

The Locomotive

Proper Boiler Installation And Maintenance Can Help Avoid Expensive Breakdowns

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Introduction

During a routine boiler inspection at a public middle school, an inspector found cracks in four cast iron sections. The boiler was less than a year old, one of an identical pair that had been installed to provide hot water for heating. A closer look showed that both boilers had been set up without support rails. The heavy sections were "suspended in air," with nothing supporting their weight, the inspector reported, and similar cracks would almost certainly have developed in the second unit.

A Timely Inspection Prevents a Loss

The school district was lucky. The inspector discovered the cracks before serious damage and boiler failure had occurred. The sections were repaired and support rails installed properly to help prevent further cracks in the two boilers.

The lesson learned? Proper installation of boilers and other pressure vessels can help avoid serious problems and breakdowns that can leave a business or institution without heat or hot water and pose a risk to the safety of employees, maintenance workers, customers and the public.



(Photo courtesy Fulton Boilers Works, Inc.)

How can you protect your business against improper installation when purchasing, replacing or reinstalling a boiler? Taking the proper steps can mean the difference between planning for and managing the risks of equipment



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operations and thousands of dollars in uncovered losses. Boilers may not be considered high-tech equipment, but they can account for plenty of expense and related problems in any facility.

Installing a New Boiler

It's important to seek experienced help when installing a new boiler, reinstalling equipment or replacing an old unit in your HVAC system. Starting with the planning stage, work with a qualified engineering firm to develop an overall plan and select the proper equipment and controls. This is the key to long-term energy efficient and reliable use of boiler equipment. Your brand new boiler may be designed with the latest technology to work better and save energy, but the opposite could be true if it is improperly installed, sized or applied to your system.

The following are some key points to consider.

Make sure the installation complies with all applicable codes and standards. Local jurisdictions typically adopt such boiler standards as the ASME (The American Society of Mechanical Engineers) Section I and Section IV. These are standards for the design and manufacture of boilers. Another standard is the NBIC (National Board Inspection Code), which addresses repair requirements. Many jurisdictions have now also adopted ASME CSD-1 (Controls and Safety Devices for Automatically Fired Boilers). This standard addresses installation requirements that must be complied with by both the manufacturer and installer, and applies to boilers with a heat input rating of less than 12.5 million BTU/hr.

CSD-1 requirements include:

- One low water fuel cutoff on hot water boilers and two on steam boilers.
- Safety limit controls such as pressure control on steam boilers and temperature on hot water boilers.
- Appropriate safety or safety relief valves.
- Listed and/or labeled burner assemblies or complete burner/boiler units.

- Flame safeguard and burner management controls such as trial for ignition and purge requirements.
- Fuel train requirements such as block and bleed valves, shutoff valves and pressure regulators.

If CSD-1 has been adopted in your location, make sure that the proper installation form has been signed and dated by both the manufacturer and the installing contractor. This form certifies that the installation meets the appropriate requirements. You should keep a copy of this document and make it available to show your boiler inspector.

Make sure your purchasing contract specifies the correct boiler and equipment. Your engineering firm needs to look at the complete system when making a recommendation. Replacing an old boiler with a similar new model might be a mistake. A new cast iron boiler, for example, may have design differences such as less water volume and thinner metal sections. Those differences could cause premature boiler failure, or prevent your system from operating as effectively and efficiently as expected.

A laundry needed a new boiler. The old boiler was a 10-hp horizontal firetube model. It had worked well for years and was able to supply steam to all of the presses and other equipment. When it came time to order the new boiler, to save space the supplier recommended a 10-hp vertical firetube boiler from the same manufacturer as the original boiler.

Sounds OK, right? In this situation, it was not the correct design approach. As soon as the new boiler was in place the laundry owner noticed that steam pressure could not be maintained unless he reduced the number of presses or other equipment in operation. He could not process as much laundry.

What happened? According to the manufacturer the problem was the steam release area of the boiler. A horizontal firetube boiler has a much greater steam release area than a vertical firetube boiler of the same rating. As a result, the vertical firetube boiler could not keep up with the swings in load and steam pressure would drop sharply. The

lesson learned is to consider other factors, not just boiler rated capacity. Consider also the performance characteristics of particular designs. A perfectly good boiler in the wrong application will not live up to the expected performance.

Keep a list of the work that needs to be done and make sure your contractor follows through. Document any instances in which a boiler contractor says its workers must return to complete a task. Keep a priority list and don't wait for the contractor. Call and ask when the work will be completed. Confirm that the work is done — and done properly.

Failure to monitor your contractor can lead to boiler breakdown and repairs, sometimes long after the unit has been accepted and put into service. This was the case with a new boiler installed in a college fraternity house. Once the boiler was operating, the contractor intended to wait a day or two before connecting the boiler to the old system's condensate return piping. That would allow time, he explained, for the displaced rust to be flushed out of the system. But the contractor did not return to reconnect the system's piping. Instead, outside water continued to drain and flush the system until scale built up and ruined the boiler.

Confirm that all owner/operator manuals are delivered, handed over and kept in a safe place. You don't want your personnel to be looking for the manual when confronted with an unexpected problem or scheduled boiler maintenance. Make sure that all operators read and understand these manuals.

In areas with frequent power outages, have an electrician wire all critical components of the HVAC system to an emergency diesel generator. In one facility, only some parts of the hot water system were connected to backup power. This allowed the water in one very large loop to cool to less than 140 degrees F. When power returned, the cold loop demanded heat and valves opened allowing flow in that loop. Thermal shock damage occurred when the water reached the hot boiler. Each system is different, so your requirements must be determined and addressed by both HVAC and electrical professionals.

Have your insurance carriers review the boiler work before your contractor transfers responsibility for the unit to your business or institution. An inspector from your equipment breakdown insurer can help you identify and deal with outstanding technical issues related to jurisdictional requirements. Your property carrier can give advice about fuel train requirements such as oil or gas valve arrangements and about fire code requirements such as smoke detectors and sprinklers. Your local building official should sign off on the work as well before the contractor is dismissed.

Don't accept the boiler until your contractor has fired up the unit for the first time and the contractor trains your personnel. Your contractor should make sure that the unit is operating properly and all instruments and devices are tested and functioning. Be sure that the employees who will tend to the boiler are given a thorough walk-through of the equipment and any necessary training. Your equipment insurance inspector can conduct an in-service inspection on your behalf and observe the contractor's operational testing of various boiler safety systems.

Help Is Available

For additional questions about boiler installation, operation and maintenance, contact your contractor, insurance carrier, or the state agency responsible for boiler safety and inspections. Your insurance carrier can be a valuable resource, offering professional advice on boiler installation and operation. Also take advantage of loss prevention services such as seminars and training that can help you keep your equipment running and show you how to make better decisions when buying maintenance or repair services.

About the Author

Brian W. Moore, P.E., is a Principal Engineer and boiler specialist for The Hartford Steam Boiler Inspection and Insurance Company. He earned B.S. and M.S. degrees in mechanical engineering from the Massachusetts Institute of Technology, and an M.B.A from the University of Connecticut. Moore has more than 25 years of experience in the boiler business.