MIURA BOILER CO.,LTD.

MIURA SPRAY SCRUBBER DEAERATOR MDT-SERIES

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

MIURA BOILER CO., LTD.
MIURA BOILER WEST INC.

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1. Introduction

The Miura Deaerator is a feed water source, for a boiler to eliminate non-condensable gases (i.e., oxygen, carbon dioxide and air) that would normally be dissolved (in the fresh water make up) before entering the deaerator.

Oxygen dissolved in boiler feed water is a major cause of corrosion, not only on the boiler's interior but also in the steam system, which is made of iron, steel or brass.

Pitting is by far the most prevalent mode of corrosion, occurring most frequently and resulting in boiler failure. It is commonly accepted knowledge that dissolved oxygen is chiefly responsible for pitting.

Carbon dioxide itself is corrosive. Once it is vaporized within a boiler, CO_2 gas is delivered together with steam to various steam components. As steam condenses, the gas is re-dissolved into the condensate water, rendering it acidic. The acidic water will rapidly accelerate corrosion in the piping and other steam components.

Air (i.e., non-condensable gases) is considered to play a detrimental role by possibly entering heat exchangers, where it can deter the action of heat transfer.

The Miura Spray-Scrubber Deaerator eliminates such non-condensable gases to the maximum possible extent. It also reduces the concentration of dissolved oxygen in the boiler's feed water to 0.005 ml/litter or less. Accordingly, the installation of a Miura Deaerator is the most effective, yet economical, method of maintaining clean, sound conditions in the boiler and system components over the long term.

2. Operation

Cold makeup water enters the top of a vertical compartment and sprays forth in a shower-like manner as it jets out of the spray valve (s). The spray valve is made of stainless steel and regulates the spray to a constant mist, regardless of the flow rate, by means of a spring. The makeup water is thus initially deaerated in its spray form before it hits the surface of the main deaerator unit. The initial aeration has the added benefit of reducing deaerator corrosion.

The makeup water, deaerated and heated in the initial stage, falls through the scrubber section in a curtain-like manner. There, the water is heated to a nearly saturated temperature as it maintains contact with steam until it flows into the storage section.

In the storage section a steam injector (an agitator), which is set up below the water level, is designed to maintain the temperature of the water in the storage tank homogeneously and at a constant saturated temperature.

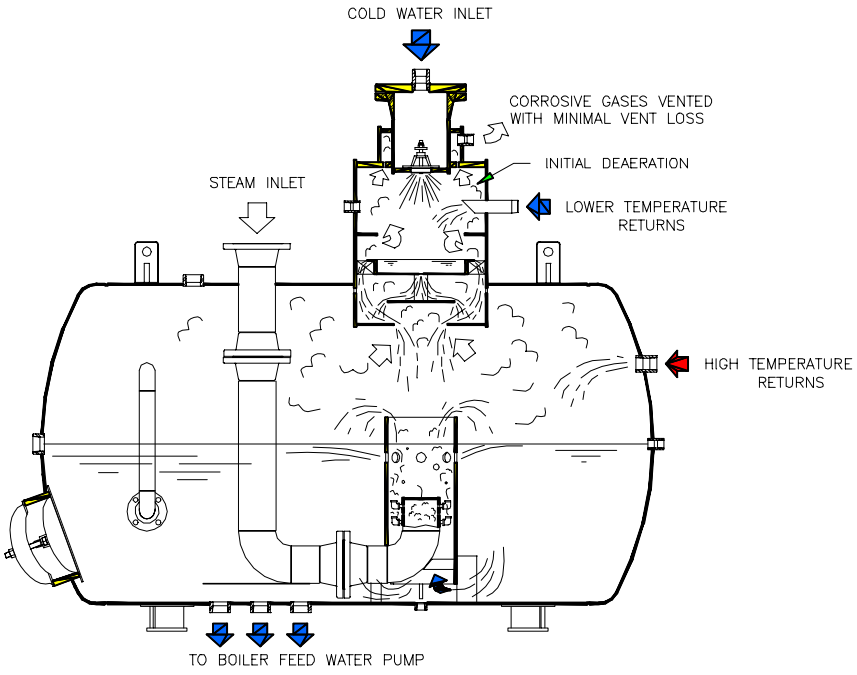

Fig. 1

3. Requirements for Steam

(1) Steam required by the makeup water: S_m [lb./hr.]

$S_m=\{Q_m * (T_1-T_2)\}/H_S$

(2) Steam required by the low-temperature returns: S_L [lb./hr.]

