

Characteristics and Implications of Cracking in Type 304L Composite Floor Tubes in Recovery Boilers

Technical Service Bulletin

Purpose

The purposes of this Technical Service Bulletin are: (1) to advise owners of recovery boilers with Type 304L composite tube floors of the need for periodic inspection for the presence of cracks; (2) to describe the various characteristics of such cracks and the potentially serious implications of these characteristics; (3) to describe and recommend repair and replacement of such tubes under various circumstances; and (4) to warn of the potential for pressure part failure if proper repairs and replacements are not accomplished in a timely manner. This advisory is applicable to any Type 304L composite floor tube, regardless of location.

Background

The characteristics of cracking in Type 304L composite tube recovery furnace floors may be representative of the following forms:

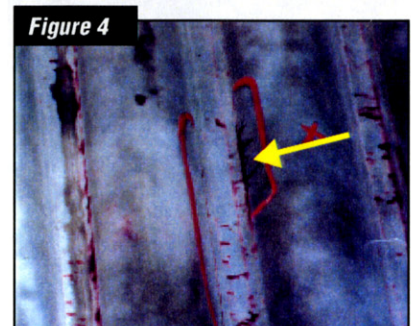
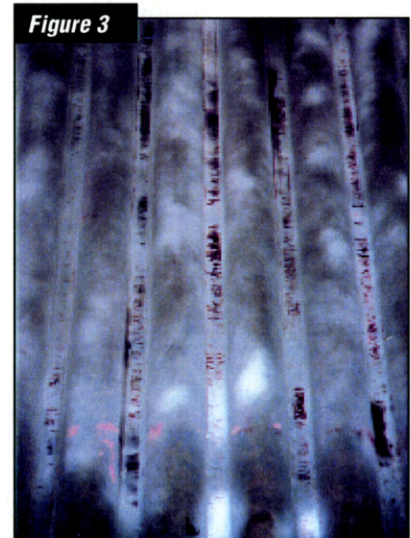
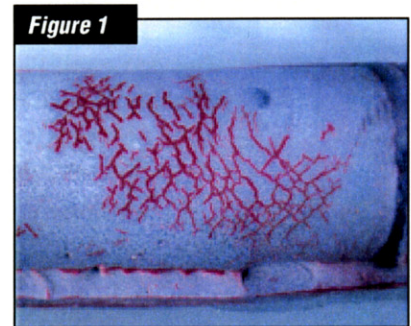
- 1) A crazed pattern of cracking anywhere on the tube surface (Figure 1)
- 2) A circumferential pattern of cracking anywhere on the tube surface (Figure 2)
- 3) A transverse orientation of cracking on the clad surface of the membrane (Figure 3)

- 4) A longitudinal orientation of cracking along the toe of the membrane to tube weld on either or both the tube or membrane sides of the weld (Figure 4)

Recommendations

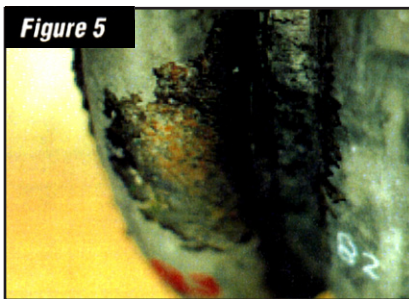
Annual inspection of recovery furnace floors requires thorough cleaning to remove all debris and frozen smelt. This enables both visual inspection and any ASME Section V approved nondestructive inspection method capable of detecting surface cracks. Inspection must include all areas of the composite tube floor, including those areas covered by refractory or other protective covering.

If cracks exist in the form of a crazed pattern on the tube (Fig. 1), they will typically not penetrate beyond the Type 304L stainless cladding and into the carbon steel pressure bearing tube. Frequently, the cracks in the stainless cladding will turn and propagate parallel to the stainless steel to carbon steel fusion boundary. If this can be confirmed, the tube may either be replaced or the cracks removed by grinding. If grinding exposes the carbon steel substrate, the surface should be weld-overlaid with Type 309L stainless steel to a thickness comparable to, but no greater than, the original clad layer. All locations where the stainless cladding has cracked sufficiently that spalling



(Continued on reverse side)

Figure 5



has occurred (Figure 5), requires that all areas of exposed carbon steel be weld-overlaid with Type 309L stainless steel.

If a circumferential pattern of cracking develops on the tube surface (Fig. 2), there is a likelihood that the cracking has or will penetrate into the carbon steel pressure bearing tube. Tube replacement is the recommended and most reliable remedial measure when circumferential cracks develop and penetrate into the carbon steel pressure bearing tube. Circumferential cracks that do not penetrate beyond the stainless clad layer should be removed by grinding.

Transverse cracks in the clad surface of the membrane (Fig. 3)

must be removed if the cracks appear to be propagating into the membrane weld and toward the tube. Grinding may be required to determine the depth and extent of cracking. Should grinding of the clad layer of the membrane expose carbon steel, weld-overlay with Type 309L stainless steel is recommended.

If longitudinal cracking develops along the toe of the membrane to tube weld (Fig. 4), there is a likelihood that the cracking has or will penetrate beyond the stainless clad layer of the tube. A floor tube failure has been reported as the result of a longitudinal crack that formed on the tube side of the membrane to tube weld. Tube replacement is the recommended and most reliable remedial measure when longitudinal cracks develop on the tube side of the membrane to tube weld and penetrate into the carbon steel pressure bearing tube. Longitudinal cracks that do not penetrate beyond the

stainless clad layer should be removed by grinding.

There is limited experience with multidirectional cracking of the membrane to tube weld. It is known however, that this form of cracking may result in spalling of the weld metal. Under these circumstances, the membrane weld must be restored to ensure structural integrity and adequate heat transfer.

Support

This advisory is intended to supplement the recommendation to periodically inspect, and repair as required, all of the recovery boiler components, including the Type 304L composite tube water walls.

Contact Babcock & Wilcox should you have any questions or require assistance concerning the inspection, repair or replacement of composite tube recovery furnace floors.

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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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