1.5"-150# RF Flg
SS-30	6"-150# FF Flg	2"-150# RF Flg
SS-45	6"-150# FF Flg	2"-150# RF Flg
SS-70	6"-150# FF Flg	2.5"-150# RF Flg
SS-100	6"-150# FF Flg	3"-150# RF Flg

Figure H1-2. Spraymaster Signature Series Deaerator Dimensions and Ratings (Single Tank) – Sheet 1 of 2

OVERALL DIMENSIONS (TANK AND STAND)								
X	Overall Package Width	81	81	95	98	101	99	117
Y	Overall Package Height	157	157	163	169	175	181	205
Z	Overall Package Length	87	123.5	125	127.5	129.5	131.5	160.5
TANK DIMENSIONS								
A	Overall Tank Height	73	73	80	85	91	97	109
B	Overall Tank Width	70	68	70.5	76.5	82.5	88.5	100.5
C	Front Head	12.31	12.31	13.13	14.37	15.44	16.31	18.81
D	High Temperature Return	49	8	8	8	8	8	20
E	Level Control	6	18	18	18	18	18	30
F	Water Inlet	17.5	37.5	37.5	37.5	37.5	37.5	49.5
G	Steam Inlet	37.5	57.5	57.5	57.5	57.5	57.5	69.5
H	Relief Valve	49	70	70	70	70	70	82
J	Relief Valve	N/A	78	78	78	78	78	90
K	Spare	N/A	86	86	86	86	86	98
	Spare	N/A	N/A	N/A	N/A	N/A	N/A	106
L	Drain	46	85	85	85	85	85	97
M	Overflow	REAR HEAD	75	75	75	75	75	87
N	Overflow	1.56	1.59	4.62	7.62	10.87	13.81	18.25

STAND DIMENSIONS -FOR ZONE IV- see note 16.								
Capacity (Gal. to Overflow)		260	415	610	840	1105	1400	2485
A1	Overall Length	52	91	91	91	91	91	116
B2	C/L to C/L Bolt Holes	47	86	86	86	86	86	110
C3	Overall Width	72.75	72.75	72.75	72.75	78	80	91
D4	C/L to C/L Bolt Holes	68.25	68.25	68.25	68.25	73.5	75.5	86.5
E5	Hole Size	1.37	1.37	1.37	1.37	1.37	1.37	1.37
F6	Anchor Bolt Size	1.25	1.25	1.25	1.25	1.25	1.25	1.25

CONNECTIONS AND TRIM								
1	Relief Valve Size / Quantity	Contact Your Local Cleaver-Brooks Authorized Representative						
2	Overflow Size	3" NPT	3" NPT	3" NPT	3" NPT	4"-150# FF	4"-150# FF	4"-150# FF
3	Steam Inlet Size	6"-150# FF	6"-150# FF	6"-150# FF	6"-150# FF	6"-150# FF	6"-150# FF	6"-150# FF
4	Water Inlet Size	8"-150# FF	8"-150# FF	8"-150# FF	12"-150# FF	12"-150# FF	12"-150# FF	12"-150# FF
5	High Temperature Return Size	1 1/2" NPT	2" NPT	2" NPT	2" NPT	3" NPT	3" NPT	3" NPT
6	Drain Size	2" NPT	2" NPT	2" NPT	2" NPT	2" NPT	2" NPT	2" NPT
7	Suction Size	2.5" NPT	2.5" NPT	2.5" NPT	2.5" NPT	3"-150# FF	3"-150# FF	4"-150# FF
8	Thermometer	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT	3/4" NPT
9	Sample	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT	1/2" NPT
10	Chemical Feed	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT
11	Recirculation	1.5" NPT	1.5" NPT	1.5" NPT	1.5" NPT	1.5" NPT	1.5" NPT	2" NPT
12	Gauge Glass Assembly							
13	Level Controller	1.5" NPT	1.5" NPT	1.5" NPT	1.5" NPT	1.5" NPT	1.5" NPT	1.5" NPT
14	Make-Up Valve							
15	Pressure Gauge	1/4" NPT	1/4" NPT	1/4" NPT	1/4" NPT	1/4" NPT	1/4" NPT	1/4" NPT
16	Control Panel	Per Design	Per Design	Per Design	Per Design	Per Design	Per Design	Per Design
17	Feed Pump/Motor	Per Design	Per Design	Per Design	Per Design	Per Design	Per Design	Per Design
18	Suction Piping	Per Design	Per Design	Per Design	Per Design	Per Design	Per Design	Per Design
19	Manway Size - SSP 15-70	12" x 16"	12" x 16"	12" x 16"	12" x 16"	12" x 16"	12" x 16"	N/A
20	Manway Size - SSP 100	N/A	N/A	N/A	N/A	N/A	N/A	14" x 18"
21	Level Alarms	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT	1" NPT
22	Overflow Drainer	Per Design	Per Design	Per Design	Per Design	Per Design	Per Design	Per Design