$S_L=\{Q_L * (T_1-T_3)\}/H_S$

(3) Flashed steam out of the high-temperature returns: S_H [lb./hr.]

$S_H=Q_H * \{h_f (T_4)-hf (T_1)\}/H_S$

where

Q_m: Makeup-water flow rate [lb./hr.]
Q_L: Low-temperature return flow rate [lb./hr.]
Q_H: High-temperature return flow rate [lb./hr.]
T_1: Temperature of steam supplied to deaerator [F]
T_2: Makeup water temperature [F]
T_3: Temperature of low-temperature returns [F]
T_4: Temperature of high-temperature returns [F]
H_s: Latent heat of vaporization under pressure with the deaerator operating [BTU/lb]
h_f: Enthalpy under pressure with the deaerator operating [lb./hr.]

Steam requirement: S [lb./hr.]

$S= S_m + S_L - S_H$

The most important factor in proper and sustained deaeration is the supply of a sufficient amount of steam to maintain the minimum deaerator interior pressure of positive 1 psi. In any event, the operating pressure must be limited to the design range of the deaerator used.

If the deaerator's internal temperature stays significantly short of the saturated temperature of the internal pressure, that may be due to a short steam supply. Such a short supply may be attributable to the incorrect size of steam valve, steam-pressure regulating valve or steam piping. Improver venting may also be a cause of low temperatures.

A short steam supply may also cause the deaerator to vibrate or hammer. A deaerating project, therefore, requires careful planning.

4. Installation and foundations

The Miura Deaerator specification sheet and drawings list the empty and fully filled operating weights, and the size and dimensions of the anchor-bolt holes. Be sure to check these specifications in planning for installation and foundation work.

Use the lifting lugs on the main deaerator unit when installing it. Also, handle the unit carefully using appropriate rigging in order to prevent damage to the nozzles and accessory parts.

The foundation must be leveled within one percent and be designed to withstand the maximum load by the deaerator and piping at their full operating weights. The deaerator may be shimmed as required after setting it in position.

The thermal expansion of the dearator unit must be taken into consideration. The Miura Deaerator is horizontally configured and supported by two saddles. One saddle is secured to the foundation with anchor bolts running through its holes. The other saddle is provided with anchor-bolt slots, allowing for free deaerator expansion in the horizontal direction.

5. Piping connections

Consideration must also be given to allowing for thermal expansion of the installed piping.

Arrange the piping so as to absorb the thermal expansion in both the horizontal and vertical directions in order to prevent the exertion of undue expansion stress on the main deaerator unit. Consider using expansion joints and other appropriate devices as required.

Each section of piping that is connected to the deaerator must be individually supported in order to keep the action of expansion and vibration off the main deaerator unit and nozzles.

Install the steam-pressure regulating valve as close to the main deaerator unit as possible. Increase the pipe size on the outlet side according to the installation drawing. Consult our company regarding valve sizing. If the regulating valve used is a sensing type, install and pipe it according to the corresponding manual.

The regulating valve must be located at a higher elevation than the main deaerator unit, and its piping must be insulated to preserve heat. We recommend the addition of a bypass valve in order to provide for a possible valve malfunction. The same precautions will apply to the makeup water valve.

Care should be exercised in planning the piping to the suction port of the feed water pump in order to prevent pump cavitations. We recommend locating the feed water pump as close to the main deaerator unit as possible and selecting the suction pipe size to be one or two sizes larger than the actual pump inlet size. Consult Miura or our rep regarding pipe sizing.

If a different pump than specified is to be used, check the required NPSH (net positive suction head) for the pump and provide the necessary head. Regardless of whether the specified or an alternate pump is used, a head on the order of eight feet is required between the pump suction port and the deaerator's normal water level.

The vent piping must be kept as short, straight and vertical as possible on its way to the rooftop. Exercise care in preventing the formation of traps and pockets, which would be detrimental to deaeration. Prevent tampering of the venting valve's (adjusted) opening by attaching a warning sign or the like.

Do not install a valve at the outlet side of the overflow trap. Since the overflow trap may occasionally discharge flashes of steam and hot water, it should be run out and open where it would not inflict burns on personnel. Run it to the blowdown separator or tank as required.

