

SPRAYMASTER SPRAYMASTER COMBO



Deaerators

Boiler Book
05/2018



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

FEATURES AND BENEFITS

Low Profile design:

- Low head allows installation in space restricted areas.

Two-Stage Deaeration in a Common Vessel:

- Recycle pumps are not required.
- Packaged for easy 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 corrosive gases from boiler feedwater.

Self-Cleaning Water Spray Valve:

- Maintains deposit-free surface.
- Reduces maintenance requirements.

Internal Automatic-Check Valve Prevents Steam Back-Flow:

- The water spray valve is normally closed at no flow.
- Prevents steam back flow through the water spray valve at no flow conditions.

Removable Water Spray Inlet Assembly:

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

Stainless Steel Deaeration Assembly:

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

Pressurized Tank Reduces Flashing and Minimal Venting:

- Recovery of exhaust and turbine steam.
- Saves BTU that would normally be exhausted to atmosphere.
- Improves plant efficiency.

Auto Vent Valve Eliminates Gases at Start-Up:

- Atmospheric contamination virtually eliminated for incoming water.

O₂ levels to 0.005 cc/l; CO₂ levels near zero:

- Cleaver-Brooks deaerator is guaranteed to remove oxygen concentrations to 0.005 cc/liter while operating between 5 and 100% capacity.
Carbon dioxide concentration is practically reduced to zero.

Capacity Not Affected by Mixed Inlet Temperature:

- Consistent performance under variable conditions.

Integral Level Control

- Automatically introduces cold water make-up to supplement condensate only when necessary to meet boiler demand:
- Saves BTU by accepting condensate before cold make-up water. Maintains a minimal water level within the deaerator vessel to prevent damage to the boiler feed pumps, 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 to limit the loss of hot condensate to drain.

Packaged Units for Cost Effective Installation:

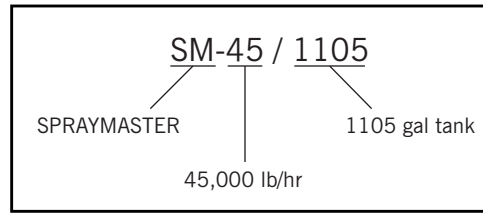
- Complete packages are prefabricated in the Cleaver- Brooks manufacturing facility to ensure piping alignment and control wiring function. The unit is partially disassembled, match marked for efficient field re-assembly.

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

Spraymaster Deaerators are designated by spray head and tank size. Example:



The table below lists storage capacity for standard tank sizes.

Minutes of storage from the overflow level to the bottom of the tank at rated capacity

Industry standard sizing is for 10 minutes of storage

Model number	SM-7	SM-15	SM-30	SM-45	SM-70	SM-100	SM-140	SM-200	SM-280	
Spray capacity (LBS/HOUR)	7000	15,000	30,000	45,000	70,000	100,000	140,000	200,000	280,000	
Spray Capacity (GPM)	14	30	60	90	140	200	280	400	560	
Total Boiler HP	203	435	870	1304	2029	2899	4058	5797	8116	
Tank size	260	18.6	8.7							
	300	21.4	10.0	5.0						
	415		13.8	6.9						
	610		20.3	10.2	6.8					
	840			14.0	9.3	6.0				
	1105			18.4	12.3	7.9	5.5			
	1400				15.6	10.0	7.0	5.0		
	2200					15.7	11.0	7.9		
	2485					17.8	12.4	8.9		
	3200						16.0	11.4	8.0	5.7
	4500						22.5	16.1	11.3	8.0
6200							22.1	15.5	11.1	

The Spraymaster Deaerator is a pressurized low-headroom 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 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 systems offer substantial advantages through lower-cost installation and simplified operation and maintenance. Spraymaster Deaerators arrive on site ready for hookup to your water, steam, and electric power connections.

The deaerator stand comes with feed pump/motor set mounted on a solid 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. Saddles or legs standard on all sizes. Select from sizes for 5 to 30 minutes of storage to overflow.

