STRESS CORROSION CRACKING OF AUSTENITIC STAINLESS STEEL

TECHNICAL BULLETIN

STRESS CORROSION CRACKING OF AUSTENITIC STAINLESS STEEL

Stress corrosion cracking is the failure of austenitic stainless steels caused by the combined action of a corrosive atmosphere and residual stress in the metal. The most common corrosive ion is the chloride ion. The chloride ion can come from wash down water, brine, sea water, potable water, cleaning solutions, or one of a variety of other sources including the insulation itself.

A practical method of reducing the possibility of stress corrosion is to use an inhibited insulation such as Thermo-1200® with XOX Corrosion Inhibitor® or Sproule WR-1200® with XOX Corrosion Inhibitor. All thermal insulations currently on the market contain some chloride ions. Thermo-1200 and Sproule WR-1200 are low chloride insulations that can be used on austenitic stainless steel.

Even non-wicking thermal insulations can trap and hold chloride ions against the stainless steel surface, thus dramatically increasing the possibility of stress corrosion. Integral to Johns Manville Thermo-1200 and to Sproule WR-1200 is XOX Corrosion Inhibitor, a distinctive formula and process that inhibits corrosion to the outside surfaces of pipe and equipment, especially stress corrosion cracking of austenitic stainless steel. XOX Corrosion Inhibitor can neutralize the effects of the chlorides.

To qualify insulation, the manufacturer or supplier must have the insulation tested by one or more of the corrosion tests and have a chemical analysis to determine the amount of inhibitor in the insulation.

The most frequently used corrosion test specification is [1]ASTM C795. *ASTM C795 references two other test methods, [1]ASTM C692 and [1]ASTM C871. C795 contains the pass/fail requirements. C692 is the 28 day corrosion test. C871 is the chemical analysis test method. If the insulation does not have adequate inhibitors such as XOX Corrosion Inhibitor, it will fail the test.

Two other common specifications are MIL-I-24244 and NRC 1.36. MIL-I-24244 is a US Dept of Defense specification for insulation that is going to be used on the stainless steel pipe and equipment associated with nuclear propulsion system. NRC 1.36 is a US Dept of Energy specification for insulation that is going to be used in nuclear power generating facilities. In all specifications the insulation sample is fitted around a piece of austenitic stainless steel. The stainless steel has a stressed U bend which provides internal stress. The insulation samples are saturated with distilled water to keep them wet, and the stainless steel is heated to the boiling point of water. This heating causes the water to be drawn through the insulation and evaporated. Any chlorides in the insulation will concentrate near the surface of the stainless steel. If the insulation does not have enough inhibitor in it, the stainless steel will corrode.

The insulation sample must pass the chemical analysis. Figure 1 (Page 2) shows the acceptability of the chloride content and the amount of soluble sodium and silicates in the insulation sample. The chemical analysis of the insulation should be plotted on the chart shown in Figure 1. If the plot point falls within the “acceptable” region below the line, then there is enough inhibitor to counteract the chlorides. This will significantly reduce the probability of stress corrosion failure.

After the insulation has passed the corrosion test and has been approved, a periodic chemical analysis is required to verify that the amount of inhibitor has not changed. Orders that must be certified to a specification are chemically analyzed before the particular order is shipped.

To make sure the insulation meets any one or more of these requirements, the insulation must be ordered from the factory as certified to meet the specification. Johns Manville will provide certificates of compliance and the chemical analysis of the material being shipped.

*Continued on Page 2

[1]ASTM- ASTM International West Conshohocken, PA www.astm.org
NRC- (U.S)Nuclear Regulatory Commission www.nrc.gov

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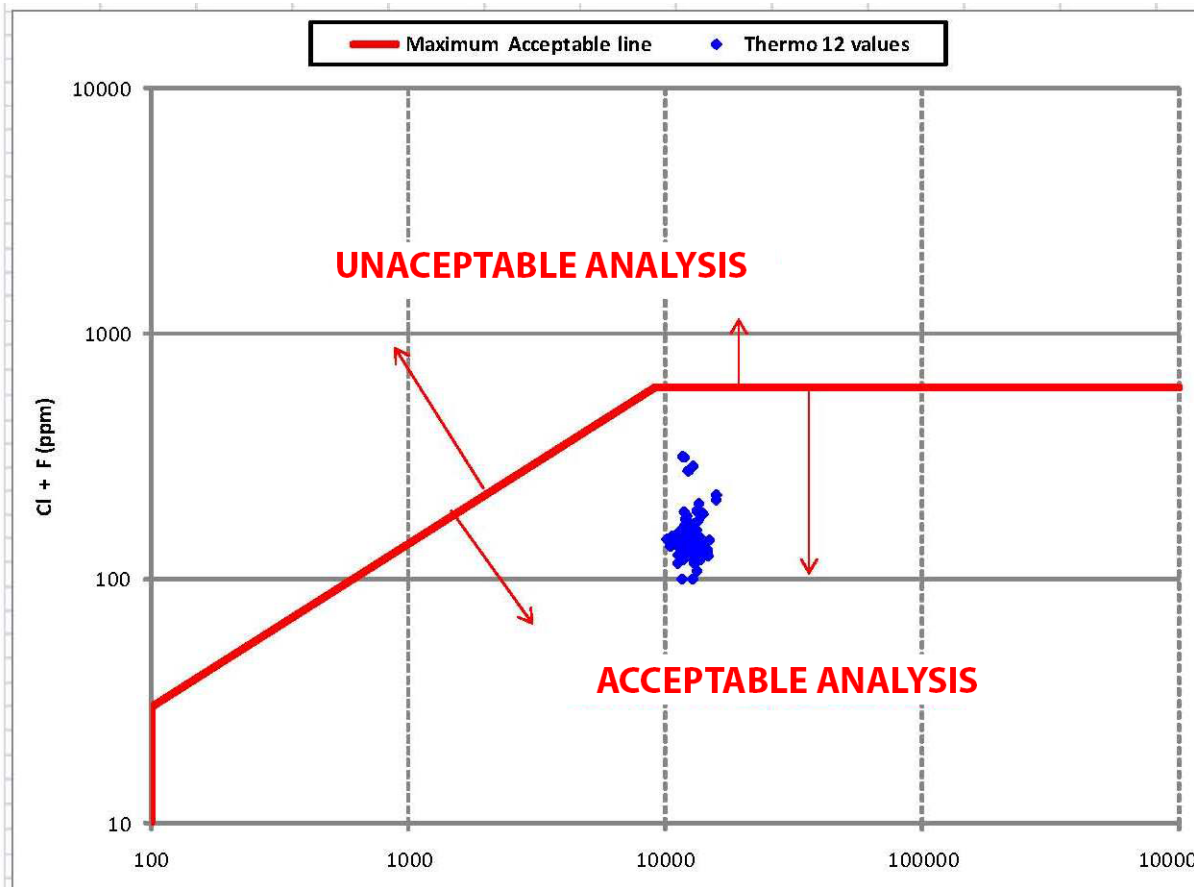
FIGURE 1 – ACCEPTABILITY PLOT FOR THERMO-12 GOLD CALCIUM SILICATE FOR THE YEAR 2009



Johns Manville

717 17th St.
Denver, CO 80202
800-866-3234
JM.com