6. Operating procedure

6-1. Venting procedure

Normally, the venting valve must be opened about one to two turns from the fully closed position to allow for complete venting of gases. A smaller valve opening would prevent the deaerator's internal temperature from rising to a point of adequate deaeration. Conversely, an excessively large opening would waste steam. Therefore, the venting valve should be adjusted under normal operating conditions. Gradually close the valve from an approximately half-open position while constantly monitoring the deaerator's internal temperature. The valve must be set at a minimum opening that would not detrimentally affect the temperature. The adequacy of the valve opening must be evaluated over a time span of one hour or longer. Use a dissolved-oxygen concentration meter to monitor performance, if one is available.

A rule of thumb for adequate venting is to see a plume of steam, about a meter in height, off the tip of the venting pipe on the rooftop.

If a variation in load or increase in return is foreseen in advance in long-term operation, periodically check for any loss in the deaerator's internal temperature. Adjust the valve opening as required.

6-2. Preliminary check

Check the following areas before using the deaerator:

(1) Before resuming operation after a long period of nonuse, check the interior for dirt and foreign materials, which must all be cleaned out before starting the unit.
(2) Review all piping for conformance with the drawings and secure installation.
(3) Check to verify that all valves are set at their closed positions.
(4) Confirm that the makeup water pressure is at or greater than 3.5 psi, and check the supply steam pressure.
(5) Check the water softness and verify the chemical pump setting.

6-3. Startup

(1) Open the venting valve fully.
(2) Turn on the power to the control cabinet. Confirm that the makeup water valve opens from the fully closed position to the fully open position. Now, begin supplying water slowly by opening the manual valve to approximately 10 percent. As the water level reaches a point near the midline of the storage tank, the electric valves will start closing at four different stages, fully closing at a few inches above the center height.
(3) First, confirm that the water level is normal. Next, shut the manual valve and drain the water out of the storage tank completely. Close the drain valve.
(4) Slowly open the steam valve. Be sure not to immediately open the valve fully but maintain a 10-percent open position until the deaerator is fully heated.
(5) When the deaerator heats up fully, check out and tighten as required all bolts on the main unit flanges, manhole and others.
(6) Open the steam valve fully. Turn on the power to the control cabinet to start feeding water. At this point, we recommend opening the drain valve for a while in order to drain the initial dirty water.
(7) Open the valves in the condensate returns and boiler's feed water pump lines.
(8) When the water rises to the normal level, adjust the opening of the venting valve.

7. Control procedure

The Miura MDT Series Deaerator uses an electrode-type level control system. It electrically adjusts the makeup water valve opening over five stages, in accordance with the water level. The sustenance of effective deaeration requires a continuous supply of water to the deaerator. Trim each of the five valve positions as necessary, as they are individually adjustable with the exception of the fully closed positions.

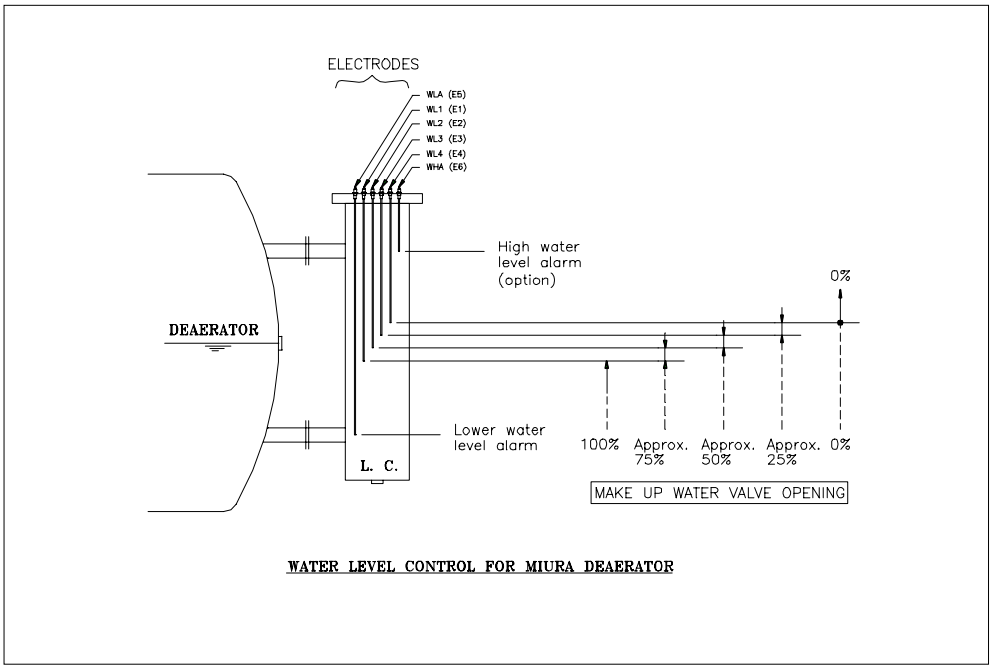

Fig. 2

8. MAINTENANCE & INSPECTION

Normally, a MIURA MDT-series deaerator requires little maintenance. The operation should be completely automatic and for normal operation little or no maintenance is required, except for the usual attention required for instrumentation and controls.

