Recommended Specifications

Furnish and install one (1) Lockwood Model _____ SS two-stage, spray scrubber deaerator with internal vent condenser and integral storage section. The deaerator shall be rated at _____ pounds per hour (outlet capacity including condensed steam). The deaerator shall be guaranteed to:

1. Heat the feedwater to the saturation temperature corresponding to the steam pressure within the heater.

2. Reduce feedwater oxygen content to 0.005 cc/liter as determined by the Heat Exchange Institute method, Winkler method, or any modifications outlined by the ASTM.

3. Reduce the free carbon dioxide in the feedwater to zero as determined by the APHA method.

4. Operate with minimum noise at all flow rates from 3 percent to 100 percent of outlet capacity.

The deaerator shall be constructed of SA-516 Grade 70 carbon steel plate with a minimum thickness of 1/4", designed for _____ PSIG pressure in accordance with the latest revision of the ASME Code, and shall be so stamped. The deaerator shall include 316 cast stainless steel spray valve(s) with 303 stainless steel spring(s), an internal direct contact stainless steel vent condenser, and a final stage steam scrubber. Deaerator shall provide _____ cubic feet of storage (_____ gallons) measured to the overflow level. This storage shall be equivalent to _____ minutes of the rated outlet capacity. Deaerator shall be operable from _____ PSIG.

The entire assembly shall be factory pre-assembled and shall consist of the following components:

1. One (1) _____ pound/hour horizontal deaerator with the following accessories:
   a. One (1) - sentinel relief valve.
   b. One (1) - vent valve.
   c. One (1) - water level gauge glass assembly with shut-off cocks and protective rods to cover the full water level travel.
   d. One (1) - vacuum breaker.
   e. Two (2) - stainless steel dial thermometers with separable sockets.
   f. One (1) - pressure gauge with syphon pipe and cock.
   g. One (1) - (mechanical) (pneumatic) make-up water valve with controller, strainer, and by-pass assembly.
   h. One (1) - self contained overflow trap.
   i. One (1) - pressure reducing valve and strainer for steam supply to deaerator.
   j. Adequately sized atmospheric back pressure relief valve(s).
   k. One (1) - high water alarm switch.
   l. One (1) - low water alarm switch.

   All above components shall be prepiped with the exceptions of the steam supply valve, inlet steam strainer, and back pressure relief valve(s). Piped assemblies may be removed to facilitate shipping.

2. Heavy structural steel support stand for elevating deaerator above pumps to avoid pump cavitation. Deaerator may be removed from support stand to facilitate shipping.

3. _____ boiler feed pumps (turbine type for intermittent service) (centrifugal type for intermittent/continuous service), each mounted on heavy support base integral with tank support stand, driven by _____ HP, _____ RPM,_____ V,____ phase, 60 Hz (open, drip-proof) (totally enclosed, fan cooled), ball bearing motor. Each pump shall be sized to deliver not less than _____ GPM of 230ºF water against a total discharge pressure of _____ PSIG.

4. Interconnecting piping between deaerator storage vessel and boiler feed pumps, to include shut-off valves.

5. NEMA 12 control cabinet complete with motor starters, (disconnect switches) (fuse blocks) (circuit breakers), control transformer, alarm relays, alarm silencer button, alarm horn, lights, etc. Wiring to be in accordance with the National Electric Code.

The deaerator shall be selected based upon the following condition:

1. _____ PSIG make-up water supply.
2. _____ PSIG saturated steam supply.
3. _____ PSIG maximum boiler design pressure.
4. Make-up water to deaerator to be approximately _____ % of total inlet flow at _____ ºF.
5. Low pressure condensate to deaerator shall be approximately _____ % of total inlet flow at _____ ºF.
6. High pressure condensate to deaerator shall be approximately _____ % of total inlet flow at _____ ºF.

Any deviations from, or exceptions to, the above specifications must be clearly stated in the bid. Otherwise, bidder will be expected to furnish equipment exactly as specified herewith. All components shall be furnished by one manufacturer for single responsibility. The equipment shall be guaranteed to be free from defects in material and workmanship for a period of fifteen (15) months after shipment or twelve (12) months from date of installation, whichever period shall first expire.

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Lockwood Products, Inc.

