

Boiler Safety Program

Provided By:



American Businesses...Stronger Together!

info@nibausa.com

1-844.252.1344

WWW.NIBAUSA.COM



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INTRODUCTION

This policy is designed to provide drivers, employees, and all other concerned parties with information regarding the policies and general practices of this company. Written information is provided herein. However, it is not the intent of the company to list all aspects of its programs, policies and or procedures within this policy. It is also understood that the information contained herein is subject to change at the discretion of the company. Additional policies and directives may be issued at any time.

It is the intent of this company to operate a Safe Workplace and in accordance with the regulations set forth by all applicable Regulatory Agencies. Nothing in this policy is designed to supersede these regulations.

All drivers are expected to operate drug-free, safely and courteously on the highways. Evidence that this requirement is not being honored will result in the immediate revocation of the safety clearance of the offending driver.

Boiler Safety Program



Purpose

The Boiler Safety Program has been developed from the requirements listed by the American Society of Mechanical Engineers (ASME) and the National Board Inspection Code. This chapter provides guidance for the safe operation and maintenance of pressure boilers. Following this program will also extend the serviceable lifetime of boilers and associated equipment.

Governing Documents

The following publications are used for training, operation, maintenance and testing of all boilers:

- Manufacturer's Technical Manual
- ASME Boiler & Pressure Vessel Code, Section VII, *Recommended Guidelines for the Care of Power Boilers*
- ASME CSD-1, *Controls and Safety Devices For Automatically Fired Boilers*

Records

- Inspection records provided by an outside organization are to be maintained on file permanently.
- Repair and Maintenance records are to be maintained on file permanently.
- Weekly/Monthly Boiler Inspection records (self inspection) are to be sent to _____ each month.
- Monthly Chemical Analysis reports, by the chemical supplier, are to be maintained for one year.
- Safety Device Tests/Check records are to be maintained for one year on a most recent basis.
- Safety Valve Certification records, provided by a valve shop, are to be maintained on a most recent basis.

Hazards

Boiler operation hazards include steam/hot water burns, burns from hot equipment, steam explosions, fuel fires and chemical exposure.

Hazard Control

Engineering Controls - engineered boiler safety controls include insulation of hot areas such as piping and boiler components, automatic shutdown devices, automatic fire and fuel controls, relief valves and water level controls,



Administrative Controls - administrative procedures include operator training, chemical control procedures, operating procedures, inspections, audits, water chemistry control and planned maintenance.

External Inspections

External inspections should normally be conducted annually. The inspection should be performed by a certified boiler inspector.

External Inspection Areas

- **Leaks:** Leaks cause an excessive make-up rate to the boiler which will cause increased introduction of oxygen and a reduction in oxygen control chemicals. This action will result in higher corrosion rates inside the boiler and an increase in scale and sludge buildup. This effect will, in turn, reduce boiler efficiency requiring a higher fuel consumption. Additionally, the life of the boiler will be significantly reduced. External components are also affected by leaks. Wetted thermal insulation will create an ideal environment for accelerated corrosion of pipes and valves. Failure of these types of components, due to external corrosion, can be severe and with little or no advance warning. For this reason, wetted insulation should not be allowed to exist on any boiler or boiler support system. Discolored insulation indicates current or previous wetting.
- **Indicating Devices:** All indicating devices such as gages, thermometers, gage glasses, etc. are to be kept in good repair. Devices that are damaged or not reading correctly shall be replaced as soon as possible.
- **Safety Devices:** All safety devices such as boiler cutoffs, low water level alarms, burner failure alarms and safety valves must be kept free of mechanical and electrical defects. Safety Valves should have no evidence of leakage either from the valve stem, telltales or escape piping. All Safety valves must have a stamped label indicating last test date and pressure rating.
- **Control Systems:** Fuel control systems must be kept clean and free to move. Electrical controls should not have any external electrical safety hazards
- **Valves:** All valves are to be free of leakage and be clean to ensure proper operation when required for isolation.
- **Housekeeping:** All boiler areas should be kept clear of combustible materials. Spills of oil or chemicals should be cleaned up as they occur.
- **Signs** All accesses to boiler rooms are to be labeled "High Noise Area- Hearing Protection Required" or similar signage.
- **Piping Supports** All piping requires positive support. A check should be made to ensure there is no shifting or loosening of support brackets

Internal Inspections

Internal inspections should normally be conducted annually. The inspection should be performed by a certified boiler inspector.