Piping

Pump and motor sets are mounted on individual bases before mounting on stand base. Individual suction piping (including strainer and shutoff valve) are provided for all feed pumps.

Standard Equipment

- Spraymaster deaerator.
- Deaerator storage tank.
- Deaerator water inlet atomizing valve.
- Deaerator steam inlet atomizing valve.
- Gauge glass.
- Steam pressure gauge.
- Feedwater thermometer.
- Required tappings.

Optional Equipment

- | | |
|---|------------------------------|
| • Steam pressure reducing valve | • Discharge pressure gauge |
| • Three valve bypass and strainer (MUV) | • Discharge manifold |
| • Steam relief valves | • Overflow drainer |
| • High water alarm | • Control panel |
| • Low water alarm | • Chemical feed quill |
| • Low water pump cut off | • Vacuum breaker |
| • High-temperature condensate diffuser tube (over 227 °F) | • Insulation and lagging |
| • Boiler feed pump and motor sets | • Sentinel relief valve |
| • Recirculation orifice or relief valve | • Tank drain valve |
| • Suction shutoff valve | • Back pressure relief valve |
| • Suction strainer | • Magnesium anode |
| • Discharge check valve | • Stand |
| • Discharge shutoff valve | • Seismic construction |

Packaging

- Fully packaged, factory piped and wired.
- Half packaged, suitable for field erection with interconnecting piping and wiring by others

COMBO UNITS

The Spraymaster Combo combines a Spraymaster deaerator and a surge tank in a single vessel. Deaerator options and storage capacity are as listed above.

In addition to providing all the benefits of an independent deaerator and surge, the SM Combo offers the following features:

Double Inner Head Separates the Deaerator Pressure Vessel From Surge Tank:

Ensures the deaerator and surge tank are two separate vessels while structurally attached for space considerations. This also limits heat transfer from the deaerator pressure vessel to the surge atmospheric vessel, preventing energy loss due to surge tank water boiling.

Vented and Insulated Gap Between the Deaerator and Surge Tank:

Insulation is placed between the double inner head to further limit heat transfer from the deaerator pressure vessel to the surge atmospheric vessel. A vent is placed between the double inner head to allow moisture evaporation eliminating corrosion potential.

Low Profile Design:

Low head room allows for installation in space restricted areas.

Two-Stage Deaeration in a Common Vessel:

- Recycle pumps are not required.
- Packaged for easy maintenance.

Packaged Units for Cost Effective Installation:

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



Spraymaster Combo Models

Available Models	DA Tank Gallons	Surge Tank Gallons
SD-(7-45)-260-260	260	260
SD-(7-45)-300-300	300	300
SD-(7-140)-415-450	415	450
SD-(7-140)-610-600	610	600
SD-(7-140)-840-900	840	900
SD-(7-140)-1105-1200	1105	1200
SD-(7-140)-1400-1800	1400	1800
SD-(7-280)-2200-2200	2200	2200
SD-(7-280)-2485-2500	2485	2500

RETURN ON INVESTMENT

The advantages of a pressurized deaerator over an atmospheric boiler feed system can be readily seen in the following areas:

- Flash steam
- Exhaust steam
- Blowdown
- Makeup water
- Chemical treatment
- 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 equates to lost energy and higher fuel costs.

Exhaust Steam

Exhaust steam cannot be recovered in an atmospheric vessel application. An example would be steam turbine exhaust.

Surface Blowdown

Flash and exhaust steam losses require increased makeup water. This increase in makeup water in turn requires an increase of surface blowdown, again resulting in lost energy and associated higher fuel costs. The additional surface blowdown may also result in an increase in capital expenditure for a larger blowdown heat recovery system.

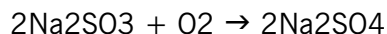
Makeup Water

The additional makeup water necessitated by flash steam, exhaust steam, and surface blowdown losses itself has an associated cost. This can include increased utility/sewer charges as well as pre-treatment equipment costs.

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:

Theoretically, it takes approximately 8 ppm of sodium sulfite as Na₂SO₃ to scavenge 1 ppm of dissolved O₂:



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.