Figure H1-2. Spraymaster Signature Deaerator Dimensions and Ratings (Single Tank) – Sheet 2 of 2

RETURN ON INVESTMENT

Payback for a pressurized deaerator verses an atmospheric boiler feed system is based on an additional capital expenditure required divided by the yearly operating cost savings. The differential in yearly operating costs are in the following areas:

- Flash steam
- Exhaust steam
- Blowdown
- Chemical treatment
- Sewer
- Intangibles

Flash Steam A percentage of the high-pressure condensate returns will flash to steam and be lost in an atmospheric vessel application. This flash steam loss can result in an energy loss and associated fuel cost. Returning condensate to a pressurized vessel decreases the amount of flash steam created and reduces losses to atmosphere.

Exhaust Steam Exhaust steam cannot be recovered in an atmospheric vessel application. This exhaust steam loss can be converted to energy loss and associated fuel cost. An example would be steam turbine exhaust.

Surface Blowdown Increased makeup water is required because of lost flash and exhaust steam. This increase in makeup water requires an increase of surface blowdown. This is directly related to cycles of concentration in the boiler. The additional blowdown loss can result in an energy loss and associated fuel cost. The additional surface blowdown may also result in an increase in capital expenditure for a larger blowdown heat recovery system.

Chemical Treatment Dissolved oxygen content in an atmospheric boiler feedwater system is a function of water temperature. Lowering the dissolved oxygen content below what is naturally present, based on mixed water temperature at atmospheric pressure, requires the addition of a chemical treatment program. The most common oxygen scavenger used is sodium sulfite. Sodium sulfite reacts with dissolved oxygen as follows:

$$2Na_2SO_3 + O_2 \rightarrow 2Na_2SO_4$$

Theoretically, it takes approximately 8 ppm of sodium sulfite as Na2S03 to scavenge 1 ppm of dissolved O_2

Makeup Water Increased make-up water is required because of lost flash steam, lost exhaust steam, and additional surface blowdown. This additional makeup water can be associated to a cost. Makeup water cost should be a combination of the utility charge plus pretreatment equipment consumable costs.

Sewer Utilities often base a sewer charge on make-up water usage. Increased makeup water usage with an associated increase in surface blowdown can affect these costs.

Intangibles Some cost savings are difficult to calculate - in general, best practices in deaeration will prolong the life of boiler room equipment, reducing repair and maintenance costs.

SAMPLE SPECIFICATIONS

The following sample specifications are provided by Cleaver-Brooks to assist you in specifying your customer's specific needs and application.

