Recommended Specifications

Furnish and install one (1) Lockwood Model _____ ST two-stage, spray tray 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 incorporate T-316 cast stainless steel spray valve(s) with 303 stainless steel spring(s) mounted within the tray compartment. The internal direct contact vent condenser, fabricated of stainless steel, shall consist of a separate compartment for concentrating the non-condensable gases before they are released to atmosphere. The final stage of deaeration shall be accomplished by using a tray system designed to heat the water with the entering steam to saturation temperature. The trays shall be constructed of grade T-304 stainless steel, with 0.050 inches minimum thickness. The trays shall be interchangeable and designed to incorporate a capillary action for the water cascading to each lower tray. The internal parts of the deaerating heater, including the tray enclosure, baffles, vent connection, and vent collecting hood, shall be constructed of 12 gauge, T-304 stainless steel. All trays are to be fabricated using TIG welding process. One piece formed and riveted trays shall not be permitted. Flow of steam shall be such that the steam entering the heater first contacts the hottest water which is leaving the last row of trays, and then proceeds upward through the tray stack in a true counter-current fashion. 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) (electrical) 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 230°F water against a total discharge pressure of _____ PSIG.

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

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 _____ °F.
5. Low pressure condensate to deaerator shall be approximately _____ % of total inlet flow at _____ °F.
6. High pressure condensate to deaerator shall be approximately _____ % of total inlet flow at _____ °F.

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 ST
TRAY DEAERATORS

ILLUSTRATED WITH OPTIONAL EQUIPMENT

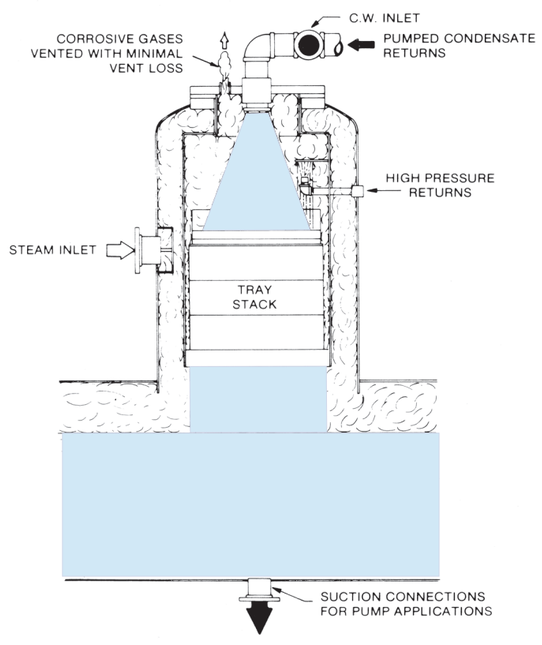
75 Years 1938 - 2013

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-tray 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.



