



Boiler Hydrotest

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Contents

- ❑ Boiler Hydrotest – IBR Guidelines
- ❑ Boiler Hydrotest – Schematics, Circuit and Procedure
- ❑ Dry/ Wet Preservation of Boiler

Boiler Hydrotest - Purpose

After installation of all pressure parts and any tube replacements the Boiler is subjected to Hydrostatic pressure. This is done to ensure healthiness of material and correctness of workmanship. This is also a statutory requirement with respect to IBR.

IBR regulation 268: Testing at Maker's work

Components to be tested

- Boiler drum and other cylindrical components having internal diameters greater than 600 mm
- All components not reasonably accessible for inspection after assembly into the boiler
- Tested hydraulically prior to welding at a pressure less than 1.5 times the maximum working pressure.

Test Pressure

- 1.5 times the maximum working pressure

Boiler Hydrotest – IBR Guidelines contd.

IBR regulation 268: Testing at Maker's work

Test Procedure

On completion of manufacture at the makers' works in the presence of Inspecting Officer, hydraulic test shall be carried as:

- The test pressure shall be raised gradually
- It shall not exceed by more than 6% of the required pressure
- The test pressure shall be maintained for 30 minutes
- The pressure shall be reduced to maximum allowable working pressure and maintained for close visual inspection of the pressure parts.
- The temperature of water used shall be 20°C - 50°C.

Boiler Hydrotest – IBR Guidelines contd.

IBR regulation 268: Testing at Maker's work

Completion Criterion

No indication of weakness and defects

Note: Components other than tubular products shall not require hydraulic testing before assembly into the boiler if the completed boiler is tested hydraulically to 1.5 times the maximum permissible working pressure at site.

Boiler Hydrotest – IBR Guidelines contd.

IBR regulation 379: Testing at Site

- *After Erection (For Registration)*
- *Before grant of increased pressure certificate*
- *After a repair (in case of minor repairs followed by NDT with approved process, it may not be done)*

Components to be tested

- Complete Pressure Parts

Test Pressure

- 1.25 times the maximum working pressure, if all components as per Regulation 268 are tested.
- 1.5 times the maximum working pressure, if any of the components as per Regulation 268 are not tested .

Boiler Hydrotest – IBR Guidelines contd.

IBR regulation 379: Testing at Site

Test Procedure

On completion of works in the presence of Inspecting Officer, hydraulic test shall be carried as:

- The test pressure shall be raised gradually
- It shall not exceed by more than 6% of the required pressure
- The test pressure shall be maintained for 30 minutes
- The pressure shall be reduced to maximum allowable working pressure and maintained for close visual inspection of the pressure parts.
- The temperature of water used shall be 20°C - 50°C.

Boiler Hydrotest – IBR Guidelines contd.

IBR regulation 379: Testing at Site

Completion Criterion

- Successful completion without appreciable leakage or undue deflection or distortion of its parts for at least **ten consecutive minutes**.
- At the first hydraulic test of a boiler deflection measurements shall be made before, during and after test of each furnace length, fire-box and flat end or other plates.
- Should any part of the boiler show undue deflection or indication of permanent set during the progress of the test, the pressure shall be released immediately such indications are observed. The working pressure for the part shall be 40 per cent of the test pressure applied when the point of permanent set was reached. This procedure shall apply to any boiler at any test.

