Ameritube LLC 1000 N. Hwy 77, Hillsboro TX 76645	Revision Level: A	Procedure No. SOP 400
	Revision Date: 10/02/2017	Page No. 1 of 3
Microstructure (Grain Size)	This Document expires one day after printing Last Printed: October 2, 2017	

Date	*Description Of Change*	*Signature*	*Rev. Level*
10/02/2017	*New Document*	*Milind Pawar*	*A*

Procedure Approval:	**Company Title:**	**Date:**
	Quality Manager	10/02/2017

1. Purpose

1.1. The purpose of this procedure is to define the methods and steps required to reveal grain size to determine temper.

2. Scope

2.1. The scope of this procedure includes the steps to be followed in performing grain size analysis.

3. Reference

3.1. ASTM E 112
3.2. ASTM E 112 plate III twined grains (Contrast Etch) chart

4. Responsibility

4.1. It is the responsibility of the lab technician who performs the preparation and analyses to follow the procedures and any safety precautions set forth by the Quality Manager and the chemical MSDS being used.

5. Materials

5.1. Deionized Water

5.2. Copper and Brass Etchant

5.2.1. 68% - 70% Nitric Acid

5.3. Copper Nickel

5.3.1. Transene Company Inc. (Nickel Etchant Type I)

6. Procedure

6.1. **Sample Preparation**

6.1.1. Samples that are 0.028” wall or heavier and ½” diameter or larger are to be cut lengthwise (split) at least 2 inches long. For safety reasons, 0.028” wall or lighter ½” diameter or smaller may be cut as a non-split sample and inspected on the end of the sample. Length of the sample should be kept long enough to keep firm grip while grinding and polishing operations to avoid mounting process.

6.1.2. Grinding: Scratches left by cutting operation must be removed in order to develop microstructure of the sample.

- The grinding procedure involves several stages, using a finer paper (higher number) each time. Each grinding stage removes the scratches from the previous coarser paper. This can be easily achieved by orienting the specimen perpendicular to the previous scratches.

Between each grade the specimen is washed thoroughly with soapy water to prevent contamination from coarser grit present on the specimen surface.

- Start from SiC grit 240 (Coarse) by gradually increasing grit size to 1200 (Fine). Keep washing the sample after each grinding paper.

6.1.3. Polishing: Use polish disc machine by keeping at speed II. Keep flow of water for lubrication. Once mirror like surface is achieved, the sample is considered to be ready for etching process.

6.1.4. Etching:

Copper and Brass Alloys

- Dip the sample in Nitric Acid for approximately 2 to 5 seconds.
- Rinse the sample in a beaker of Deionized water.
- Dip the sample for a second time in Nitric Acid for approximately 1 to 2 seconds.
- Rinse the sample in a beaker of Deionized water.
- Dry the sample using air from an air hose or hair dryer
- Place the sample on the microscope
- Use the ASTM wall chart as a reference to determine the grain size by comparison.
- If you are not able to see the grains, repeat the polishing and etching steps.
- Record the results on the microstructure work order
  If grain size is out of specification generate a nonconformance in accordance with QMS-005

Copper Nickel Alloys

- Heat the Transene Company Inc. (Nickel Etchant Type I) to 40 degrees Celsius
- Dip the sample in Transene Company Inc. (Nickel Etchant Type I)for 4 to 6 seconds
- Rinse the sample in a beaker of Deionized water
- Dip the sample in Nitric Acid for approximately 1 to 2 seconds.
- Rinse the sample in a beaker of Deionized water
- Dry the sample using air from an air hose or hair dryer
- Place the sample on the microscope
- Use the ASTM wall chart as a reference to determine the grain size by comparison.
- If you are not able to see the grains, repeat the polishing and etching steps.
- Record the results on the microstructure work order
- If grain size is out of specification generate a nonconformance in accordance with QMS-005