

BOILERMATE

Deaerators



Boiler Book
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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 and sizing information.

FEATURES AND BENEFITS

Less Mechanical Movement of Deaerator Components:

- The water spray valve is the only internal moving component within the deaerator vessel.

Counter-Flow Deaeration:

- 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.

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

Cleaver-Brooks packaged Boilermate deaerators range from 1,100 lbs/hr at 50 °F makeup to 135,000 lbs/hr at 200 °F make-up. Larger capacities can be obtained by using two columns.

Boilermate Product Offering

Boilermate Model Number	Makeup Water Temperature °F	Column Capacity lb/hr
8	50	1,100
8	100	2,000
8	150	3,000
8	200	5,000
12	50	3,000
12	100	4,400
12	150	6,000
12	200	10,650
16	50	5,300
16	100	8,000
16	150	10,800
16	200	20,000
20	50	10,000
20	100	12,200
20	150	17,500
20	200	30,000
24	50	14,400
24	100	17,200
24	150	24,500
24	200	44,000
30	50	22,200
30	100	28,250
30	150	38,000
30	200	69,000
36	50	32,200
36	100	40,000
36	150	55,000
36	200	100,000
42	50	44,300
42	100	54,250
42	150	75,000
42	200	135,000

The Boilermate deaerator is a pressurized packed column, low maintenance system designed to:

- remove dissolved oxygen in boiler feed water to 0.005 cc per liter or less.
- eliminate carbon dioxide.

A typical deaerator package includes the packed column and storage 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 packed column design is best for handling high-temperature returns. The column is constructed of a carbon steel casing with a stainless steel liner. Built into a flange on top of the column is a spring loaded self-cleaning water spray nozzle and an automatic and manual vent valve.

From experience, large industrial plants and utilities have learned that the most practical and economical way to remove oxygen from feedwater is through mechanical deaeration. The Boilermate deaerator removes oxygen economically and with trouble free performance.

Raw untreated water contains as much as ten cubic centimeters of oxygen per liter. Oxygen in water is a corrosive agent and shortens the life of boiler feed lines, boilers and condensate return lines.

The Cleaver-Brooks designed deaerator assures high purity effluent by removing oxygen and other dissolved gases, resulting in longer equipment life for industrial and commercial boiler users.

Contact your local Cleaver- Brooks authorized representative for component and sizing information.

Standard Equipment

- Boilermate column.
- Deaerator storage tank.
- Stainless steel exchange packing.
- Deaerator water inlet atomizing valve.
- Gauge glass.
- Deaerator manual and automatic vent valve.
- Steam pressure gauge.
- Feed water thermometer.
- Required tapings.

Optional Equipment

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

Packaging

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

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.

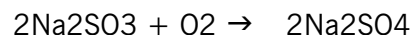
Makeup Water

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.