Internal Inspection Areas

- Fire Side inspection points
- Door gaskets
- Fire side insulation
- Tube sheet
- Tubes
- Blower
- Stack

Water Side inspections points:

- Tube bundle
- Scale buildup
- Condensate feed water tanks
- Chemistry control systems
- Level floats

Boiler Tests

The following tests are to be conducted at the frequency noted and logged on the check sheet found at the end of this chapter. All tests are to be conducted in accordance with the list of *Governing Documents* listed at the beginning of this chapter.

General Test Procedures

- **Safety/Relief Valve Operational Test (Document Monthly)** All safety valves are to be tested in place each month by using the test lever provided. With boiler pressure at least 75% of safety valve setpoint, fully open the Safety/Relief Valve and let it snap shut. If the valve does not reseat properly, repeat the test.

If the Safety/Relief valve cannot be lifted, the boiler must be shutdown immediately until the valve can be repaired or replaced.

NOTE: *Excessive hand lifting will shorten the life of the valve. Prior to installation in a boiler system, all safety valves shall be inspected, set and tested by a qualified valve repair shop. The shop should provide documentation of the inspection and methods used to set and test the safety valve.*

- **Check System for Leaks (Document Weekly)** The entire system is to be checked closely for leaks daily and documented weekly. Particular attention should be paid to pump and valve packing, automatic air vents, and condensate tank overflow lines. Excessive leaks will result in excessive corrosion & scale buildup in the boiler and result in shortened boiler life.
- **Low Water Fuel Cutoff (LWFCO) Rapid Drain Test (Document Weekly & on Startup)** With the burner in operation, rapidly flush the LWFCO chamber using the drain valve provided. The burner **must** shut off when the device is drained.



If the boiler does not have at least one properly functioning LWFCO, it must not be left unattended, while operating, until repairs are made.

ENSURE VISUAL AND AUDIBLE ALARMS FUNCTION PROPERLY.

- **Burner Check (Document Monthly)** Observe the boiler and burner for a long enough period to be certain that the burner operates normally. Test the Combustion Safeguard System.
- **Water Chemistry Check (Document Monthly)** Ensure contracted vendor has conducted proper water chemistry checks and provided support documents. Conduct action recommended on report to maintain proper chemistry.
- **LWFCO Slow Drain Test (Document Quarterly)** With the burner in operation, verify the function of the LWFCO by slowly reducing the level of the water in the boiler. **Great care** must be taken to prevent actually firing the boiler with insufficient water.
- **Circ and/or Condensate Pump Check (Document Quarterly with the LWFCO Test)** When conducting the LWFCO test, verify operation of the condensate pump and/or emergency feeder.
- **Safety Valve Setpoint Test (Document Annually)** Safety and relief valves are to be tested annually to ensure they are set correctly and are in proper operational condition. Normally this can be accomplished while the boiler is shutdown for annual internal inspection.
- **Drain Water Gage Glass (As necessary) Danger: Possibility of escaping hot water/steam can cause burns.** If necessary, to remove suspended or floating impurities, drain and flush the water column and gage glass by shutting the top and bottom isolation valves of the gage glass then slowly crack open gage glass drain. Shut gage glass drain after water column has drained. **Slowly** open upper gage glass isolation valve then slowly open lower gage glass drain. Water level should immediately rise in the gage glass

Blowdowns

Boilers should be blown down (surface and bottom) daily. Surface Blowdowns are conducted to remove surface film, oil etc.. Bottom Blowdowns are conducted to lower Total Dissolved Solids (TDS), limit sludge buildup and adjust boiler chemistry. When conducting blowdowns, the operator must ensure that all persons are clear of the blowdown piping escape point.

Simultaneous blowdown of two or more boilers is not to be performed if they are serviced by the same discharge piping system.

