

TAM International, Inc.

ES-7.3-21 Specifications for Outside Vendor Heat Treating & Stress Relieving

Approved by Department Manager

Signature/Date: Mark Wyatt, 5/8/2012

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Reviewed by ISO Management Representative

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1.0 Scope

- 1.1 These specifications define the requirements for heat treating and stress relieving metals or parts used in TAM products.

2.0 Status and Records

- 2.1 Changes in these instructions shall be documented in accordance with EI-7.3-03 Instructions for the Control of Engineering Drawings.

3.0 General Requirements

- 3.1 Parts shall be pre-inspected by the Vendor for suitability of heat treating or stress relieving processes, if necessary.
- 3.2 Vendor shall ensure that traceability markings are maintained throughout the processes or replaced immediately after completion of the process.
- 3.3 A 10% sample of returned parts received after completion of heat treating shall be selected and hardness tested.
- 3.3.1 Hardness sampling shall be performed on a calibrated hardness tester. Verification of the tester's accuracy to the hardness standard shall be recorded, along with the hardness of the sample on form QF-16.
- 3.4 The parts will then be inspected per QI-8.2.4-07 "Instructions for Inspection and Receiving of Outside Supplier Processed Parts".

4.0 Heat Treating

- 4.1 Heat treating shall be performed per vendor procedures unless otherwise specified, to achieve defined material properties.
- 4.2 A certificate attesting to the heat treatment performed and vendor's test results shall be provided by the vendor and reviewed by TAM Inspection for acceptance.

5.0 Stress Relieving

- 5.1 Stress relieving shall be done as per the following, unless otherwise specified:
- 5.1.1 Stress relief temperature shall be maintained 75F +/- 25F below the tempering temperature for the material.
- 5.1.2 Stress relief temperature shall be held for 1 hour per inch of wall thickness of the part.

6.0 Heat Treat Specification for Chemical and Physical properties of Vasco MAX® C-250 used in TAM products.

Solution annealed, ultra high strength 18% Nickel, Colbalt strengthened steel (C-Type) Maraging, Grade C-250, Vacuum Induction Melted (VIM) plus either Vacuum Arc Remelted (VAR) furnished in the solution annealed condition.

6.1 HEAT TREAT:

- 6.1.1 Heat treat each batch of material and run (1) set of coupons for testing individual mechanical properties per Section 4.2. **Note:** (1) set consist of coupons for Mechanicals, Chemistry, Tensile and Charpy.
- 6.1.2 Each batch of material shall consist of a double solution anneal at 1500°F + 25°F / - 0.0°F, hold for 1.0 / 1.5 hours, air cool to ambient; reheat at 1500°F + 25°F / - 0.0°F, hold for 1.0 / 1.5 hours, air cool ambient and reheat for age Harding at 900°F / 925°F for 6.0 / 6.5 hours, air cool to ambient. **Note:** Vendor to confirm temperature using thermocouple.

6.2 MECHANICAL PROPERTIES:

- 6.2.1 Qualification testing must be performed on each batch of material being heat treated to demonstrate that the mechanical properties are in accordance with ASTM A370.

	<u>< 4" Dia.</u>	<u>> 4" Dia.</u>
Minimum Ultimate Tensile Strength (psi)	260,000	250,000
Minimum Yield Strength (psi by 0.2% offset)	255,000	245,000
Minimum Compressive Yield Strength (psi)	280,000	270,000
Minimum Elongation (% in 2") Original gauge length must be reported.	11	10
Hardness (HRC)	48 / 52*	48 / 52*
* Hardness shall not be cause of rejection if other mechanical properties are acceptable		
Reduction of area (%)	58%	56%
Charpy V-Notch (ft-lb)	20	19

6.3 QUALITY:

- 6.3.1 Vendor and supplier workmanship, dimensions, weights, and tolerances shall meet ASTM A29 for bar and ASTM A519 for seamless tubing.
 - 6.3.2 Bars 4.0" in diameter and greater shall be ultrasonically inspected for internal soundness in accordance with Military Standard Mil-STD-2154 and meet the minimum requirements of class B.
 - 6.3.3 Material identification number (heat or cast number or melt code) shall be permanently marked on each piece of material, preferably steel stamped.
- 6.4 **REPORTS:**
- 6.4.1 Material ordered to this specification shall be accompanied by a Heat Treat Test Report. Reports shall contain the following minimum information which will be subject to inspection upon receipt.
 - 1) Statement of Material Condition (Section 4.1)
 - 2) Mechanical Properties Test (Section 4.2)
 - 6.4.2 All requirements are subject to verification at the discretion of TAM International.