

## Cast iron boilers maintenance, inspection and testing for the owner/operator

Inspection, maintenance and testing of cast iron boilers

### Scope/Purpose

Cast iron boilers are found throughout Canada providing heat or hot water supplies to many users. We find these boilers in apartment buildings, educational institutions, health care institutions, mercantile buildings, as well as industrial occupancies.

Because cast iron is very brittle, it is highly susceptible to cracking. Internal corrosion and scale build-up impedes operational efficiency and will lead to overheating, poor circulation and eventual metal failure. Internal inspection of metal surfaces cannot be performed on these boilers, therefore proper maintenance, inspection and testing must be carried out before, during and after the heating seasons.

There are three classes of cast iron sectional boilers:

- Class 1 – Low-pressure steam, less than 15 psi
- Class H – Hot water heating boiler
- Class S – Hot water supply boiler, less than 160 psi and 250°F

### Sectional boilers: All classes

Older units found sitting idle during summer months in a damp basement are exposed to external corrosion. Make sure the holding nuts on the through tie rods are not tight.

Determine whether the tie rods are rusted into their holes, which may have the same binding effect as tight securing nuts.

In addition to rust depositing between the sections, rapid start-up can cause serious damage to the boiler sections. This results in thermal shock, which causes stress cracking in the gray cast iron sections, which are very brittle. In layman's terms, stress cracking is caused by the rapid change in temperature of the metal as the flame is applied directly to the metal from the outside and the cold water is circulating through the inside. To help reduce the possibility of this occurring, at least two weeks prior to the beginning of the normal heating season, (around September 15th) have a qualified service technician perform the annual pre-season service inspection of the main burner(s), circulating system and safety devices. Start the boiler at this time and leave it in the "On" position to cycle as the temperature demands dictate.

The boiler and heating loop can slowly warm up in this fashion before heavy heating demands are required.

## Heating and supply boilers

Older boilers without good blowdown facilities have a tendency to develop serious scale build-up, which results in overheating and eventual metal failure. Operating a boiler in this condition also increases fuel consumption. To help reduce this threat, follow this procedure prior to shutting down the boiler at the end of a heating season.

### Class I boilers – Low pressure steam boilers

Steam can cause severe injury. A knowledgeable service technician taking all necessary safety precautions should perform this procedure.

- While under full operating pressure, blow the waterside down, using the lowest isolating valve commonly known as the blowdown valve.
- Open the valve wide for a period not exceeding 15 seconds.
- Close the valve and allow the water level in the boiler to re-establish itself to a normal operating level. Repeat this procedure until no large particles of scale or sludge can be seen in the boiler feed water discharging through the blowdown line. (No more than 3 blowdowns). Wait at least 5 minutes between blowdowns for the boiler to sufficiently heat the incoming freshwater makeup.
- After the water level has re-established itself (one half a gage glass showing) temporarily shut the boiler down. When the steam pressure reaches "0" PSI carefully open the safety valve. Once no steam can be seen escaping through the safety valve, a predetermined amount of sludge conditioner and oxygen scavenger should be introduced somewhere on the steam side of the boiler i.e.. upper water level control outlet piping. Your service technician through a qualified water treatment specialty company can purchase the proper chemicals.
- Once the chemicals have been introduced into the boiler, replace all open piping connections and close the safety valve. With proper water level restored in the boiler, start the boiler up once again and continue to operate until the end of the heating season. With the increased dosage of chemicals in the boiler, active corrosion and scale build-up should be greatly reduced while sitting idle during the summer months.

### Class H boilers – Hot water heating boilers

- For hot water heating boilers, shut the firing mechanism down.
- Shut the circulating pump down and close the inlet and the discharge valve.
- Isolate the expansion tank and fresh water makeup valve. Open the blowdown valve to remove the scale or sludge build-up.
- Allow the boiler to drain for no more than 15 seconds. Open the safety valve carefully to ensure no pressure build-up remains within the boiler. The level in the boiler must be below the safety valve so that it can be removed and the chemicals added.
- Once this is done, put the safety valve back on and close it. Open the expansion tank isolating valve, fresh water makeup valve inlet and outlet valves slowly, and allow the boiler water level to re-establish itself.
- When this has been done, return the boiler to operation for the remainder of the heating season.
- Visually check the water level in the expansion tank daily to ensure that the boiler is full. If the expansion tank doesn't have a gage glass, have one installed by a qualified welder/fitter. Normally, there should be about one half a gage glass showing at all times.

## Class S boilers – Hot water supply boilers

Domestic hot water cannot have feed water chemicals in the water therefore it is recommended that a good quality water softener unit be installed into the fresh water make-up supply line to the boiler. Hot water supply boilers may be a direct heating system with a large storage tank within the system. Should the supply heating system incorporate a hot water heat exchange unit within the storage tank so that it is an indirect heating system, then the boiler can be treated the same as a hot water heating boiler.

### Low pressure steam boilers

- Test the low water fuel cut-off safety device once a week. On cast iron boilers, this is typically a float type water level control valve.
- By opening the lower (water side) drain valve below the float chamber, the chamber is emptied and the float immediately drops causing electrical circuitry to shut off the fuel valve to the burner.
- Once the drain valve is closed and the water level is re-established in the level control valve, the burner will restart after a preset boiler furnace purge cycle.
- This test can only be done while the boiler is under fire. Should the flame fail to go out, call your service repairman immediately, as this is an unsafe condition. While your doing this test; visually note the water level in the gage glass, which is a component of the level control valve assembly. The water level should be restored to its normal position upon closing of the drain valve.
- The gage glass must be maintained in good operating condition at all times. This is the only accurate indicator of the water level in the boiler.

### Safety valve and safety relief valve testing

It is advisable for all safety valves to be manually tested not less than once each month and pressure tested once each year on all low pressure steam boilers. This test should not be made unless the valve is subjected to a pressure of at least 75% of the set pressure.

For hot water heating and supply boilers, the recommended pressure differential between the pressure relief valve set pressure and the boiler operating pressure should be at least 10 PSI or 25% of the boiler operating pressure, whichever is greater.

For low-pressure steam heating boilers, the recommended pressure differential between the safety valve set pressure and the boiler operating pressure should be at least 5 PSI.

This risktopic contains good maintenance practices for cast iron boilers, in addition to the maintenance procedures provided by the manufacturer.

risktopic

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