Water Chemistry

Boiler chemicals are caustic and are to be handled by trained personnel only. Proper PPE, as indicated on the MSDS, is to be used at all times. Spills of boiler chemicals are to be cleaned up as they occur.



Operating Parameters

Operation of the boiler in the proper ranges will help ensure the mechanical integrity and expected lifetime of the boiler. The following information is provided to assist operators in analyzing trends.

- **pH:** If Boiler water pH is low, accelerated general corrosion (rust) will occur. If pH is too high, caustic and oxygen pitting corrosion will occur. Both types of corrosion reduce the life of the boiler.
- **Stack temperature:** Stack temperature should be in the range of 300 to 400 degrees (depending on the boiler load) an excessively high stack temperature indicates that the efficiency of the boiler has been significantly reduced.
- **Steam Pressure:** Steam pressure should never exceed 150 psi unless part of an approved test, such as pressure lift check of safety valves.

Pre-Startup Checks

Prior to firing a boiler all pre-startup checks recommended by the manufacturer are to be conducted.

Automatic Boiler Shutdown Checks

Daily, generally during startup, all automatic boiler shutdown devices are to be checked to ensure proper operation. These include but are not limited to:

- Flame Out Shutdown Device
- Low Water Level Alarm and Boiler Shutdown Device

Daily Checks

The following checks should be conducted daily when boiler is operating:

- Checks for leakage of water, steam or fuel
- Wetted thermal insulation
- Pipe supports for proper alignment and condition
- Boiler area clear of debris and combustible material
- Low water level shutdown and alarm
- Flame out shutdown
- Safety valves not obstructed or leaking
- Gages, thermometers and gage glasses readable and functioning

Extended Shutdown

If a boiler is to be shutdown for greater than 12 to 24 hours it should be placed in a full wet lay-up condition. This condition will limit the general corrosion activity to below that which would occur if the boiler was left in a partial or full drain condition.



Maintenance

All maintenance should be controlled such that replacement parts with the proper rating are used. Substituting improper materials or parts can result in a boiler explosion or catastrophic rupture of the steam system. All maintenance is to be carried out under the Lockout /Tagout, Confined Space Entry, Electrical Safety, and Hot Work programs as applicable. Special care must be taken to ensure that the thermal energy associated with the boiler has been dissipated prior to commencing maintenance.

Valves: Packing adjustments on steam valves is not be done unless the valve has been depressurized.

Pumps: Packing adjustments on pumps should be performed with the pump running. Adjustments should be made one flat at a time. Excessive tightening over a short period of time can cause pump shaft sleeve damage which will result in an increase in shaft packing leaks. General, pumps without mechanical seals at the shaft should have a leakage of a minimum of 2 drops per second and a maximum of 6 drops per second. This leakage provides cooling and lubrication for the shaft packing.

Gaskets: Whenever a mechanical joint has been disassemble, new gasket material of the proper type must be used for reassembly. Old gaskets are never to be reused.

Boiler Accidents

Boiler systems are designed for safety and efficiency. The key to safe boiler operation is the operator. History has shown that without proper operation and maintenance, boiler conditions and safety deteriorate, causing potential hazards due to neglect and misunderstanding.

Leading causes of accidents:

1. Failure of the fuel cutoff system when the water level inside the unit becomes too low for proper operation.
2. Operator error, poor maintenance, or improper maintenance.
3. Failure of any primary safety controls and failure of the safety relief valve (which should relieve the excess pressure or excessively high temperature water supply inside the tank when pressure or temperature rises above a safe operating level due to the failure of primary safety controls).
4. The addition of cold water to an extremely overheated water heater or boiler.

Common Boiler Room Accidents



Dry Fire Accidents: Dry fire accidents are also called boiler meltdowns. These accidents occur when the boiler is allowed to operate without adequate water in the boiler. Functioning low water cutoffs are essential to preventing dry fire accidents. Boiler damage can run from severe buckling and deforming of the boiler to complete meltdown or potential boiler explosion.

Excessive Pressure Accidents: Excessive pressure is potentially the most lethal form of boiler accident. These accidents occur when the boiler can no longer contain the excessive pressure allowed to build in the boiler. The operator control, high pressure limit, and the pressure relief valve need to fail before these accidents can occur. Excessive pressure accidents, even in small boilers, have been known to completely destroy a building.

