

Background

In May 2000 Babcock & Wilcox (B&W) presented a paper to the International Conference on Life Management and Life Extension of Power Plants entitled: Standard Recommendations for Pressure Part Inspection during a Boiler Life Extension Program (#BR-1701). Three years earlier, B&W published a similar paper for industrial boilers entitled: Boiler Fitness Survey for Condition Assessment of Industrial Boilers (#BR-1635).

These papers discuss and recommend programs and methods for boiler pressure part assessment to increase the availability, reliability and efficiency of existing, older boilers of any type while promoting their safe and cost effective operation. As B&W surveys the numbers and types of boilers in operation around the world, we find an ever increasing number that have been in service for fifty, sixty and even more than seventy years. This causes one to consider that the same methods and programs that are discussed and recommended in BR-1701 and BR-1635 are applicable to the customer who still has older boilers in service today.

Problem

Extending the use of power and steam plants has resulted in many boilers operating beyond their normal expected service lives. The actual useful life depends upon boiler type, past care and maintenance, operating conditions, fuels and many other factors. As a result, failures have occurred and may occur in the future in places and on equipment which have provided relatively trouble-free service for decades, such as, tubes and tube welds in vestibules, tubes encased in refractory or behind casing, or other areas of pressure parts. This Plant Service Bulletin provides customers with information and recommendations concerning the inspection of pressure parts on boilers that are in advanced years of service or

have been out of service for months at a time where there are potential issues and hazards that need to be identified and addressed before failures occur.

A good quality maintenance management program strives to avoid unscheduled outages, not only because they are costly, but also because they can result in catastrophic failures, leading to personal injuries, deaths and/or property damage. In the past, these inspection and maintenance programs focused on components that were susceptible to fatigue, corrosion and erosion. As boilers age, it is necessary to expand the inspection and maintenance procedures to areas that have not typically been previously addressed. Although a component (pressure part, support, etc) may visually look acceptable for operation, it does not necessarily mean it is acceptable for continued service. Examples of unseen and unacceptable pressure component deterioration are flow accelerated erosion/corrosion on the inside of feedwater and condensate piping, and pitting and corrosion behind refractory, insulation or casing on furnace tubes.

Out-of-service corrosion can take place in almost any boiler. On the gas side, humidity in the air can condense and mix with acidic products of combustion and rapidly corrode metal parts. This is especially true around access doors, viewports and behind refractory. On the waterside, dissolved oxygen pitting can occur in both straight runs and bends or anywhere condensate can form and accumulate and locally degrade metal components over time. Corrosion fatigue, a problem attributed to boiler cycles (fatigue) and localized internal attack of tube metal by corrosion, is more likely to develop the longer a boiler is in service. Therefore, nothing should be overlooked or left to chance.

Action Required

A more thorough and comprehensive pressure part inspection program is required for older boilers, including areas that are difficult to access, infrequently inspected, or were never thought to be a problem before. It has always been important to properly inspect boilers. It is important for owners and operators of older boilers to:

- Read and follow the operating and maintenance instructions for the boiler and associated equipment (e.g., burners, valves, fans, motors, sootblowers, etc).
- Read and follow the recommendations of BR-1701 and BR-1635, copies of which are available upon request. Also follow the guidelines for the inspection of boilers found in the National Board Inspection Code (NBIC) and in the ASME Section VII Code.
- Develop and implement a good quality maintenance management program that is tailored to your older boiler(s).
- Employ good, thorough inspection and nondestructive testing practices and incorporate them into your maintenance management program, including internal inspections of pressure parts and tubing behind casing, encased in refractory and in other hard to reach places. Corroded or worn tubing in these locations may now be the weakest links and represent imminent failures. Utilize newer inspection techniques such as comprehensive pressure part remote visual inspection, electromagnetic acoustic transducers and digital radiography. Priority should be given to any potential failure outside of the boiler that could directly expose personnel to high pressure water or steam.

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In the interest of customer safety and product satisfaction, B&W has published a number of service advisories, technical papers and other informative bulletins to provide information on known issues and how to address or avoid them. Included below is a list of service advisories that are the more obvious. However, we encourage you to visit the Resources page of our website (<http://www.babcock.com/resources>) for a complete list of Plant Service Bulletins, all of which may be downloaded.

B&W Support

When you elect to initiate further inspection of your equipment, we can assist in developing the specific information needed for an individual unit. Contact B&W's Field Engineering Services if you have any questions or need further assistance.

Suggested Additional Reading:

1. BR-1701 "Standard Recommendations for Pressure Part Inspection during a Boiler Life Extension Program"
2. BR-1635 "Boiler Fitness Survey for Condition Assessment of Industrial Boilers"
3. Selected Plant Service and Technical Service Bulletins

Selected Plant Service Bulletins

- PSB-1, Creep Fatigue and Ligament Cracking of 1-1/4 Cr-1/2Mo-Si (T11 and P11) Pressure Parts
- PSB-2, Out-of-Service Corrosion Failure of Horizontal Downcomer, Supply, and Riser Pressure Part Connections
- PSB-12, Subcooling in Cycling Boilers
- PSB-17, Threaded Connections on High Temperature Applications
- PSB-18, Ligament Cracking of 2-1/4 Cr-1Mo (SA-335 P22)
- PSB-20, UP Boiler Furnace Protection
- PSB-22, Economizer Inlet Header Cracking
- PSB-23, Welded Plate Elbows in High Temperature Applications
- PSB-26, Tube Thickness Evaluation Repair or Replacement Guideline
- PSB-28, Membrane Wall Corner Tube Failures
- PSB-29, Stress-Assisted Corrosion: Boiler Waterside
- PSB-37, Reheaters: Out of Service Corrosion
- PSB-41, UP Boiler Mix Stud Plate Cracking
- PSB-44, Chemical Cleaning Guide
- PSB-47, Feedwater Pipe Thinning
- PSB-49, Steam Cooled Spacer Tube Related Cracking of Secondary Superheater Outlet Headers
- PSB-50, Convection Pass Lower Header Enclosure Plate Cracking
- PSB-54, Feedwater Pipe Thinning and Rupture
- PSB-55, Corrosion-Fatigue Failures of Riser Tube Bends

Selected Technical Service Bulletins

- Floor Tube Corrosion: External and Water Side, May, 1992
- Recovery Boiler Floor Tube Inspections, May, 1995
- Superheater Floor Tube Failures, June, 1995
- Characteristics and Implications of Cracking in Type 304L Composite Floor Tubes in Recovery Boilers, March, 1997
- UP Boiler Tube Leaks, March, 1998
- Riser and Tube Attachment Failure and Corrosion, November 2006

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