

Steam and Lower Waterwall Drum Manway Gasket Failure

Background: During a boiler startup at a Mid-Atlantic power station, several spiral-wound gaskets were observed extruding from the Alstom lower waterwall drum manways. The boiler was taken offline and replacement gaskets were transferred from a sister station. When the replacement gaskets arrived at the site, it was observed that the gaskets appeared to be different from the original gaskets (Figure 1), even though the stock numbers were the same. VSP was contacted for technical advice, and it was determined that the failure was caused by using gaskets with inadequate design pressure ratings. The repair outage required draining of the boiler. Repair and Replacement Power Costs exceeded \$14,000.

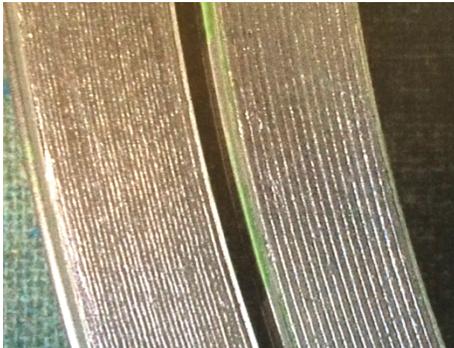


Figure 1. The figure above shows spiral-wound gaskets rated for high pressure on the left side, and low pressure on the right side.



Figure 2. The figure above shows the increased spot welds as well as the multiple layers of interior metal windings which act as an inner ring.

VSP Investigation: VSP examined the gaskets and discovered that they varied greatly in the number of windings per inch, as shown in Figure 1. The spiral-wound gasket stock descriptions did not designate pressure construction ratings. A review of the purchase order determined that the customer had not specified pressure construction ratings and therefore had been sourced the less-expensive spiral-wound gaskets designed for 0-999 psig service pressures. Because the boilers operated at 2400 psig, the gaskets should have been specified and sourced as high pressure construction of 1,000-2,999 psig.

Problem Resolution: The investigation provided several recommendations. First, all windings-only, spiral-wound gaskets without pressure construction ratings should be removed from inventory. Second, VSP surveyed the company's fleet of boilers and drum manways and identified the pressure construction specifications required for their spiral-wound gaskets. In the case of the round Alstom drum manways, engineers at VSP developed a unique, windings-only, spiral-wound gasket, which incorporates a flexible inner ring, as shown in Figure 2. This design allows it to be easily deformed to fit inside the manway and then formed back to its round shape without damaging the gasket. This new design has reinforced metal windings on the inside diameter and an increased number of spot welds, which allow the gasket to be bent in order to fit inside the round manway. This design prevents the gasket from unwinding or creating weak points at the welds which are not evident until gasket failure from internal pressure.

Lessons Learned. It is extremely important to know the specifications of all gasket materials being used as well as the applications in which the gaskets are used. For spiral-wounds, it is vital that you choose a gasket with the correct pressure rating for the application. If the gasket has a pressure rating that is lower or higher than is appropriate for the application, it may be expected to fail.

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