

Fires Resulting from Low Water Cutoff Control Malfunctions

By

Charles C. Roberts, Jr., Ph.D., P.E.

Good design practice and local codes require that water heating boilers be equipped with a low water cutoff control. This device signals the burner to shut down when the water level in a boiler decreases to a predetermined level. An alarm then sounds for the boiler attendant to provide manual feed water (more water), or an automatic feed water control activates, bringing the water level to the appropriate height. The water level may decrease, due to small leaks in the system, causing overheating of the boiler if the low water cutoff malfunctions. The boiler can be damaged and the heat from the upper portion of the boiler can ignite combustible

materials such as wood joists in the boiler room. Figure 1 shows a boiler that has experienced overheating. Burn patterns are severe on the top side of the boiler while the



Figure 2

lower portion is unscathed. Figure 2 shows the deepest char depth, which is just above the boiler toward the flue end, a place expected to be quite hot from an overheating boiler. This particular boiler had a float type low water cutoff control. Electrical measurements were performed on all controls.



Figure 1



Figure 3

Testing indicated that the low water cutoff control was still signaling the burner that the water level was within limits yet there was no water in the boiler. This testing was performed with the control on the boiler. Figure 3 shows the low water cutoff after removal from the boiler. Notice the severe sludge deposits inside the control as shown by the arrow. This prevented the float from descending and opening the circuit to the burner. After the control was cleaned it worked properly. The probable cause of this fire was lack of maintenance causing a low water cutoff control to malfunction. The manufacturer of this control installed a warning tag on the unit stating that the operator should blow down (clean out) the control every week. It appeared that this had not been done for several months. The system had no water treatment apparatus installed.

While analyzing a fire in a building housing a boiler, the following characteristics may indicate a low water cutoff control related fire:

a. The fire started in the boiler room or along a passage near the boiler flue.

- b. The boiler is badly damaged especially on the upper portion near the breeching.
- c. The boiler tubes on top are severely distorted while those on the bottom are not.
- d. There is no water treatment on the system to reduce the accumulation of contaminants entering the boiler water circuit.
- e. There appears to be generally poor housekeeping and poor maintenance in the boiler room.
- f. The boiler fluid delivery piping was known to have leaked extensively.

If a malfunction of the boiler is suspected, DO NOT remove the boiler controls until they are tested in place. A slight movement of a sticky low water control can cause it to return to an operational condition resulting in loss of important evidence. The remaining controls should also be tested to rule out any additional or aggravating causes such as a malfunctioning gas valve or temperature limit device.

Charles C. Roberts, Jr. PhD. is a registered professional engineer at C. Roberts Consulting Engineers, Inc., Big Rock, IL 60511 and may be reached at 630/556-3039 or CCR@croberts.com