

Floor Tube Corrosion: External and Water Side

Purpose

Advise owners and operators to inspect specific areas of the floor of Kraft recovery boilers for external corrosion on the underside of the tubes and stress-assisted corrosion on the water side of the tubes.

Problems

Recent inspections have revealed two independent forms of corrosion in the floor tubes of boilers that are equipped with the smelt spouts on the rear wall and that utilize a 2" OD floor tube construction adjacent to the sidewalls. This 1970's vintage construction, which can exist in either one of two arrangements, is shown in Figures 1 and 2. The corrosion problems may occur in either arrangement.

External corrosion thinning of the underside of 2" OD, carbon steel corner floor tubes has been reported. The corrosion is in the form of general metal wastage and the severity of the corrosion may vary along the length of the tube. The corrosion may not necessarily be most pronounced at the lower crown of the tube and may tend to be more severe at positions located 45 degrees from the tube crown. The corrosion is believed to be the result of water, and possibly, acidic solutions that may become trapped beneath the corner floor tube during outages following a water wash (Figure 3). Insufficient drying following a water wash can compound the problem. No tube failures related to this form of wastage have thus far been reported.

Stress-assisted corrosion and

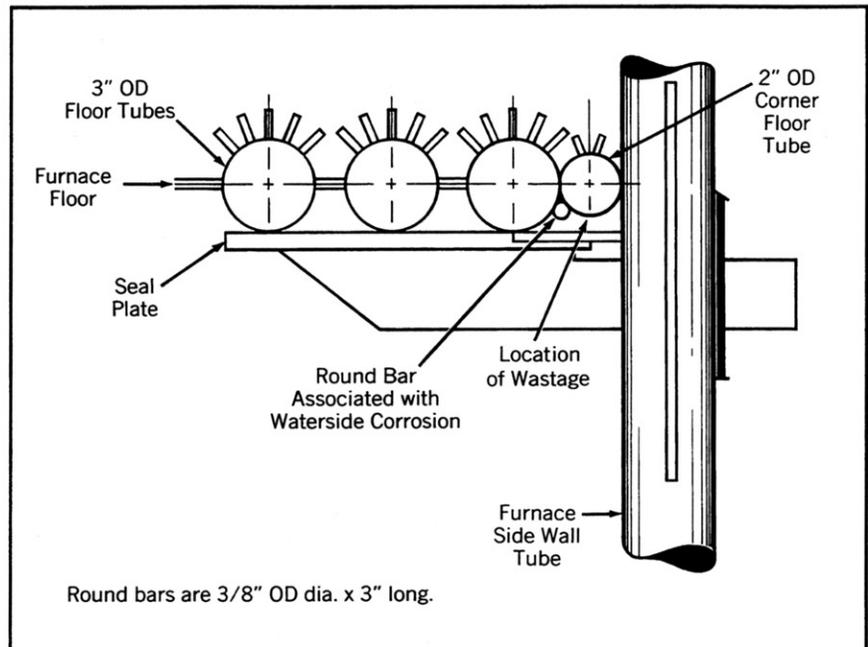


Figure 1. Example of 3/8" round bar welded on one side of the corner floor tube only and spaced on two foot centers.