PART 1 GENERAL

1.1 Packaged Deaerator Specification

A. Provide one (1) Cleaver-Brooks Model SSP _____ Signature Series spray type, pressurized, horizontal deaerator rated at _____ pounds per hour. The system shall be a single tank design. Performance is guaranteed to remove oxygen to not more than 0.005 ccs/liter in the effluent throughout all load conditions between 5 and 100 percent with a 20:1 turndown ratio. The deaerator shall be designed for operation at 5 PSIG, but shall be suitable for use from 2 to 15 PSIG. Feedwater, low and medium temperature condensate shall be admitted to the deaerator through a single spring-loaded, self- cleaning, adjustable stainless steel spray valve, which shall provide proper internal vent condensing and water distribution at any load between 5 and 100 percent of rated capacity.

PART 2 PRODUCTS

2.1 Deaerator

A. The water temperature in the primary heating and vent concentrating section is to be raised within 2 to 3 °F of steam saturation temperature causing the majority of non-condensable gases to be released. The water is then to be collected in a stainless steel conical water collector. From the collector, it shall flow to an atomizing valve where high velocity steam shall contact the water stream and break it into a fine mist. At this stage, the water shall be heated to full steam saturation temperature. The mixture is to strike a deflecting baffle, which separates water and steam. Hot, gas-free water shall then drop to the storage compartment of the pressure vessel to complete the deaeration process. The non-condensable gases released during the process and steam shall flow upward, through the primary heating spray portion, into the internal vent concentrating section, where they contact the cold influent water. Here, the steam is to be condensed to continue the cycle. Released gasses are discharged to atmosphere through the vent outlet.

B. All internal surfaces, which come in contact with un-deaerated water, shall be constructed of Type 316 stainless steel. An automatic vent valve shall be thermostatically controlled to provide a swift means of venting during a sudden buildup of gases. This condition is most typically seen at start up. The manual vent valve shall contain a fixed orifice for continuous venting. Venting rate shall not exceed 0.1 of 1% of the rated deaerator capacity at 5 PSIG.

2.2 Deaerator Vessel

A. The deaerated water storage tank shall have a minimum of 10 minutes of storage and have a capacity of _____ gallons measured to overflow. The tank shall be _____ diameter x _____ long. A 12 x 16 inch elliptical manway shall be provided for access to the deaerator. All nozzles 3" and under shall be 3000 lbs. forged steel couplings. All nozzles over 3" shall be 150 lbs. flat face flanges. Heads to be ASME torispherical type constructed of ASTM A516 GR 70 carbon steel with a minimum thickness of 0.25 inches. Shell plate to be fabricated of ASTM A36 carbon steel with a minimum thickness of 0.25 inches. The tank shall be designed in accordance with ASME, Section VIII of the Pressure Vessel Code for 50 PSIG at 650 °F and stamped accordingly. Certification shall be required. Joint efficiencies to be 70% circumferential per Table UW-12, which does not require stress relieving or nondestructive examination.

B. A quantity of two (2), ½ inch tappings for water sampling and chemical injection shall be provided under the water line.

2.3 Deaerator Load Specification

Load Specifications

LOAD	PERCENTAGE	LBS/HR	TEMP	PRESSURE
Raw Make up		GPM		25 psig Minimum
Low Temperature Returns (Less than 200 °F)				10 psig Minimum
Med. Temp Returns (200 - 230 °F)				10 psig Minimum
High Temp Returns (greater than 230 °F)	Not To Exceed 25%			

2.4 Deaerator Standard Trim and Accessories

A. The basic deaerator shall be equipped with the following trim and accessories. Piping on packaged units shall comply with ASME Power Piping Code B31.1.

2.5 Deaerator Make-Up Valve and Controller

A. A _____ " inlet make-up water regulating valve with bronze body and threaded NPT connections that is electronically actuated. The valve shall be a globe style Siemens Flowrite VF 599 Series two-way valve designed to operate with an electronic actuator with a 3/4-inch (20 mm) stroke. The electronic actuator shall be the Siemens Flowrite EA 599 Series SKB/C Electronic Valve Actuator. The actuator shall receive a 0 to 10 Vdc or a 4 to 20 mA control signal to proportionally control the valve. The valve shall be rated for _____ GPM at _____ PSIG inlet pressure. The valve shall meet ANSI leakage class IV (0.01% of Cv) shutoff standards. The valve shall be normally closed, with stainless steel trim, linear control, include Teflon V-ring packing and be suitable for temperatures up to 330°F.