The deaerator requires annual inspection. In plants where duty is unusually severe or abnormal water supplies are used, semi-annually or more frequent inspection may be required.

Check out the following items in a periodic inspection:

(1) Interior corrosion and scaling.
(2) Installed conditions of the spray valve(s). Replace the gaskets as required. We recommend valve replacement approximately once every three years in order to maintain continuously effective deaeration.
(3) Check the makeup water control valve for leakage at the fully closed position. Minute leakage through the valve would cause hard water to feed through the water softener.
(4) Replace the manhole and flange gaskets if leakage or scratches are found on them.
(5) Check the level-control electrodes for dirt deposits. Inspect their insulation. Replace with new ones as required. The inspection procedure for these is the same as for the boiler electrodes.
(6) Recalibrate the thermometers, and the pressure gauges and others. Replace the glass in the water gauge as necessary.
(7) Clean out the strainer at the inlet port on the boiler's feed water pump.
(8) Inspect the condition of all insulation and make repairs where required.
(9) It is imperative that the venting valve be readjusted on the initial startup after inspection.

MIURA TWO-STAGE, SPRAY SCRUBBER DEAERATORS

MODEL	MDT-300	MDT-600	MDT-900	MDT-1200
OUTLET CAPACITY (LBS/Hr)	10,000	20,000	30,000	40,000
TANK CAPACITY (Gal to overflow)	230	460	620	930
WEIGHT *Dry (LBS)	1,400	1,750	2,000	3,850
WEIGHT *Flooded (LBS)	4,680	7,450	9,250	15,700
TANK SIZE (Dia X Length)	3' X 6'	4' X 6'	4' X 8'	5' X 8'
DESIGN PRESSURE (PSI)	30	30	30	30
OPR. PRESSURE (PSI)	5～15	5～15	5～15	5～15
OVERALL HEIGHT (Approx)	80"	90"	90"	110"
OVERALL WIDTH (Approx)	98"	101"	125"	130"
OVERALL DEPTH (Approx)	62"	70"	70"	82"
CONNECTION SIZES				
STEAM INLET (Flanged)	4"	5"	6"	6"
WATER INLET (NPT scr'd)	1"	1 1/2"	2"	2"
MAKE-UP VALVE (NPT scr'd)	1"	1 1/2"	2"	2"
CONDENSATE INLET (180-227F)	1"	1 1/2"	1 1/2"	2"
CONDENSATE INLET (180F&under)	1 1/4"	1 1/2"	2"	2"
PUMP SUCTION (NPT scr'd)	two 2"	three 2"	three 2"	four 2"
OVER FLOW OUTLET (NPT scr'd)	1 1/2"	2"	2"	2"
TANK DRAIN (NPT scr'd)	1"	1"	1"	1 1/4"
VENT TO ATMOS. (NPT scr'd)	1"	1"	1"	1"
VACUUM BREAKER (Option)	1"	1"	1"	1"
RELIEF VALVE OUTLET (NPT scr'd)	2"	2 1/2"	2 1/2"	2 1/2"
CHEM. INLET (NPT scr'd)	1"	1"	1"	1"
SPARE CONN. (NPT scr'd) Plugged	two 2"	two 2"	two 2"	two 2"
MANHOLE (ELLIPTIC)	12" X 16"			
ITEM LIST				
STAND 6' (*OPTIONAL)				
ELECTRIC MAKE-UP VALVE				
LEVEL CONTROLLER				
CONTROL PANEL				
FEED WATER PUMP (*OPTIONAL)				
STEAM PRESSURE REDUCING VALVE (*OPTIONAL)				
OVER FLOW DRAINER				
GAUGE GLASS ASSEMBLY				
PRESSURE GAUGE WITH SYPHON PIPE AND COCK				
THERMOMETER (WATER)				
THERMOMETER (STEAM)(*OPTIONAL)				
RELIEF VALVE				
VENT VALVE				
LOW WATER LEVEL ALARM				
HIGH WATER LEVEL ALARM (*OPTIONAL)				

DISTRIBUTOR INFORMATION	
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FAX	
DATE OF INSTALLATION	
BOILER MODEL	

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