TYPE SS
SPRAY DEAERATORS

ILLUSTRATED WITH OPTIONAL EQUIPMENT

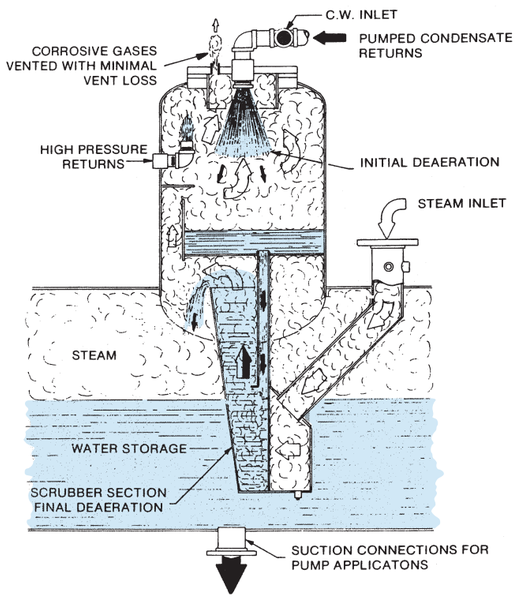
75 Years 1938 - 2013

Lockwood Deaerators

The primary function of a Lockwood Deaerator is to remove non-condensable gases (oxygen, carbon dioxide, and air) from boiler feedwater. The presence of undissolved oxygen in feedwater is a principal factor in corrosion of steam system components constructed of iron, steel, or brass. Carbon dioxide, besides being itself corrosive, will accelerate corrosion when combined with oxygen. Carbon dioxide in feedwater will also carry over into the steam and subsequently into the condensate, forming corrosive carbonic acid that will erode piping and heat transfer equipment. Air (non-condensable gases) is an insulator and will "plate out" on heat transfer surfaces as the steam condenses, greatly reducing heat transfer efficiency.

Lockwood spray-scrubber deaerators are designed to remove these non-condensable gases and reduce the oxygen content of the feedwater to not more than 0.005 cc/liter, and reduce the titratable free carbon dioxide to zero. As an added benefit, the feedwater from a Lockwood deaerator, being at saturation temperature, eliminates problems caused by cold water being injected into a boiler such as thermal shock and an unstable water level created by collapsing steam bubbles.

Oxygen, carbon dioxide and air are costly elements which must be eliminated to preserve boilers, piping, and heat transfer equipment. Oxygen scavenging chemicals are somewhat effective in reducing oxygen content, but are of little value in removing carbon dioxide and other non-condensable gases. Mechanical deaeration is the best and most economical method of accomplishing these tasks.



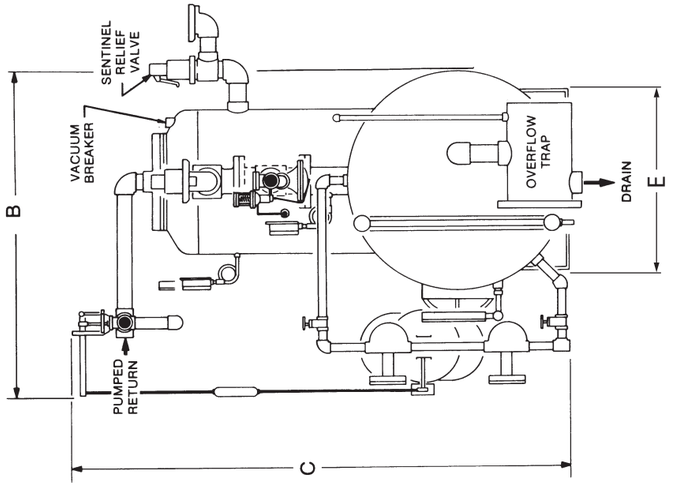
Operation

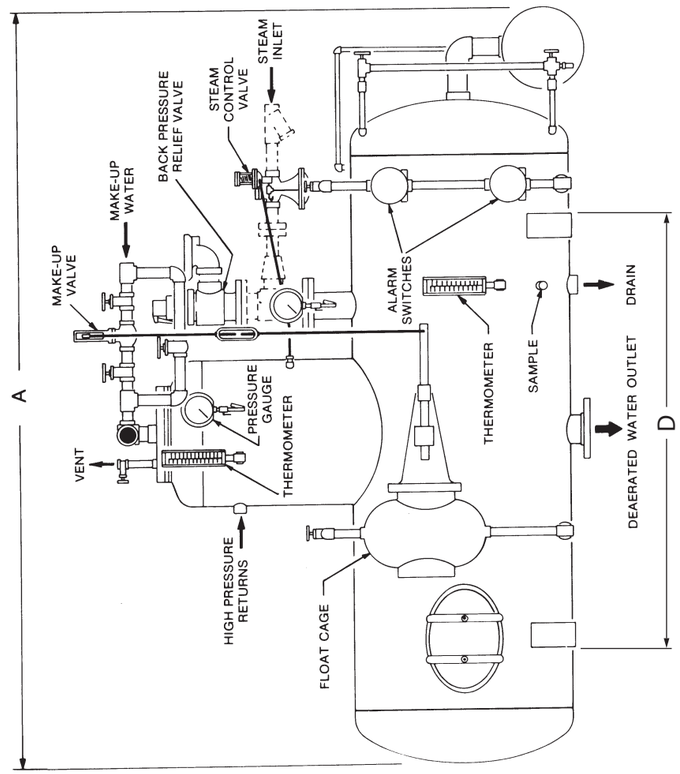
Incoming cold or tempered water first enters into the internal direct contact vent condenser of the vertical heater compartment, where stainless steel spray valve(s) direct the flow of water in conical sheets into a steam atmosphere. (Tempered water is a mixture of pumped condensate and cold water make-up.)