Fuel Related Accidents: Fuel related accidents usually occur when the operator fails to purge combustible gases from the fire box before ignition is attempted.

Never bypass safety devices with jumper wires to restart your boiler. Unintended ignition of unburned combustion gases in the fire box is possible.

Leaking fuel valves can also be the cause of these accidents. If the operator notices any gas odor the boiler should be shut down and the fuel supplier called immediately.

Water Chemistry Control

Boilers are filled with water that contains naturally occurring impurities. Common impurities such as calcium, magnesium and oxygen can, if they are not controlled, effect boiler performance and durability.

All water contains dissolved minerals such as calcium and magnesium. If these minerals are allowed to reach high enough levels in the boiler water they will come out of solution and form as a hard shell on the hot surfaces of the boiler. This hard shell is called scale and is often found on the outside of the fire tubes. Scale insulates the heating surfaces recuducing the ability of the fire tubes to transfer heat from the hot combustion to the boiler water. High stack temperatures or ruptured fire tubes are common problems related to scale build up.

Boiler water also contains dissolved gases such as oxygen or carbon dioxide. These gases in the presence of water and metal can cause corrosion. Corrosion eats away the metal effecting the durability of the boiler.

Water treatment strategies: Boiler heating systems lose water through steam and water leaks. Additional water called "makeup water" is added to the boiler to replace these losses. The amount of make up water and the level of naturally occurring impurities in the water will determine the type of water treatment required. Boiler heating systems that have very few leaks will require simple water treatment programs. Your boiler inspector or water treatment professional can assist you in developing a water treatment program. Steam and hot water boilers typically require different water treatment programs.



Steam boilers: Steam boilers are usually treated to prevent scale and corrosion. Scale producing dissolved minerals accumulate in the boiler water when mineral rich make up water replaces mineral free steam and condensate leaks. Strategies to prevent scale attempt to keep the components of scale such as calcium and magnesium suspended in the boiler water or to reduce their concentrations in the boiler water. Draining water from the boiler (bottom blowdown) is a common method for reducing the concentration of solids and to discharge sludge.

Corrosion is reduced by adding oxygen scavenging chemicals to the boiler water. Boiler water testing is required to ensure that conditions suitable for scale and corrosion are not present.

Hot water boilers: Scale build up is usually not a problem in hot water boilers. Although make up water contains dissolved minerals, system leaks discharge water with an equal amount of dissolved minerals. Since as many minerals are leaving the boiler system as enter it; minerals do not have the opportunity to accumulate in the boiler water.

SOP: Preparations and Safety Precautions for Internal Inspection

Annually, each boiler is inspected internally by a licensed boiler inspector provided by our insurance carrier. Proper preparation is necessary to ensure a safe condition exists for the inspection. When a boiler is to be prepared for internal inspection, the water level should not be lowered from normal operating level until the unit has been cooled down. Cooldown of Boilers is not to exceed the rate recommended by the manufacturer. Fast cooldown can result in cracking and damage to the boiler casing, tubes and welds. **Follow all Confined Space Entry procedures.**

Preparing a boiler for internal inspection:

- 1. Lock & Tagout** the fuel supply and ignition systems
- 2. Shut, Lock & Tagout all system isolation valve for steam, gas, water and feed systems.** Open drain valves or cocks between any two closed valves before opening the manholes and entering any part of a boiler which is connected to a common header with other boilers or other sources of steam . Alternatively, lines may be blanked or sections of pipe removed. All drains and vent valves must be opened.
- 3. Draw off all water** and thoroughly washout the water side.
- 4. Remove manhole** and handhole plates, washout plugs, as well as inspection plugs in water column connections as required by the inspector.
- 5. Cool & Clean** the boiler thoroughly
- 6. Remove all grates**



7. Remove insulation and brickwork as required by the inspector in order to determine the condition of the boiler, headers, furnace, supports or other parts.

8. Remove pressure gages for testing when required by the inspector.

9. Open boiler doors for fireside inspection.

10 . Ventilate all accessible areas of the boiler and conduct Confined Space Entry procedures.