



## Technical Data Sheet

# ATI 64-MIL™

## Alloyed Titanium (UNS R56400)

### INTRODUCTION

ATI 64-MIL™ titanium alloy (UNS R56400) is a two phase  $\alpha+\beta$  titanium alloy, with aluminum as the alpha stabilizer and vanadium as the beta stabilizer. This high-strength alloy can be used at cryogenic temperatures to about 800° F (427° C). ATI 64-MIL™ alloy is used in the annealed condition and in the solution treated and aged condition. Some applications include: armor, compressor blades, discs, and rings for jet engines; airframe and space capsule components; pressure vessels; rocket engine cases; helicopter rotor hubs; fasteners; critical forgings requiring high strength-to-weight ratios; medical and surgical devices. This alloy is produced by primary melting using vacuum arc (VAR), electron beam (EB), or plasma arc hearth melting (PAM). Remelting is achieved by one or two vacuum arc steps.

### SPECIFICATIONS & CERTIFICATES

- AMS 4928 – Bars, Forgings, and Forging Stock (Annealed)
- AMS 4965 – Bars, Forgings (Solution Treated and Aged)
- AMS 4967 – Bars, Forgings (Annealed, Heat Treatable)
- AMS 4911 – Plate
- ASTM B265 – Plate
- ASTM F 1472 – Bars, Forgings, Sheet, Strip, and Plate
- MIL-DTL-46077 – Armor Plate
- ISO 5832-3 – Wrought Alloy

### FORGEABILITY

ATI 64-MIL™ alloy is finish-forged from 1,750° F; (954° C) with a finishing temperature of 1,450° F; (788° C). Minimum reductions of 35% are recommended to obtain optimum properties.

### FORMABILITY

ATI 64-MIL™ alloy is difficult to form at room temperature even in the annealed condition. Therefore severe forming operations such as bending or stretching are performed on annealed material at temperatures up to 1,200° F; (649° C) without affecting mechanical properties. Hot sizing or shaping can be done by creep forming in the 1,000 - 1,200° F; (538 - 649° C) range.

### MACHINEABILITY

ATI 64-MIL™ alloy can be machined using practices for austenitic stainless steels with slow speeds, heavy feeds, rigid tooling, and large amounts of non-chlorinated cutting fluid.



## Technical Data Sheet

### WELDABILITY

ATI 64-MIL alloy is easily welded in the annealed condition, or in the solution and partially aged condition, with aging being completed during the post weld heat treatment. Precautions must be taken to prevent oxygen, nitrogen, and hydrogen contamination. Fusion welding can be done in inert gas filled chambers, or using inert gas welding of the molten metal and the adjacent heated zones using a trailing shield. Spot, seam, and flash welding can be performed without resorting to protective atmospheres.

### SPECIAL PRECAUTIONS

ATI 64-MIL™ alloy can be subjected to hydrogen contamination during improper pickling and by oxygen, nitrogen, and carbon pickup during forging, heat treating, brazing, etc. This contamination could result in a deterioration in ductility which would adversely affect notch sensitivity and forming characteristics.

### PHYSICAL PROPERTIES

Melting Range: 2,800 - 3,000° F (1,538 - 1649° C)

Density: 0.160 lbs/cu. in.; 4.47 gm/cc

Beta Transus Temperature: 1830° F (±25°): 999° C (±14°)

### HEAT TREATMENT

ATI 64-MIL™ alloy can be heat treated in several ways.

1. Stress Relief Anneal: 1,000 - 1,200° F; (538 - 649° C), 1 to 8 hours, air or furnace cool
2. Solution Heat Treatment: 1,675 - 1,750° F; (913 - 954° C), 1 hour, water quench
3. Aging Treatment: 975 - 1,025° F; (524 - 552° C), 4 to 8 hours, air cool

The very best of properties in the solution treated and aged condition are obtained in small cross sections that are rapidly quenched. Larger sections sizes and/or a quench delay may cause properties to be lower than the optimum values.

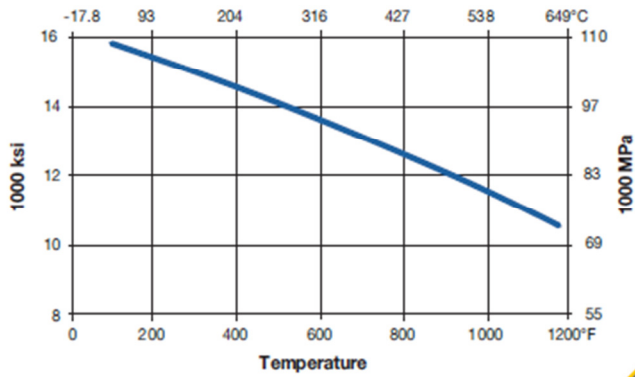
### HARDNESS

Typical hardness in the annealed condition is Rockwell C 30-34, and about Rockwell C 35-39 in the solution and aged condition.