Boiler Hydrotest – General Schematics

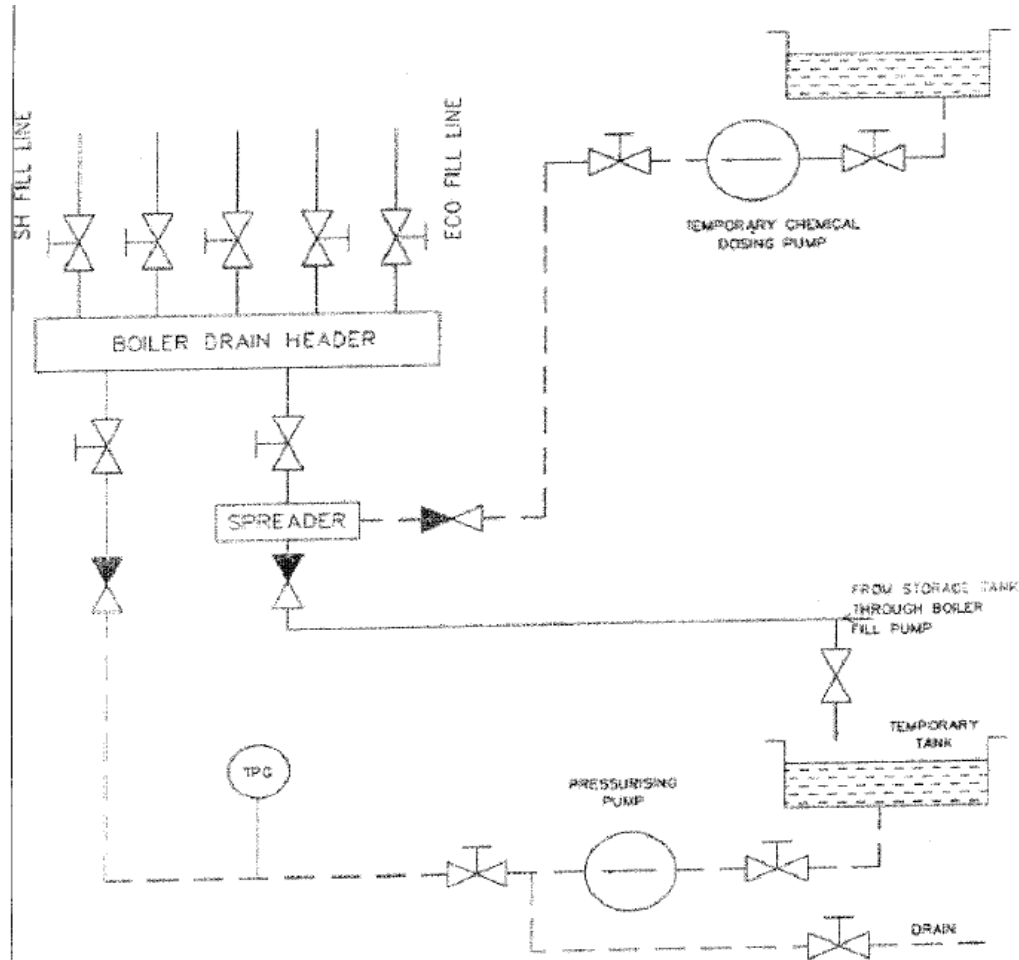


FIG 2 - HYDRAULIC TEST OF BOILER - TYPICAL ARRANGEMENT FOR FILLING, PRESSURISATION & PRESERVATION

Boiler Hydrotest – Procedure

The Hydrotest of Boiler is done in two stages:

Stage-1:

Hydro test of complete **water and Superheater steam circuit** including drainable and non-drainable sections of Boiler up to Boiler Stop valves.

Thus this will include:

- a. Economiser
- b. Boiler Drum
- c. Downcomers and Water walls
- d. LTSH
- e. Platen Superheat (Non drainable)
- f. Final Superheater (Non drainable)

The hydro test pressure is chosen as the 1.5/ 1.25 times the maximum of maximum working pressure of components participating.

Boiler Hydrotest – Procedure contd.

Stage-2

This covers the reheater circuit . The QCNRV of reheater does not participate and CRH section up to this point is blanked. One Interceptor valve blanking device is also installed. Thus the circuit comprise of CRH lines from QCNRV to Reheater, Reheater and HRH lines up to IV.

The hydro test pressure is chosen as the 1.5/ 1.25 times the maximum of maximum working pressure of components participating.

Boiler Hydrotest – Procedure contd.

Services

- **Standard Pressure gauge** – one At drum and one near pressurizing pump - Calibrated at NABL accredited laboratory with least count of 1KSC.
- **DM Water** – Of following quality

Parameter	Unit	Value
PH at 25 deg C	-	7 +/- 0.2
Conductivity	µmho/ cm	<0.2
Total Hardness	-	Nil
Total Silica	ppb	<20
Chloride	ppb	Nil
Sodium	ppb	<3

- **Chemicals** – Ammonia and Hydrazine Hydrate in quantity such that water being filled shall have 200 ppm of hydrazine and pH of 9.5 - 10

Boiler Hydrotest – Procedure contd.

Services

- Pressurizing Pump – Of suitable capacity for pressurization
- Boiler Fill Pump – For initial filling
- Temporary Chemical Dosing Scheme
- Flood Lights and 24V hand lamps
- Reliable Communication System
- Ambulance and Fire Tender

State of the plant

- Erection of Boiler PPs and piping is complete as per drawing.
- All necessary welding jobs are complete, stress relieved and X-rayed
- All necessary valves including drain valves are installed and kept closed
- All safety valves are installed and hydrostatic plugs assembled
- The isolating valves provided in all other branches viz. soot blowing tapping, SH spray connection, RH spray connection are closed tight. They are tested separately at specified pressures.

Boiler Hydrotest – Procedure contd.