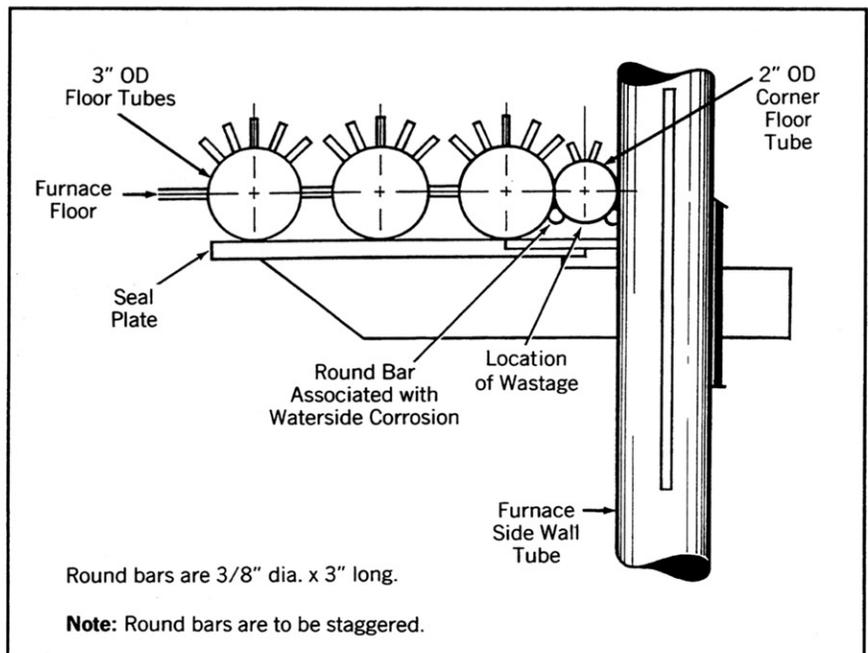


Figure 2. Example of 3/8" round bar welded to two sides of the corner floor tube and staggered on six foot centers.

cracking on the water side (ID) has also been reported in both the 2" OD floor tube and adjacent 3" OD floor tube. The corrosion tends to concentrate on the water side in the area immediately beneath the 3" OD floor tube. The corrosion tends to concentrate on the water side in the area immediately beneath the 3" long, 3/8" diameter round bars that are used for alignment as shown in Figures 1 and 2. The corrosion is believed to be caused by a less than ideal aqueous environment, with damage occurring at preferential sites due to the simultaneous action of stress and chemical reactions (Figures 4 and 5). There has been one verified failure of a 2" OD floor tube as a result of stress assisted corrosion located at a round bar attachment. Further information about stress-assisted corrosion and the locations where damage may prevail in recovery boilers can be found in Plant Service Bulletin #29, "Stress-Assisted Corrosion: Boiler Waterside", that was issued by B&W in November 1987.

Stress-assisted corrosion on the water side of the 2" OD floor

tube can also occur on the crown of the tube on the cold side as shown in Figure 5. This condition can occur if the round bars on both side of the 2" OD tube were incorrectly installed in an opposing rather than in a staggered fashion. The issue of incorrect placement of round bars was addressed in Product Informative #9-1404 "Recovery Furnace Floor Improvements" that was issued by B&W in April 1983.

Recommendations

- During the next scheduled outage, inspect the underside of the 2" OD corner floor tube and adjacent 3" OD floor tube for external corrosion thinning. This may be accomplished by removing portions of the corner seal plates (as shown in Figure 1 and 2) from the underside of the furnace floor and measuring the tube thickness.
- During the next scheduled outage, inspect the water side (ID) of both the 2" OD corner floor tube and adjacent 3" OD floor tube for evidence of water side stress-assisted corrosion and cracking associated with the 3/8" diameter alignment bars.

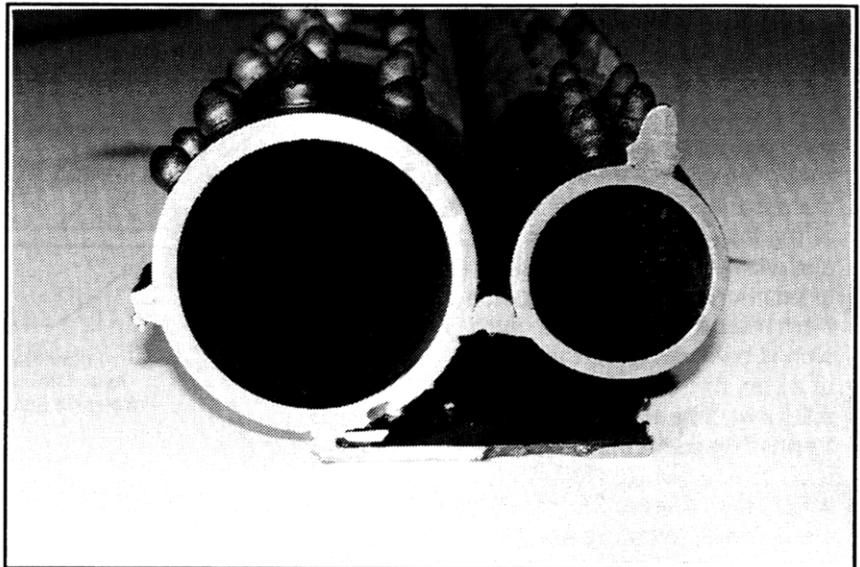


Figure 3.

