

Boiler Layup Procedures For Systems with Demineralized or RO Feedwater

High-pressure boilers that are out of service for even short periods of time face the very real possibility of corrosion on the internal surfaces. Wet Layup - the procedure that is used when the boiler will be out of service for shorter periods of time and may need to be brought back into service within several hours' prior notice. Dry Layup - the procedure that is generally used in boilers that are to be out of service for extended periods of time (≥ 30 Days), or in situations whereby the boilers are subject to the possibility of freezing, thus precluding the possibility of wet layup. Prior to any long-term storage, the boiler should be thoroughly cleaned and inspected. Superheater Layup - if superheaters are present, see Superheater Layup Procedure.

The procedures that follow are designed to allow boilers to be kept off line for any period of time with reduced risk of damage.

Wet Layup Procedure

Laboratory data, supported by actual field experience has shown that R-12LU and DuBois other volatile passivating oxygen scavengers provide:

- Wet standby corrosion protection that is superior to hydrazine, and
- Freedom from worker concerns regarding the handling of a suspected carcinogenic material.

The following wet layup procedure is appropriate for use in boiler systems where high purity water is required.

1. Fill the boiler to its normal operating level, with demineralized, deaerated feedwater. Never fill the boiler with non-deaerated water.
2. Add one of the following passivating oxygen scavenger products to the boiler storage water:
 - a. R-12LU (catalyzed hydroquinone) to maintain a residual of 2,000 to 3,000 ppm as product. This will require the addition of 2.0 to 3.0 gallons of R-12LU per 1,000 gal of water in the boiler.
 - b. R-53LU (catalyzed diethylhydroxylamine – DEHA) to maintain a residual of 200 ppm as DEHA or 900 ppm as product. This will require approximately 0.9 gallons of R-53LU per 1,000 gallons of water in the boiler.
 - c. R-1304LU (carbohydrazide) to maintain a residual of 200 ppm as carbohydrazide or 3300 ppm as product. This will require an addition of approximately 3.2 gallons of R-1304LU per 1,000 gallons of water in the boiler.
3. Adjust boiler storage water pH to 9.5-10.0 with appropriate neutralizing amine. This will be approximately 0.5 lbs of active amine per 1,000 gallons of water in the boiler.
4. In the event that external circulation is not available, lightly fire the boiler, using an auxiliary fuel such as natural gas, in order to establish sufficient circulation to ensure proper mixing of the chemicals throughout the entire boiler.
5. After circulating, and before the unit has completely cooled and some steam pressure remains, the boiler should be completely filled with demineralized, deaerated feedwater.

- a. An alternative to complete flooding is to place the boiler under a 5 to 10 psig Nitrogen Blanket to prevent air inleakage. CAUTION: When nitrogen blanketing is employed, safety placards should be posted and an appropriate reentry procedure established.
6. Tightly close all connections and apply a small positive pressure to the boiler in order to compensate for the vacuum that develops as the unit cools to room temperature. This can be achieved via the feedwater pump.
 - a. As an alternative to applying a back pressure, it is possible to maintain a positive head or reservoir to serve the same purpose. This is done by connecting a clean 55-gal drum to the vent line or other available fitting at the top of the boiler. As the boiler is filled, the drum collects the overflow. Then, as a vacuum develops because of cooling, the water in the drum enters the boiler to keep it full. Additional demineralized water added to keep the drum filled should be treated with R-12LU (about 1.3 lbs per 50 gallons of water) OR with R-53LU (about 0.4 lbs per 50 gallons of water), OR R-1304LU (about 1.4 lbs per 50 gallons of water) plus neutralizing amine (fed to attain pH 9.5 to 10.5).
7. The boiler should be tested weekly as long as the unit is in storage. Additional oxygen scavenger, plus neutralizing amine, should be fed as required to maintain the recommended chemical residuals. When more chemical is added, it is desirable to circulate the boiler water for a short time by means of an external pump.
8. In preparation for returning the boiler to service, drain the boiler to the normal operating levels and bring the unit back on-line in the normal manner.
9. Increase the rate of continuous blowdown during the first 24 to 48 hours of operation.
10. Initiate the feed of regular boiler water treatment chemicals as soon as the boiler is placed into service.

Superheater Layup Procedure

Both drainable and non-drainable superheaters can be considered as part of the boiler as far as treatment procedures are concerned, and are flooded in the same manner as described in Wet Layup Procedure.

1. Circulate the water in the superheater section to ensure thorough mixing of chemicals.
2. For start-up, follow the manufacturer's instructions for firing rate and procedures for boiling water out of the superheater tubes.

Dry Layup Procedure

1. The boiler should be drained, cleaned and thoroughly dried. Drying is accomplished by circulating warm or hot air throughout the unit. This can be accomplished by stoves, blowers or compressed air. Special attention is required for low areas where water may collect and/or non-drainable superheaters.
2. A chemical desiccant or vapor phase corrosion inhibitor is placed in the boiler (each drum for desiccants) so that air circulation below the container is possible. The more commonly used materials and rules-of-thumb requirements include:
 - a. Quicklime: @ 6 to 10 lbs/1,000 lbs/hr rated capacity, or @ 6 lbs per 100 ft³ of volume
 - b. Silica gel: @ 10-12 lbs/1,000 gal boiler holding capacity, or @ 8-10 lbs/100 ft³ of volume
 - c. Activated alumina: @ 8 lbs/100 ft³ of volume
 - d. Cortec Boiler Lizard @ 1 bag (3.3#)/1,000 gallons of boiler holding capacity. Use of this vapor phase corrosion inhibitor will result in up to 12 months protection.
3. As soon as the desiccant/inhibitor is in place, close all boiler openings and tightly blank all connections.
4. An inspection of the desiccant and an evaluation of its continued ability to absorb moisture should be made every 2 to 3 months. Boilers treated with vapor phase corrosion inhibitor should not be re-opened for inspection.
5. In preparation for returning the boiler to service, remove all desiccant materials from the boiler and bring the unit back on-line in the normal manner.
6. Initiate the feed of regular boiler water treatment chemicals as soon as the boiler is placed into service.