B. A McDonnell & Miller 93-7B level controller shall electronically control the make-up valve.

C. The make-up valve shall **optionally** be included in an assembly using an ANSI Class 125 LB three-valve bypass with inlet Y-type cast iron strainer. Strainer screen to be removable and of stainless steel construction.

2.6 Deaerator Steam Pressure Reducing Valve (PRV) Station

A. A _____" steam pressure reducing valve with cast iron body and _____ connections. The valve shall be a self-contained unit capable of reducing _____ PSIG saturated steam to the operating pressure of the deaerator at a flow rate of _____ LBS./HR. The valve shall be 250 lb. class with stainless steel trim and an adjustable pilot. The valve manufacturer shall be Spence, Model _____.

B. The steam pressure reducing valve shall **optionally** be included in an assembly using a three valve bypass with Y-type cast iron strainer. Strainer screen to be removable and of stainless steel construction.

2.7 Deaerator Safety Relief Valve(s) (SRV)

A. Include a quantity of _____, _____" relief valves sized to relieve full capacity of the pressure reducing valve in the event of its failure. Valves to meet Paragraph UG-125 of ASME Unfired Pressure Vessel Code, Section VIII. Valve body to be of _____ construction. Relieving set pressure to be 50 PSIG. Relief valve manufacturer to be Kunkle, Model _____.

2.8 Deaerator Water Level Alarms

A. A NEMA 1 high water alarm shall be an externally mounted float type switch. The switch shall make contact on rise and break on fall. The float cage construction shall be cast iron.

B. A NEMA 1 low water alarm shall be an externally mounted float type switch. The switch shall make contact on fall and break on rise. The float cage construction shall be cast iron.

C. A NEMA 1 low-water cutout alarm and switch shall be an externally mounted float type switch. The switch shall make contact on fall and break on rise. The float cage construction shall be cast iron. The cutout will protect the pumps from a dry-run condition.

2.9 Deaerator Overflow Drainer

A. A _____" overflow drainer sized to relieve full capacity at the operating pressure of the deaerator. The overflow drainer shall be a float type trap. The construction is to be a steel housing with stainless steel float ball. The overflow drainer manufacturer shall be Warren Model _____.

2.10 Deaerator Suction Piping

A. Suction piping for pumps shall consist of a _____ gate valve, cast iron Y-type strainer with replaceable stainless steel screen and flexible connector or hose. This piping assembly shall be 125 LB class construction. The vortex breaker shall be located in the tank nozzle.

2.11 Boiler Feedwater Pump and Motor Set

Pumps may be selected to run either on/off or intermittent.

Intermittent

A. Quantity _____, vertically oriented, multistage centrifugal type boiler feedwater pump and motor set. Pump to be rated for _____ GPM at _____ feet TDH with _____ feet NPSH required. Pump to be _____ materials of construction and have mechanical seals for a maximum water temperature of 250 °F. Pump impeller to be hydraulically balanced. The pump shall be mounted on a steel baseplate channel and flexibly coupled with an OSHA type coupling guard to a _____ HP, _____ phase, _____ Hz, _____ Volt, _____ RPM, _____ enclosure motor. Motor to be non-overloading at the rated condition without using any portion of the service factor. Pump and motor set to be factory aligned prior to shipment. Pump manufacturer to be Grundfos Model _____k.