Because this location does not lend itself to detection by radiography, an internal boroscope inspection may be the only feasible method.

- If significant corrosion is found on either the OD or ID of the tubes, both the 2" OD and adjacent 3" OD floor tubes should be replaced.
- Replace both the 2" OD and adjacent 3" OD floor tubes if prior x-ray inspections have revealed the presence of sig-

nificant water side, stress-assisted corrosion at other locations in the boiler.

- If the 2" OD and adjacent 3" OD floor tubes are replaced, an alternative arrangement of tube attachment is recommended.

Repair and Support

It is recommended that you consult with B&W Field Service Engineering concerning the inspection and any subsequent repairs or modifications.

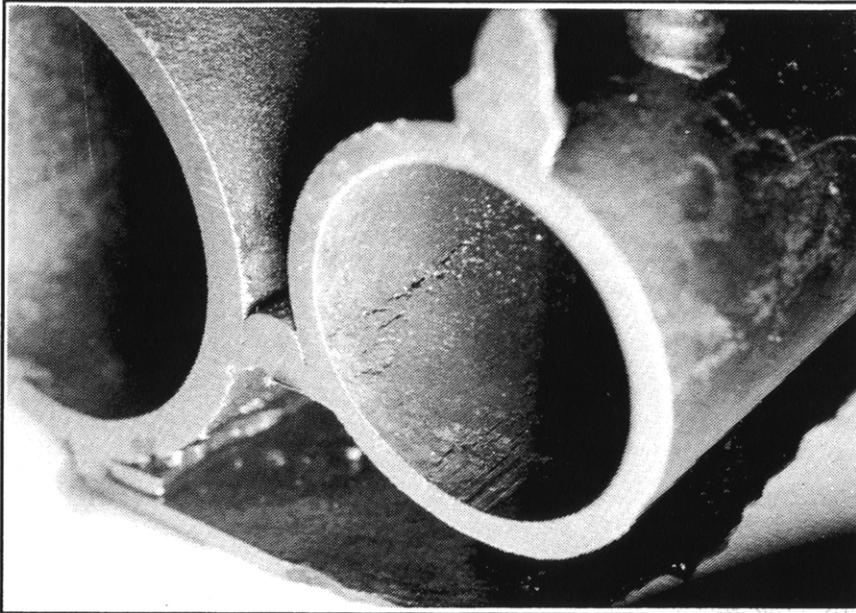


Figure 4.

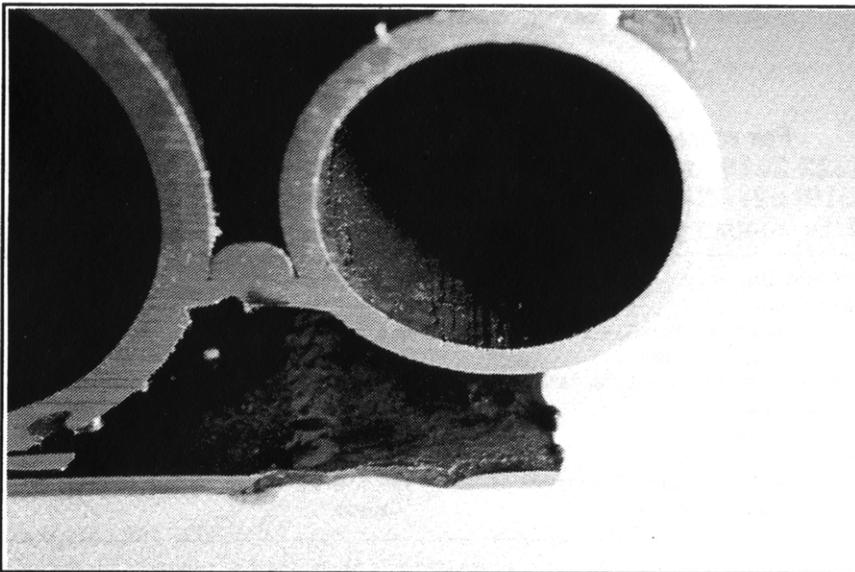


Figure 5.

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Babcock & Wilcox Power Generation Group, Inc.

20 S. Van Buren Avenue
Barberton, Ohio 44203 USA
Phone: 330.753.4511
Fax: 330.860.1886

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