

TRAYMASTER

Deaerators



Boiler Book
05/2017



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

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.

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 a 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:

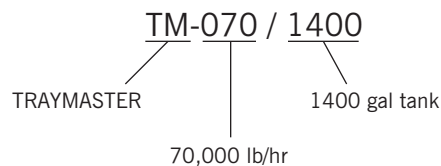
- Complete packages are prefabricated in the Cleaver- Brooks manufacturing facility to ensure piping alignment and control wiring function. The unit is partially disassembled, match marked for efficient field re-assembly.

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

Traymaster Deaerators are designated by tray capacity 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		TM030	TM045	TM070	TM100	TM125	TM140	TM175	TM200	TM225
Tray Capacity (LBS/HR)		30,000	45,000	70,000	100,000	125,000	140,000	175,000	200,000	225,000
Tray Capacity (GPM)		60	90	140	200	250	280	350	400	450
Total Boiler HP		870	1304	2029	2899	3623	4058	5072	5797	6522
Tank Size	600	10.0	6.7	4.3						
	900	15.0	10.0	6.4	4.5	3.6				
	1400	23.3	15.6	10.0	7.0	5.6	5.0	4.0		
	2000	33.3	22.2	14.3	10.0	8.0	7.1	5.7	5.0	4.4
	2500	41.7	27.8	17.9	12.5	10.0	8.9	7.1	6.3	5.6
	2800	46.7	31.1	20.0	14.0	11.2	10.0	8.0	7.0	6.2
	3500	58.3	38.9	25.0	17.5	14.0	12.5	10.0	8.8	7.8
	4000	66.7	44.4	28.6	20.0	16.0	14.3	11.4	10.0	8.9
	4500		50.0	32.1	22.5	18.0	16.1	12.9	11.3	10.0
	5000		55.6	35.7	25.0	20.0	17.9	14.3	12.5	11.1
	6000		66.7	42.9	30.0	24.0	21.4	17.1	15.0	13.3
	7000			50.0	35.0	28.0	25.0	20.0	17.5	15.6
	8000			57.1	40.0	32.0	28.6	22.9	20.0	17.8
	9000			64.3	45.0	36.0	32.1	25.7	22.5	20.0
	10000				50.0	40.0	35.7	28.6	25.0	22.2
	11000				55.0	44.0	39.3	31.4	27.5	24.4
	12000				60.0	48.0	42.9	34.3	30.0	26.7
	13000					52.0	46.4	37.1	32.5	28.9
	14000					56.0	50.0	40.0	35.0	31.1
	15000					60.0	53.6	42.9	37.5	33.3
16000						57.1	45.7	40.0	35.6	
17000						60.7	48.6	42.5	37.8	
18000							51.4	45.0	40.0	
19000							54.3	47.5	42.2	
20000							57.1	50.0	44.4	

Traymaster product offering continued

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

Model Number		TM250	TM300	TM350	TM400	TM450	TM500
Tray Capacity (LBS/HR)		250,000	300,000	350,000	400,000	450,000	500,000
Tray Capacity (GPM)		500	600	700	800	900	1000
Total Boiler HP		7246	8696	10145	11594	13043	14493
Tank Size	600						
	900						
	1400						
	2000						
	2500	5.0					
	2800	5.6	4.7				
	3500	7.0	5.8	5.0			
	4000	8.0	6.7	5.7	5.0		
	4500	9.0	7.5	6.4	5.6	5.0	
	5000	10.0	8.3	7.1	6.3	5.6	5.0
	6000	12.0	10.0	8.6	7.5	6.7	6.0
	7000	14.0	11.7	10.0	8.8	7.8	7.0
	8000	16.0	13.3	11.4	10.0	8.9	8.0
	9000	18.0	15.0	12.9	11.3	10.0	9.0
	10000	20.0	16.7	14.3	12.5	11.1	10.0
	11000	22.0	18.3	15.7	13.8	12.2	11.0
	12000	24.0	20.0	17.1	15.0	13.3	12.0
	13000	26.0	21.7	18.6	16.3	14.4	13.0
	14000	28.0	23.3	20.0	17.5	15.6	14.0
	15000	30.0	25.0	21.4	18.8	16.7	15.0
16000	32.0	26.7	22.9	20.0	17.8	16.0	
17000	34.0	28.3	24.3	21.3	18.9	17.0	
18000	36.0	30.0	25.7	22.5	20.0	18.0	
19000	38.0	31.7	27.1	23.8	21.1	19.0	
20000	40.0	33.3	28.6	25.0	22.2	20.0	

The Traymaster deaerator is a pressurized low maintenance system designed to remove dissolved oxygen in boiler feed water to 0.005 cc per liter or less and eliminate carbon dioxide. A typical deaerator package includes the tray 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 tray column design is best for handling high-temperature returns. The column is constructed of carbon steel. Built into the top of the tray box is a spring loaded self-cleaning water spray nozzle. Automatic and manual vent valves are built into the top of the vent condenser.

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 Traymaster deaerator economically effects oxygen removal through a design that is trouble free in performance.

Raw water, untreated and not deaerated, contains as much as ten cubic centimeters of corrosion-causing oxygen per liter. Oxygen in water corrodes 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 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 proved to most effective and economical to every boiler owner. Contact your local Cleaver-Brooks authorized representative for component and sizing information.

The design of the Traymaster deaerator offers simplicity in both operation and service. The tray section, the heart of the deaerator, requires no maintenance. There are no moving parts to adjust or maintain. Installation is simple and quick.

Standard Equipment

- Tray column
- Deaerator storage tank
- Stainless steel trays of riveted construction
- Deaerator water inlet atomizing valve(s)
- Gauge glass
- Deaerator manual and automatic vent valve
- Steam pressure gauge
- Feedwater thermometer
- Required tappings

Optional Equipment

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

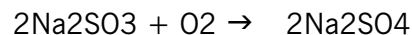
Makeup Water

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.