State of the plant

- All vents are open
- All the hangers in Boiler and Piping are set/ locked as per recommendations
- Required manholes and peepholes in the furnace are open for inspection
- Sky Climbers/ Scaffolding arrangements are provided inside boiler
- Boiler drain is suitably connected to storm water drains
- All debris are removed from various elevations
- All handrails and platforms are completed

Note: No boiler welding including attachment welding is allowed to be done after successful hydro test.

Boiler Hydrotest – Procedure contd.

Test Procedure

Air Testing of Pressure Parts

- Before filling water in Boiler Air tightness test is done to detect any leakages due valve left open, X-ray plug forgotten, any cuts not observable by visual inspection etc.
- This reduces DM water consumption and time
- The air used for testing shall be filtered and free of oil
- Before admitting air all the drain and vents are closed tight
- Boiler is pressurized up to 2KSC with air
- Boiler is inspected and leakage if any shall be corrected
- After test completion all the vents shall be left open

- **Completion Criterion** – No appreciable pressure drop in a day

Boiler Hydrotest – Procedure contd.

Test Procedure

Hydro Test of Pressure Parts

- The Boiler system is filled with fill pump from bottom using drain cum fill lines with the treated DM water.
- Completion of filling of various circuits is ensured by water coming out of vents
- Close and open the vent several times to ensure proper venting
- The pressurizing pump is started and pressure is raised up to 25 KSC and thorough inspection is made.
- Pressure should be raised in steps and held for 10 minutes at 100 and 200 KSC.
- Average rate of rise of pressure shall be 10 KSC/ minute up to 80% of test pressure. Afterwards, it should be 2 KSC/ minute.
- At test pressure pressurizing pump shall be stopped and drop in pressure shall be monitored for 30 minutes.

Boiler Hydrotest – Procedure contd.

Test Procedure

Hydro Test of Pressure Parts

- **Completion Criterion** – The drop rate should not be more than 1 KSC/ minute and no appreciable deflection of components
- After completion of test Boiler shall be depressurized at the rate of 1KSC/ minute using vents.
- At a pressure of 50 KSC, the pressure is held and Boiler is thoroughly inspected.
- If found satisfactory, full depressurization and draining can be done
- At 2KSC the vents are left full opened.

Note: During raising pressure for the first time no person should be allowed to enter Boiler after 50 KSC.

Dry/ Wet Preservation of Boiler

Dry/ Wet Preservation of Boiler

- As the non-drainable parts of boiler can not be drained completely, the only way to expel such water is to light-up the boiler.
- If boiler light-up is not planned after some duration Boiler shall be dry / wet preserved.
- The steam piping shall be dry preserved.

- **Dry Preservation** – Under inert gas capping at minimum pressure of 0.35 KSC

- **Wet Preservation** – Regular sampling and feed of chemical to maintain parameters.

Dry/ Wet Preservation of Boiler

Wet Preservation of Boiler - Schedule

Duration	Water Filled Surface	SH Circuit	RH Circuit
< 1 week	Hydrazine – 200 ppm and Ammonia – 10 ppm, PH 9.5-10 pressure 5-10 KSC	Hydrazine – 200 ppm and Ammonia – 10 ppm, PH 9.5-10 pressure 5-10 KSC	Hydrazine – 200 ppm and Ammonia – 10 ppm, PH 10-10.5 Under N2 capping of 0.35 KSC
1 week – 1 month	Hydrazine – 300 ppm and Ammonia – 10 ppm, PH 9.5-10 pressure 5-10 KSC	Hydrazine – 300 ppm and Ammonia – 10 ppm, PH 9.5-10 pressure 5-10 KSC	Hydrazine – 300 ppm and Ammonia – 10 ppm, PH 10-10.5 Under N2 capping of 0.35 KSC

Dry/ Wet Preservation of Boiler

Wet Preservation of Boiler - Schedule

Duration	Water Filled Surface	SH Circuit	RH Circuit
1 month – 6 months	Hydrazine – 700 ppm and Ammonia – 10 ppm, PH 9.5-10 pressure 5-10 KSC	Hydrazine – 700 ppm and Ammonia – 10 ppm, PH 9.5-10 pressure 5-10 KSC	Hydrazine – 700 ppm and Ammonia – 10 ppm, PH 10-10.5 Under N2 capping of 0.35 KSC
> 6 months	Hydrazine – 1000 ppm and Ammonia – 10 ppm, PH 9.5-10 pressure 5-10 KSC	Hydrazine – 1000 ppm and Ammonia – 10 ppm, PH 9.5-10 pressure 5-10 KSC	Hydrazine – 1000 ppm and Ammonia – 10 ppm, PH 10-10.5 Under N2 capping of 0.35 KSC

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Thank You