

## Low water and your boiler

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### Introduction

A low water condition is one of the leading causes of boiler accidents and injuries. The National Board of Boiler and Pressure Vessel Inspectors has compiled the leading causes of boiler accidents, injuries and deaths for boilers and pressure vessels as of December 31, 2001. In all three categories of boilers the second leading cause of damage and injuries was due to a low water condition in the boiler. Only the category of "operator error or poor maintenance" had a higher incident rate. Accidents in 2001 were down 17 percent from 2000 with about 40 percent being caused by low water condition.

### Low water protection devices

There are three main types of low water protection devices commonly found in use today: float type, probe type and flow-switch type. Travelers recommends automatic low water protection on all boilers and two such devices on unattended steam boilers. When two low water protection devices are installed, either device will shut the boiler down should a low water condition be detected. All three types of low water protection devices perform the same basic function. Any of these types may be combined together.

The float type device looks and acts similar to the float control in the typical home toilet. The tank behind your toilet has a float in it. As the tank fills with water, the float rises and activates a valve that shuts the water off. When you flush your toilet, the water level drops, causing the float to drop and open the valve. The float in your boiler acts the opposite. When the water level in the boiler drops to a predetermined level, the float drops and activates an electrical switch that causes the fuel valve to shut. The float is normally located in a small chamber attached by piping to the outside of the boiler. In most cases, even if the water level returns, the fuel valve will not be allowed to open until an operator resets the control system. Float type devices are normally used in larger boilers and function as the primary low water protection device.

The probe style low water protection device performs the same basic function in a slightly different way. The probe is a long rod of metal that sticks down into the boiler (typically from the top of the boiler). This rod is an electrode connected to an electrical circuit in the boiler control panel. The water inside the boiler touches the rod and causes the electrical circuit to be completed. As long as the water touches the metal probe, the boiler fires normally. But should the water level drop below the probe, the electrical circuit is broken and the fuel valve shuts. The probe type device is typically used in water heating boilers or as a secondary low water protection device on a steam heating boiler.

The flow-switch type low water protection device does not actually measure the water level in the boiler. Rather than determine the water level, it measures the amount of water flowing into the boiler. This device is basically a switch inside the piping through which the feed water enters the boiler. If the flow of water to the boiler is interrupted, then the flow-switch acts to shut off the fuel. This type of low water protection device is found on water heating boilers and hot water supply boilers where the boiler is completely full of water during normal operation.

All three types of low water protection devices require a certain amount of maintenance. Lack of adequate maintenance is the leading cause of failure of a low water protection device. During normal operation sediment and scale is produced from boiler chemicals and hardness in the water. Without proper testing and maintenance, this sediment and scale can accumulate undetected inside the housing of the low water protection device and interfere with its proper operation. However, only a qualified professional should conduct this maintenance. Failure to reassemble the low water protective device can interfere with the device's ability to function properly and may cause damage to your boiler.

A qualified professional should dismantle the low water fuel cut off control on your boiler for a complete overhaul at least annually. For unattended steam boilers and attended high pressure steam boilers, an annual slow drain test should be conducted annually to verify the proper operation of the low water protection system. Follow the specific procedures outlined by the low water protection device manufacturer. If you do not have the original manual that came with the boiler, a quick Internet search will help connect you to the manufacturer. The manufacturers of these devices issue service bulletins, maintenance, and service life recommendations.

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Should a low water condition occur in your boiler, take the following actions to minimize the damage. Shut off the fuel to the boiler. Do not attempt to re-establish the water level in the boiler (you can significantly increase the damage by attempting to feed water into an overheated boiler).

Before you return the boiler to service, you should have the boiler and water control system checked by a boiler repair company. If damage has occurred, you should contact your boiler inspector.

### Summary

A low water condition is one of the leading causes of boiler accidents and injuries. Proper maintenance and testing of the three basic types of low water protection devices can prevent most low water conditions from occurring. Lack of adequate maintenance is the leading cause of failure to a low water protection device. Proper actions you take after a low water condition has occurred may minimize the damage to your boiler. Reduction of the frequency and length of boiler outages is critical.

### Reference

Donald. E. Tanner, "The Big Picture," National Board Bulletin Summer 2002, Columbus, Ohio, Pp. 2 and 3.

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