Continuous

B. Quantity _____, vertically oriented, multistage centrifugal type boiler feedwater pump and motor set. Pump to be rated for _____ GPM at _____ feet TDH with _____ feet NPSH required. Pump to be _____ materials of construction and have mechanical seals for a maximum water temperature of 250 °F. Pump impeller to be hydraulically balanced. The pump shall be mounted on a steel baseplate channel and flexibly coupled with an OSHA type coupling guard to a _____ HP, _____ phase, _____ Hz, _____ Volt, _____ RPM, _____ enclosure motor. Motor to be non-overloading at the rated condition without using any portion of the service factor. Pump and motor set to be factory aligned prior to shipment. Pump manufacturer to be Grundfos Model _____ k. A stainless steel recirculation orifice is to be supplied with the pump and shipped loose for field installation to provide minimum bypass flow.

2.12 Deaerator Support Stand

A. The _____ feet high stand shall elevate the deaerator tank to provide the net positive suction head required by the pump at the rated condition to prevent cavitation plus a 2 foot safety factor. The stand shall be constructed of heavy square steel tubing.

B. The stand shall be designed for Seismic Zone 2B.

C. Calculations for Seismic Zone 2B or a design upgrade to Seismic Zone 4 may be provided optionally.

2.13 Deaerator Control Panel

A. Control panel shall be in a NEMA 1 enclosure and wired to the National Electric Code. The wire shall be black number coded. The assembly is to contain individual motor starters with 120 Volt holding coil and fuse protection. Individual oil-tight pump run lights shall be provided. All switches and lights to have nameplate identification. The assembled panel shall be given a factory continuity test prior to shipment.

2.14 Electric Components

A. Audible and visual high, low-water and low-water cutout alarm functions shall be provided by a bell, horn or electronic sounder with silence switch and individual oil-tight lights. Control circuit transformer to supply 110-120 Volts, single-phase power supply. The transformer shall be mounted, wired and fused. Auxiliary contacts shall be optionally furnished per customer's requirements. Contacts shall be normally open.

B. The deaerator shall have a gauge glass assembly that covers the operating range of the unit. The gauge glass shall be quartz, 0.625 inch diameter by 24 inch maximum length. Each length of glass shall be furnished with a bronze gauge cock set and protector rods. The deaerator shall be supplied with a pressure gauge that has a 4-1/2 inch dial with a 0-60 PSIG range and a thermometer with a 50 to 300 °F range.

2.15 Deaerator Preparation and Packaging

A. The deaerator is to be hand cleaned with a solvent to SSPC- SP-1 standards prior to painting. Prime coated to not less than 1 mil thick and finish coated with enamel paint to not less than 1 mil thick prior to shipment.

B. The deaerator vessel, stand, controls and piping shall be packaged together as a complete system. The unit is to be disassembled for shipment. Piping is to be matched marked for ease of reassembly.

PART 3 EXECUTION

3.1 Deaerator Manuals and Warranty

A. All units shall include three (3) bound, Operating and Maintenance manuals. The warranty period to be not less than twelve months after start-up or eighteen months after shipment, whichever comes first.

B. Deaerator Options for Trim and Accessories

1. The tank shall be optionally factory-insulated and lagged with blanket insulation, pins, clips, and a durable steel jacket. The blanket insulation is to be fiberglass, 2" thick, 1 LB/CU-FT, and have a rating of R3.85. Pins are to be located on 18" centers and holding clips attached. The steel jacket or lagging shall have a shell thickness of 22 gauge (0.299") minimum and head thickness of 12 gauge (0.1046") minimum.
2. The optional magnesium or sacrificial anode shall provide cathodic protection against galvanic corrosion. This rod shall be 1-5/16" diameter with a 1/4" steel core to assure a good electrical contact and added strength. The design shall have a small weep hole to signal it has been consumed.
3. The optional chemical feed quill shall be located beneath the normal tank water level. The quill material shall be constructed of stainless steel. The tube shall provide even distribution and blending of chemical.
4. Additional discharge piping, manifold piping and recirculation piping may be provided optionally.