

TAM International, Inc.

ES-7.3-05 Appendix 2 Raw Material Specification for VascoMax® C-250 Metal

Approved by Engineering Manager

Signature/Date: Mark Wyatt 08/11/2015

Reviewed by Sr. Quality Analyst

Signature/Date: Thomas Young 08/11/2015

Revision Level: B

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1.0 Scope

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

2.0 Chemistry

The composition of the product supplied shall conform to the following analysis limits as determined in accordance with AMS 6512. Reported analysis shall include the results of quantitative determination of all elements listed, plus any other elements used to control mechanical properties.

<u>ELEMENT</u>	<u>SYMBOL</u>	<u>% / WEIGHT</u>
CARBON	(C)	0.03 Max
MANGANESE	(Mn)	0.10 Max
SILICON	(Si)	0.10 Max
PHOSPHORUS	(P)	0.01 Max
SULFUR	(S)	0.01 Max
NICKEL	(Ni)	17.00 / 19.00
COBALT	(Co)	7.00 / 8.50
MOLYBDENUM	(Mo)	4.60 / 5.20
TITANIUM	(Ti)	0.30 / 0.50
ALUMINUM	(AL)	0.05 / 0.15
Chromium	(Cr)	0.50 Max
Copper	(Cu)	0.50 Max
Iron	(Fe)	Balanced

3.0 Mechanical Properties

- 3.1 There are no mechanical properties required of this material in the solution annealed condition.

- 3.2 Bar Tolerances:

OD Range:	0.250 / 0.499	0.500 / 0.999	1.000 / 3.625
Tolerances:	-0.000 / +0.005	-0.000 / +0.010	-0.000 / +0.031
OD Range:	3.625 / 6.000	6.001 / 8.000	8.001 – 10.000
Tolerances:	-0.000 / +0.047	-0.000 / +0.063	-0.000 / +0.078

4.0 Conditions

- 4.1 Bars and seamless tubing shall be manufactured from material which is Vacuum Induction Melted (VIM) plus either Vacuum Arc Re-melted (VAR) furnished in the solution annealed condition.
- 4.2 The vendor or supplier shall furnish fine grained material. The grain size, when determined in accordance with ASTM E112 comparison method, should be number 5 or finer with occasional grains as large as 4 permissible.

5.0 Quality

- 5.1 Vendor and supplier workmanship, dimensions, weights, and tolerances shall meet ASTM A29 for bar and ASTM A519 for seamless tubing.
- 5.2 Material identification number (heat or cast number or melt code) shall be permanently marked on each piece of material, preferably steel stamped.

6.0 Reports

- 6.1 Material ordered to this specification shall be accompanied by a Mill Test Report. Reports shall contain the following minimum information which will be subject to inspection upon receipt:
 - 1. Statement of Material Condition (Paragraphs 4.0)
 - 2. Chemical Analysis (Paragraph 2.0)
- 6.2 All requirements are subject to verification at the discretion of TAM International.

Rev	Date	Description	Prepared By:	Reviewed By / Approved By	Date
A	--	New Document	--	--	--
B	7/8/11	Remove 1.2,1.3,4.3,5.2	Doyle Warren	D. Warren, M. Wyatt, T. Young	7/22/11