In the internal direct contact vent condenser most of the corrosive gases are removed before the water strikes any steel surfaces and is expelled from the deaerator through a stainless steel vent pipe with a restricted orifice to the outside.

The hot deaerated water then passes into the steam scrubber section where remaining traces of undissolved gases are released as the water is vigorously scrubbed with a large excess of steam containing no free oxygen.

It is important for the surface tension of the water to be broken down so that the gas bubbles formed by heating the water can escape.





NOTE:

1. **Storage capacities based on 10 minutes, other capacities avail-able upon application.**
2. **Water outlet(s) vary with appli-cation.**
3. **Weights apply to vessel only, and do not include acces-sories.**
4. **All dimensions, vol-umes, etc. are approximate and subject to change without notice.**
5. **Overflow trap sizing based on five P.S.I.G. operation pressure except:**
   *** P.S.I.G. operating pressure**
   **** 15 P.S.I.G. operating pressure**
6. **Consult Factory**

Model	Capacity (#/Hr.)	Storage		Storage Tank		Deaerator		Dimensions				Water Inlet	Over-flow	Steam Inlet	Weight – Lbs.
		Cu. Ft.	Gallons	Dia.	S.S.L.	Dia.	S.S.L.	A	B	C	D				Shipping
5SS	5,000	13	100	30"	4'-0"	24"	25"	6'-3"	4'-3"	5'-11"	42"	2-1/2"	1"	2-1/2"	1,100
10SS	10,000	26	200	30"	6'-8"	24"	25"	9'-0"	4'-3"	5'-11"	74"	2-1/2"	1"	3"	1,300
15SS	15,000	40	300	36"	6'-0"	24"	28"	8'-6"	4'-9"	6'-9"	56"	2-1/2"	2"	4"	1,600
20SS	20,000	53	400	36"	8'-0"	24"	28"	10'-6"	4'-9"	6'-9"	89"	2-1/2"	2"	5"	1,800
30SS	30,000	80	600	42"	9'-1"	24"	28"	11'-9"	5'-3"	7'-3"	104"	2-1/2"	2"	6"	2,500
45SS	45,000	120	900	42"	13'-11"	30"	30"	16'-9"	5'-3"	7'-6"	161"	2-1/2"	2"	8"	3,100
60SS	60,000	160	1200	48"	13'-4"	30"	30"	16'-3"	5'-9"	8'-0"	154"	3"	3"	8"	4,300
75SS	75,000	200	1500	48"	17'-0"	36"	30"	20'-0"	5'-9"	8'-6"	170"		4"	10"	5,550
90SS	90,000	240	1800	54"	15'-5"	36"	30"	18'-9"	6'-3"	9'-0"	152"	3"	4"	10"	5,600
120SS	120,000	320	2400	54"	21'-0"	36"	30"	24'-3"	6'-3"	9'-6"	176"	4"	4"	12"	6,600
150SS	150,000	400	3000	60"	21'-2"	42"	30"	24'-9"	6'-9"	10'-3"	182"	4"	6"	12"	8,350
180SS	180,000	480	3600	72"	17'-8"	42"	42"	21'-6"	7'-9"	12'-3"	170"	6"	6"	14"	7,900
210SS	210,000	560	4200	72"	20'-10"	48"	42"	25'-0"	7'-9"	12'-3"	Note #6	6"	6"	14"	8,650
240SS	240,000	640	4800	72"	24'-0"	48"	42"	28'-3"	7'-9"	12'-3"	Note #6	6"	6"	16"	9,450
270SS	270,000	720	5400	72"	27'-3"	48"	42"	31'-6"	7'-9"	12'-3"	Note #6	6"	6"	18"	10,200
300SS	300,000	800	6000	84"	22'-0"	54"	42"	26'-6"	8'-9"	13'-3"	Note #6	8"	*6"	18"	11,650
330SS	330,000	880	6600	84"	24'-4"	54"	42"	28'-9"	8'-9"	13'-3"	Note #6	8"	*6"	20"	12,500
360SS	360,000	960	7200	84"	26'-8"	60"	42"	31'-0"	8'-9"	13'-3"	Note #6	10"	*6"	20"	13,350
390SS	390,000	1040	7800	84"	29'-0"	60"	42"	33'-6"	8'-9"	13'-3"	Note #6	10"	*6"	20"	14,200
420SS	420,000	1120	8400	90"	26'-0"	60"	42"	30'-6"	9'-3"	13'-9"	Note #6	10"	**6"	24"	16,700

Larger sizes available upon request.