



EFFICIENT AND SAFE HEATING BOILER OPERATION PRACTICES

When was the last time you asked yourself the following question: Is our heating boiler operating in a safe and efficient manner? If you have never considered the question, you're not alone. The reason is simple: heating boilers tend to remain "out of sight, out of mind" until they have stopped operating and temperatures inside your building plummet.

Hot water heating and steam heating boilers account for the vast majority of boiler failures each year, costing owners millions of dollars in repair and replacement costs. In the vast majority of instances, these failures were preventable. Our industry experience reveals the following to be prominent causes of boiler failures:

- Operating the boiler with inadequate water level causing overheating and cracking of heating surfaces
- Lack of proper water treatment leading to overheating and cracking of heating surfaces or leakage due to corrosion or wasting away of metal surfaces

A common misconception is that heating boilers and hot water heaters pose little or no danger to the public because they operate at relatively low operating pressures. This could not be further from the truth. Although infrequent, heating boiler explosions still do occur. Heating boilers and water heaters contain a tremendous amount of energy and can be deadly if not properly maintained and operated. A 30 gallon domestic hot water heater typically found in a single family residence has the equivalent explosive potential of approximately one pound of TNT. Many commercial properties have boilers and water heaters much larger than a residential sized unit and thus contain even more explosive potential.

So how do you know for sure that you have an efficient and safe heating boiler? Follow these best practices and you'll be well on your way.

Best Practice No. 1: Have your boiler inspected regularly by an authorized inspection agency.

An Authorized Inspection Agency (AIA) is an entity that employs trained and commissioned boiler inspectors. The



AIA may be the jurisdictional authority, an insurance carrier that provides equipment breakdown insurance, or in a limited number of jurisdictions a properly credentialed third party inspection agency.

Chubb Loss Control Services is recognized by the National Board of Boiler and Pressure Vessel Inspectors and all jurisdictions in the United States and Canada as an Authorized In-Service Inspection Agency. We can perform in-service jurisdictional inspections for policy holders that have equipment breakdown insurance coverage through one of our member companies.

Two key benefits to having your boiler inspected by an authorized inspection agency are:

- The inspector becomes a "fresh set of eyes" to your facility and brings unique skills and broad industry perspectives that will assist you in eliminating unsafe conditions.
- The inspection will keep your facility in regulatory compliance with state, province or local jurisdictional requirements

The inspection of your boiler will consist of either external or internal examinations based on jurisdictional requirements. The inspector will evaluate the condition of your heating boiler with respects to construction, installation, maintenance, and operation. A key aspect of the inspection is to ensure that your boiler is equipped with fully functional controls and safety devices.

Most jurisdictions in the United States and Canada have established laws that require boilers to be constructed, installed, and inspected to codes and standards established by the American Society of Mechanical Engineers (ASME), National Board of Boiler and Pressure Vessel Inspectors or other standards adopted by your jurisdiction. Boiler inspection laws can vary greatly from one jurisdiction to another and can be difficult to interpret. Contact your Chubb Equipment Breakdown Risk Engineer (EBRE) for assistance in determining the jurisdictional requirements that pertain to your boiler.

Best Practice No. 2: Assign the duties of boiler operation and maintenance to only properly trained/licensed personnel.

Assigning the responsibility of boiler operation and maintenance to individuals that have not received proper training is a recipe for potential disaster. Operator error and improper maintenance are almost always found to be at the root cause of a boiler failure.

Very few jurisdictions require heating boilers to be operated by licensed operators. Since most jurisdictions do not, it is imperative that those individuals assigned the responsibility for boiler operation and maintenance receive an adequate level of training. Some facilities may not have the capacity to maintain operating/maintenance personnel. In those cases, service contracts with reputable firms are a viable alternative as long as boiler operations are being checked on at least a weekly basis during the heating season.

Your Chubb EBRE can assist you in determining the proper level of attention your boiler needs in accordance with jurisdictional requirements and industry best practices.

Best Practice No. 3: Test and maintain controls and safety devices in accordance with industry standards. Immediately repair or replace any safety device found defective.

The proper testing of boiler controls and safety devices is by far the most important activity you can perform on your boiler. Combustion controls, water level controls, pressure operating controls, and pressure relief devices must be examined and tested in accordance with recommended industry practices.

The frequency and complexity of testing varies with the type of boiler control or safety device. In some cases, the use of a qualified contractor is recommended. However, many of the key controls and safety devices such as low water fuel cutouts, pressure relief devices, and combustion system flame sensors can be routinely tested without the need of a contractor assuming the person performing the test has received proper training.

Control or safety devices that do not perform properly during the test should be replaced promptly. Boilers should be shut

down immediately when low water control testing fails to shut a boiler down properly, when flame failure tests do not shut down the boiler or when pressure relief devices fail to operate properly. The boiler should not be restored to operation until the devices are repaired or replaced by a qualified technician.

Do not perform any test of a boiler control or safety device without proper training and supervision. Your Chubb EBRE can provide assistance in establishing a proper boiler control and safety device testing program for your facility.

Best Practice No. 4: Monitor boiler operations on a periodic basis and keep a written record of those observations. Correct piping leaks when found.

The periodic monitoring of your heating boiler is not enough. The results of each round need to be recorded in a log and reviewed periodically for indications of adverse trending. Proper record keeping and trending analysis will dramatically reduce the potential for boiler failure. Industry experience clearly demonstrates that facilities that maintain and review operating logs have fewer failures.

Heating boiler operating logs do not have to be sophisticated. Logs should include checks for leakage from the boiler and associated piping systems, burner control system checks, water level indication, temperature and pressure indication, and the testing of critical boiler controls and safety devices.

