

BOILER OUT OF SERVICE – STEAM BOILER

There are two basic procedure for laying up a steam boiler:

Wet Lay-up and Dry Lay-up

1. Wet lay-up is recommended for short down times (30 days or less) and has the advantage of allowing the boiler to be returned to service on short notice. But, this method can be a problem if the boiler will be exposed to freezing conditions..
2. Dry lay-up is recommended for long down times (greater than 30 days), but is practical only if the boiler can be drained hot (120-170° F.) or if external drying can be provided.

Wet Lay-up of a Steam Boiler

In the wet procedure, the boiler is completely filled with chemically treated water and sealed to prevent any air in-leakage. Nitrogen gas under slight pressure can also be used to displace air and “blanket” the boiler surfaces from corrosion. (See safety precaution)

The following steps should be taken to wet lay-up a boiler:

- 1A. At least 30 minutes before the boiler comes off line, add the following chemicals:

Sodium Sulfite

5 lbs. / 1,000 gallons of water

A Ploymeric Dispersant

1 lb. / 1,000 gallons of water

Caustic Soda

3 lbs. / 1,000 gallons of water

- 1B. If the boiler has been out of service for cleaning or has never been online, use the following procedure:

Select the highest quality water available to lay-up the boiler. Steam condensate, softened water, filtered fresh water and boiler feedwater are generally acceptable for lay-up. Raw city water should not be used.

Prepare the chemical solution in a separate tank using the concentrations as described in the above list. Add the concentrated lay-up solutions to the boiler during the time it is being filled.

After the boiler is filled and the lay-up solution is added, operate the boiler for at least 30 minutes to obtain circulation and mixing of the chemicals. Operate modulating units on low fire.

2. After filling, the boiler must be tightly blanked or closed. Electric energy to the unit must be turned off. All vent valves are operated as needed to ensure that the boiler can be completely filled with the required solution. To prevent in-leakage of air, pressurize unit with 5 psig nitrogen through a suitable connection during the lay-up period. An alternative is to install a 55 gallon drum or auxiliary vessel, fitted with a cover and containing properly treated water, above the highest part of the steam drum. The drum and auxiliary vessel should be connected to an available opening such as a vent line at the top of the boiler to create hydrostatic head. The tank will provide a ready visual check of water loss or in-leakage during lay-up. (See Figure 1)

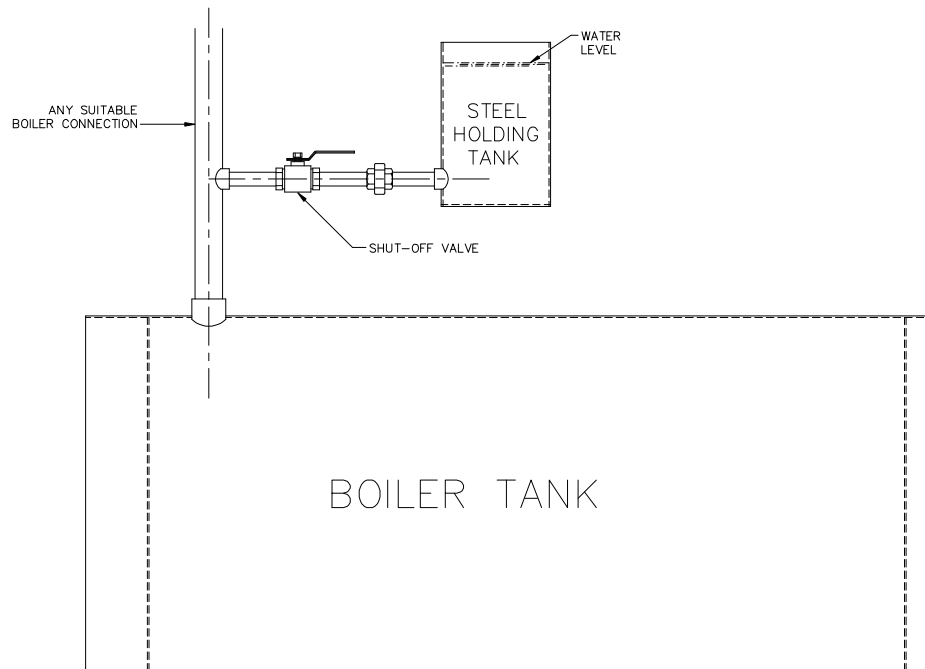


Figure 1
Arrangement for keeping boilers completely full of water during wet lay-up.