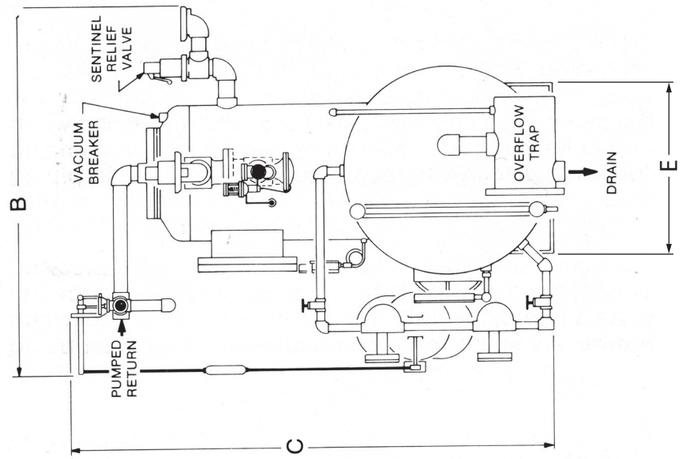
Operation

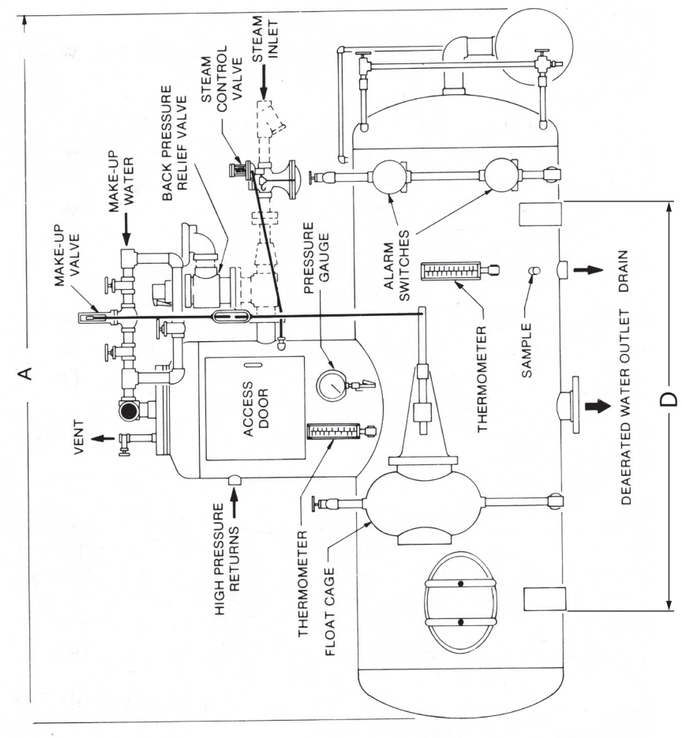
Incoming cold or tempered water first enters into the internal direct contact vent condenser of the vertical heater compartment, where stainless steel spray valve(s) direct the flow of water in conical sheets into a steam atmosphere. (Tempered water is a mixture of pumped condensate and cold water make-up.)

In the internal direct contact vent condenser most of the corrosive gases are removed before the water enters the tray compartment. These gases are expelled from the deaerator through a stainless steel vent pipe with a restricted orifice to the atmoshere.

The hot deaerated water is further exposed to oxygen free steam as it falls through the stainless steel trays where remaining traces of undissolved gases are released. Counterflow design assures full deaeration.

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, weights, vol-umes, etc. are approximate and subject to change without notice.
5. Consult Factory

Model	Capacity (#/Hr.)	Storage Cu. Ft.	Storage Gallons	Storage Tank Dia.	Storage Tank S.S.L.	Deaerator Dia.	Deaerator S.S.L.	Dimensions A	B	C	D	E	Water Inlet	Over-flow	Steam Inlet	Weight – Lbs. Shipping
5ST	5,000	13	100	30"	4'-0"	24"	40"	6'-3"	4'-3"	7'-3"	42"	28"	2-1/2"	1"	2-1/2"	1,400
10ST	10,000	26	200	30"	6'-8"	24"	40"	9'-0"	4'-3"	7'-3"	74"	28"	2-1/2"	1"	3"	1,600
15ST	15,000	40	300	36"	6'-0"	30"	40"	8'-6"	4'-9"	8'-0"	56"	33"	2-1/2"	2"	4"	2,100
20ST	20,000	53	400	36"	8'-0"	30"	48"	10'-6"	4'-9"	8'-6"	89"	33"	2-1/2"	2"	5"	2,400
30ST	30,000	80	600	42"	9'-1"	36"	48"	11'-9"	5'-3"	9'-6"	104"	38"	2-1/2"	2"	6"	4,700
45ST	45,000	120	900	48"	9'-8"	42"	52"	12'-9"	5'-9"	10'-6"	112"	44"	2-1/2"	2"	8"	4,950
60ST	60,000	160	1200	54"	9'-8"	48"	52"	13'-0"	6'-3"	13'-0"	112"	49"	3"	3"	8"	6,200
90ST	90,000	240	1800	54"	15'-5"	54"	5'-8"	18'-9"	6'-3"	14'-0"	148"	49"	3"	4"	10"	11,600
120ST	120,000	320	2400	54"	21'-0"	54"	6'-8"	24'-9"	6'-3"	15'-3"	162"	49"	4"	4"	12"	13,100
150ST	150,000	400	3000	60"	21'-2"	60"	6'-4"	24'-3"	6'-9"	15'-6"	96"	54"	4"	6"	12"	13,900
180ST	180,000	480	3600	72"	17'-8"	66"	7'-4"	21'-6"	7'-9"	17'-9"	154"	54"	6"	6"	14"	15,650
210ST	210,000	560	4200	72"	20'-10"	72"	6'-0"	25'-0"	7'-9"	16'-0"	Note #5	Note #5	6"	6"	14"	16,100
240ST	240,000	640	4800	72"	24'-0"	72"	6'-8"	28'-3"	7'-9"	17'-6"	Note #5	Note #5	6"	6"	16"	17,800

Larger sizes available upon request.