A generic heating boiler operating log is provided in this document and is suitable for the typical heating boiler application. Your Chubb EBRE can assist you in setting up a proper boiler operating record keeping program that is tailored to your boiler application.

Best Practice No. 5: Implement a boiler water treatment program through a qualified consulting firm.

Excessive mineral content and excessive amounts of dissolved oxygen in your water supply can cause significant harm to your boiler if left untreated. Over time excessive mineral deposits will solidify inside your boiler reducing heat transfer rates and significantly driving up fuel costs. Oxygen attack will lead to corrosion and leakage of tubes and heating surfaces.

The lack of, or misapplication of a boiler water treatment program is the leading cause in reducing a boiler's useful life. Boilers that are properly operated and have established water treatment programs have been known to last in excess of 30 years. In contrast, newly installed boilers operating without proper water treatment have required extensive repairs or even complete replacement in very short periods of time.

The establishment of a proper water treatment program should be conducted using a qualified water treatment

consulting firm. Solutions to minimize the adverse effects of poor water quality are site specific and require proper testing and analysis. Additional measures such as the use of water softening systems and idle boiler lay-up procedures may be necessary. In some cases, chemical treatment of boilers may not be appropriate for the boiler's design and alternative solutions may be necessary. These decisions require proper understanding of water chemistry and industry experience and should not be administered by a novice. With that said, boiler operators should have a basic understanding of how to test and chemically treat boiler feed water under the strict supervision of a consulting firm. Your Chubb EBRE can offer advice in how to establish a proper water treatment program.

Best Practice No. 6: Use only certified repair concerns when having welded repairs performed on boilers.

If your boiler requires a welded repair, the welding company needs to be certified the ASME, National Board or has been authorized by the jurisdiction to perform such repairs. In most cases, the welded repair will require an examination by an authorized inspector under contract with the repair firm before the boiler can be placed back into operation.

Improper weld repairs completed by an unqualified welder can lead to catastrophic results. Weld repairs not conducted to jurisdictional requirements will result in the decertification of the boiler until proper repairs are made. Consult with your Chubb EBRE before completing any welded repair on your boiler.

Best Practice No. 7: Keep the boiler room clean and free from the storage of combustibles and flammables.

Boiler rooms are not storage rooms. Unfortunately, all too often they become common places to put custodial supplies, surplus office equipment and flammables such as paint and gas cans all which present potential fire hazards. In addition, boiler rooms that are poorly lighted, dirty, and cluttered can be unsafe for personnel due to slip and fall hazards and may impede the ability of a responder to quickly secure the boiler in the event of an emergency.

Boiler rooms should be adequately lighted. Combustibles and flammables should be stored elsewhere. There should be clear access to all areas in and around the boiler and auxiliary equipment contained in the boiler room. The emergency boiler shut off switch should be clearly identified and accessible. Finally, the boiler room should be kept as clean as possible. Excessive soot, dirt and debris will mask fuel or water piping leaks that will lead to future problems. Your Chubb EBRE can provide advice on acceptable boiler room housekeeping practices specific to your boiler application.

Resources

ASME Code Section VI Recommended Rules for the Care and Operation of Heating Boilers

National Board Inspection Code (NBIC) Part 2 Inspection

Canadian Standards Association (CSA) B51



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LOSS CONTROL SERVICES

IMPORTANT INFORMATION

Introduction

Periodic operating tests of safety valves and low water fuel cut-offs should be made to ensure proper functioning should a low water or over pressure condition occur. All tests should be conducted with the boiler in operation. When dual low water cut-offs are installed, test each device independently.

A. Low Water Fuel Cut-offs Recommended Frequency of Tests

Low pressure (steam) heating boilers: blow down each float or electrode chamber at least weekly. Conduct functional test of low water cut-off by lowering actual water level of boiler on a quarterly basis under proper supervision.

Caution: Should the burner fail to shut off during the test, do not operate the boiler until the cut-off control has been serviced and the cause of the malfunction corrected.

Servicing/Maintenance

A dismantle inspection of the low water fuel cut outs should be conducted annually. Replacement of worn parts should only be completed by a qualified technician.

B. Safety Valves/Relief Valves

Safety/relief valve are the last line of defense against a boiler explosion caused from excessive pressure. They operate under close tolerances and must be maintained in optimum working condition. They must be designed for the application in accordance with code requirements, have proper pressure and capacity settings and be installed properly. Safety relief valve should not be allowed to leak. Prolonged leakage may prevent the device from actuating when pressure exceeds safe limits and could result in a catastrophic explosion.

Servicing/Maintenance

Safety/relief valves are only to be serviced by contractors that maintain certification with the National Board of Boiler and Pressure Vessel Inspectors or are permitted by the local jurisdictional authority.

Under no circumstance should safety/relief valves be disassembled or adjusted by anyone not having proper training and certification.

Recommended Frequency of Tests Low Pressure Steam and Hot Water Boilers: Manually test safety/relief valves quarterly. Pressure test safety/relief valves annually prior to the beginning of the heating season.

Caution: Should the safety valve or relief valve fail to lift or reseal properly, remove the boiler from operation immediately. Do not operate the boiler until the pressure relief device is restored to proper operating order.

Emergency Contacts

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| Type of Firm | |
| Company Name | |
| Contact Name | |
| Phone / Email | |
| Boiler Manufacturer/ Distributor | |
| Boiler Repair Company | |
| Fuel Supplier | |
| Rigging Contractor | |
| Crane Service Provider | |
| Water Treatment Consultant | |
| Police Department | |
| Fire Department | |
| Medical Responder | |
| Boiler Inspector | |



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