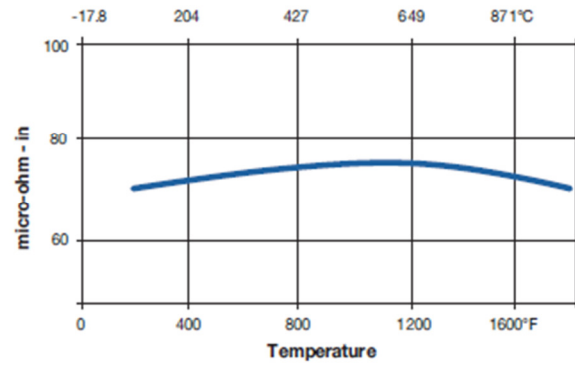


## Technical Data Sheet

Modulus of Elasticity for ATI 64-MIL™ Titanium Bar

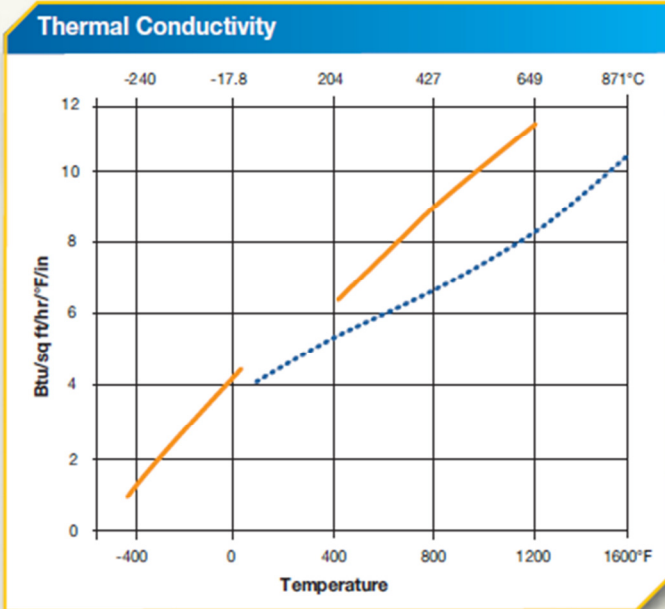
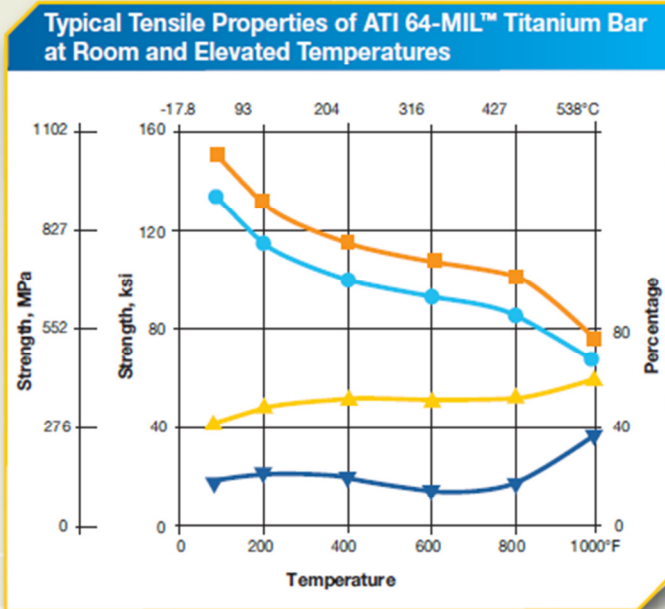


Electrical Resistivity of ATI 64-MIL™ Titanium Bar





Technical Data Sheet



■ ULTIMATE TENSILE STRENGTH  
▲ REDUCTION IN AREA

● 0.2% YIELD  
▼ ELONGATION

●●●● BAR ANNEALED  
— 0.125 IN. SHEET

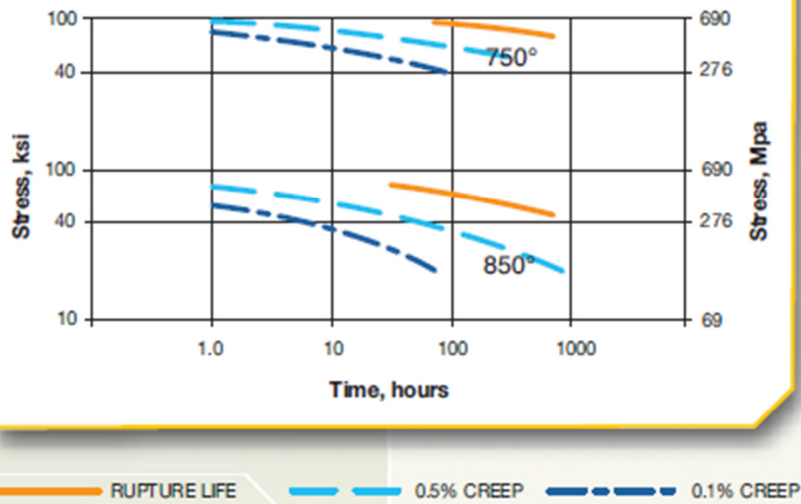
1,700° F, 20 MIN, WQ  
900° F, 4 HR, AC (bar form only)

Chemistry	N	C	H	O	Fe	Al	V	Ti	Other Elements
% w/w, min.	-	-	-	-	-	5.50	3.50	-	-
% w/w, max.	0.05	0.10	0.0125	0.20	0.30	6.75	4.50	Bal	0.40 Total 0.10 Each

Data are typical and should not be construed as maximum or minimum values for specification or for final design. Data on any particular piece of material may vary from those herein. U.S. and foreign patents; other patents pending. © 2011 ATI. All rights reserved.



## Technical Data Sheet

**Creep-Strength and Stress-Rupture Life  
of ATI 64-MIL™ Titanium Bar at 750° and 850° F**
**CONTACT**

[ATIdefense@ATImetals.com](mailto:ATIdefense@ATImetals.com)

1-877-590-3979

[www.atimetals.com](http://www.atimetals.com)