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Ammonia Vapor Test	This Document expires one day after printing Last Printed: July 25, 2014	

Date	*Description Of Change*	*Signature*	*Rev. Level*
5/29/2011	*New*	*Jeremy Wilson*	*A*

Procedure Approval:	**Company Title:**	**Date:**
	Quality Manager	5/29/2011

1. Scope

1.1. This test method describes a step by step procedure to determine the presence of residual stresses in wrought copper alloy products that may lead to stress corrosion cracking. An Ammonia vapor atmosphere is used as an accelerated test.

1.2. The severity of this test method depends upon the pH of the corrosive solution. Ref: Table I for the 4 (four) different atmospheres to which the product may be exposed, and the appropriate pH of the solution to be used for the test, depending on the risk level associated with the intended application. An appropriate risk level (pH value) shall be specified in the product specification.

2. Reference Documents

2.1. **ASME SB 858**
2.2. **ASTM B 858**
2.3. **MTR module**

Table I

Corrosiveness of Atmosphere	pH Value Safety Requirement Low	High
Low		
Indoor atmosphere conditions	**8.3**	**9.5**
Moderate		
Indoor atmosphere with risk of formation of condensation	**9.5**	**10.0**
Outdoor Atmosphere, temperate climate	**9.8**	**10.0**
High		
Atmosphere with ammoniacal pollution, for example in stables	**10.0**	**10.5**

3. Summary

3.1. The prepared test sample(s) shall be placed in a closed container and exposed to Ammonia Vapor with a specific pH at ambient temperature for 24 hrs. Upon removal from the test atmosphere, the test sample(s) shall be examined for cracks.

4. Equipment

4.1.1. **pH Meter**
4.1.2. **Closed Vessel, such as a desiccator**
4.1.3. **Equipment with 10x to 15x magnification**

5. Materials

5.1. Reagent grade chemicals shall be used in all tests unless otherwise specified.

5.1.1. DI Water Type IV or better, of Specification D 1193
5.1.2. Ammonium Chloride (NH_4CI)
5.1.3. Hydrogen Peroxide (H_2O_2) 30 to 35% technical grade
5.1.4. Sodium Hydroxide (NaOH)
5.1.5. Sulfuric Acid (H_2SO_4) 5%

6. Mixing

6.1. **Ammonium Chloride Solution**
6.1.1. Dissolve 107 g of ammonium chloride in DI Water Type IV or better, of Specification D 1193 and dilute to 500 mL. Store the solution in a sealed container.

6.2. **Sodium Hydroxide Solution**
6.2.1. Dissolve 300 to 500 g of sodium hydroxide into DI Water Type IV or better, of Specification D 1193 and dilute to 1 L. Store the solution in a sealed container.
(Warning: Sodium Hydroxide can cause chemical burns to the skin and eyes. Use of proper safety equipment is required.)

6.3. **Sulfuric Acid Solution**
6.3.1. Slowly add 50 mL of concentrated sulfuric acid into DI Water Type IV or better, of Specification D 1193 and dilute to 1 L. Store the solution in a sealed container.

6.4. **Test Media**
6.4.1. Slowly add sodium hydroxide solution to ammonium chloride solution to give a test solution with a pH value appropriate to the intended application (see Table I). Maintain the solution at ambient temperature and dilute with DI Water Type IV or better, of Specification D 1193 up to a volume of 1 liter (L). Prepare the solution under a fume hood, Check the pH value with the pH meter after dilution and adjust if necessary. Store the solution in a sealed container.

6.5. **Alkaline Solution**

6.5.1. The alkaline solution shall be 150 g of Sodium Hydroxide to 1 liter of DI Water Type IV or better, of Specification D 1193 or a purchased product. Verify pH to be above 11 prior to degrease of sample(s).

6.6. **Pickling Solution**

6.6.1. The pickling solution for cleaning test sample(s) before and after testing shall be 5% Sulfuric Acid. If necessary, for cleaning test sample(s) after testing, a small amount of hydrogen peroxide solution may be added to the pickling solution 20 to 30 mL per liter.

7. Test Sample(s) Preparation

7.1. The test sample(s) shall be 6 inches (150mm) in length. Remove all burrs and sharp edges with a file or abrasive paper.

7.2. Degrease the test sample using the alkaline solution.

7.3. After degrease, clean the test sample(s) in the pickling solution and immediately rinse the test sample(s) off with cold water, then hot water and completely dry it in a stream of warm air.

8. Test Procedure

8.1. Poor 1 liter of test media into the desiccator and verify the pH is as required per the governing specification and Table I of this specification QP 10-07.

8.2. Allow the test sample(s) to reach the required temperature of 68 to 86 degrees and transfer to the desiccator and place on the porcelain support. When placed on a porcelain support the region of the test piece that is in contact with the support will be disregarded when inspecting for cracks. The test piece shall be placed in the center of the desiccator with a minimum of 10mm from the desiccator walls. When more than 1 test sample is placed in the desiccator there shall be a minimum of 10mm from each sample.

8.3. The exposure time shall be 24 hours.

8.4. After 24 hours of exposure remove the test sample(s) from the desiccator and immediately clean it in the pickling solution for a few minutes at ambient temperature below 104 degrees until the surface of the sample(s) is free from corrosion test media to allow for examination of possible cracks at a 10x to 15x magnification.

8.5. Before inspection, deform the test sample(s) slightly by bending or flattening to open up fine cracks.

8.6. Record all results in accordance with ASME SB 858 and Ammonia Vapor Certificate located in the MTR module and retain for quality records.