3. Laid-up boiler must be tested weekly to make sure that the proper levels of sulfite and alkalinity are being maintained. To do this, take a sample of the boiler water from the surface blowdown line or other high point. The test results should be

200 ppm minimum, sodium sulfite (as SO_3)

400 ppm minimum phenolphthalein alkalinity (as CaCO_3)

If the test show that chemical concentrations have decreased below the recommended minimum, a practical procedure is add additional lay-up solution to the drum and inject into the boiler by lowering the water level. To mix the chemical, operate the boiler for 30 minutes, and then follow the procedures previously described under item 2 for complete filling of the boiler. Attention should be directed to valve maintenance so that untreated water does not accidentally enter the boiler and cause dilution of properly treated lay-up solutions.

Dry Lay-up of a Steam Boiler (over 30 days)

In storing a boiler dry, trays of moisture-absorbing chemicals are place in the boiler, and all openings are sealed. In an alternative dry procedure, the boiler is drained, dried as completely as possible, the manholes closed and all connections tightly blanked or closed. The boiler is then pressurized with nitrogen to prevent air from getting inside the boiler. The success of this procedure depends on thorough drying of all boiler metal surfaces after draining and the exclusion of air during lay-up by pressurizing the boiler with nitrogen. (See safety precaution)

CAUTION: Boilers laid-up dry shall be tagged with information to indicate the unit must not be operated until moisture-absorbing chemicals are removed and the boiler refilled.

The following steps should be taken for dry lay-up:

Desiccant Method

1. After the boiler has cooled, drain it completely.
2. Flush the boiler thoroughly and inspect it. A boiler containing porous moisture retaining deposits should not be laid-up dry because of the possibility of under-deposit corrosion occurring. If cleaning is needed, this must be done before the boiler is laid-up.
3. Dry thoroughly. Circulated warm air should be used in drying the metal. Put quick lime (not hydrated lime) or commercial grade silica gel on wooden or plastic trays and place them inside the boiler shell. The trays should be placed so that air may circulate underneath. Use at least 5 lbs of quick lime per 1,000 lbs/hr capacity or 5 lbs per 30 horsepower. If silica gel is used, the quantities recommended are 8 lbs per 1,000 lbs/hr capacity or 8 lbs per 30 boiler horsepower. Do not fill trays more than half full.

4. Close all manholes and blank or close all connections on the boiler as completely as practical to prevent in-leakage of humid air. An option is to pressurize the boiler with 5 psig nitrogen after the desiccant is installed.
5. Inspect the waterside of the boiler every three months for evidence of active corrosion. Check the desiccant and replace if necessary. If the boiler has been pressurized with nitrogen, it should not be entered until the safety precautions below for nitrogen have been taken. Do this work as quickly as possible to minimize the entry of humid air.
6. If desiccant is wet, dry out the boiler again before replacing the desiccant and then re-pressurize with nitrogen.

Nitrogen Blanketing Method

- 1A. Drain the boiler before the pressure falls to zero and pressurize with 5 psig nitrogen through a suitable connection while draining. Maintain this nitrogen pressure throughout the draining and subsequent storage.
- 1B. An alternate method is to completely dry a clean boiler and then purge the air from the boiler and pressurize to 5 psig nitrogen. Be aware that all metal surfaces not completely dried are vulnerable to corrosion, particularly if oxygen is present. Drying can be aided by employing low auxiliary heat or blowing hot dry air through the boiler.
2. If a boiler has been down for repairs and is to be laid-up with nitrogen, it should be operated to re-pressurize with steam and then drained and pressurized with nitrogen as previously discussed.
3. All connections and valves must be blanked or closed.

Note: Operating boilers must be removed from service properly to minimize adherence of boiler water suspended solids on boiler metal surfaces. This can be accomplished by immediately flushing with hot, pressurized water, while waterside surfaces are still wet. If a boiler contains deposits that formed during operation or due to improper shutdown procedures, mechanical or chemical cleaning is required.

Safety Precaution

The use of nitrogen for blanketing is recommended in many of the lay-up procedures. Nitrogen will not support life, therefore, it is essential that proper precautions be taken before such equipment is entered for inspection or other purposes. These precautions shall include disconnecting the nitrogen supply line, thorough purging and venting of the equipment with air and testing for oxygen levels inside the equipment. Appropriate caution signs shall be posted around the equipment to alert all personnel that nitrogen blanketing is in use.