TITANIUM GRADE 5 (TI-6AL-4V), 120 KSI (827 MPA), BARSTOCK, SUBSEA COMPATIBLE

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F	1267868	25-FEB-2016	Ketron, Scott	Coles, Michael	RELEASED

Summary:

This specification covers material for Titanium Grade 5 bar (Ti-6Al-4V, UNS R56400), a two-phase alpha + beta alloy. This is not approved for sour service under NACE MR0175 / ISO 15156. If sour service is not needed but increased fracture toughness and ductility are (especially at low temperatures) Ti Gr. 23 should be used. If sour service compatibility and/or resistance to localized corrosion at higher temperatures is needed, Ti Gr. 29 should be used.

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1.0 Scope

This specification covers material for Titanium Grade 5 bar (Ti-6Al-4V, UNS R56400), a two-phase alpha + beta alloy. This is not approved for sour service under NACE MR0175 / ISO 15156. If sour service is not needed but increased fracture toughness and ductility are (especially at low temperatures) Ti Gr. 23 should be used. If sour service compatibility and/or resistance to localized corrosion at higher temperatures is needed, Ti Gr. 29 should be used.

If conflict exists between this specification and other specifications, this specification shall take precedence.

2.0 Reference Specifications

Documents	Descriptions
ASTM B348	Standard Specification for Titanium and Titanium Alloy Bars and Billets.
NACE MR0175 / ISO15156	Materials for use in H2S-containing environments in oil and gas production.

3.0 Manufacturing Process

The melting practice for this material shall be a minimum double-melt with the last melt being the Vacuum Arc Melting (VAR) process.

4.0 Chemical Composition Requirements

The chemical composition shall meet the requirements listed in Table 1.

Table 1: Chemical Requirements. (All are maximums unless otherwise noted)

Elements	Wt. Percentage (%)
Carbon	0.08
Iron	0.40
Aluminum	5.5 – 6.75
Oxygen	0.20
Vanadium	3.5 – 4.5
Titanium	Balance
Nitrogen	0.05
Hydrogen	0.0150 (150 ppm)

5.0 Heat Treatment

The material shall be provided in the annealed condition to meet the specified mechanical properties in section 6. Material shall be tested from a bar prolongation. Material condition as well as all thermal processing shall be reported.

6.0 Metallurgical Properties

6.1 Mechanical Properties

The material shall meet the mechanical property requirements of Table 3

Table 3: Mechanical Property Requirements. (All are minimums unless otherwise noted)

Tensile Strength		130 ksi (896 MPa)
Yield Strength		120 ksi (827 MPa)
Elongation in 4D or 5D		10 %
Reduction of Area	Longitudinal (L)	25 %
	Long Transverse (LT)	20 %
Note: Hardness is not a good indicator of the mechanical properties of titanium alloys.		

Tensile properties shall be determined using a strain rate of 0.003 to 0.007 in./in./min through the specified yield strength, and then increasing the rate so as to produce failure in approximately one additional minute.

6.2 Impact Properties

Impact toughness behavior does not correlate well with ductility or fracture toughness for titanium alloys. If a specific fracture toughness is desired, fracture toughness testing according to ASTM E1820 should be performed.

7.0 Surface Finish and Repair

Repair by welding is not acceptable.

8.0 Documentation

Documentation that is in compliance with EN 10204 type 3.1 inspection certificates shall be supplied provided to FMC with each shipment of material. This type of certificate requires the supplier to provide test results for all requirements listed in specifications that are attached to the part report.

In addition, the material certificate shall include the following information:

- Manufacturer of the starting material for the finished product, melting and refining practice.
- Heat treatment conditions (temperatures and holding times shall be stated).