Ti-3Al-2.5V and Ti-3Al-2.5V 0.05Pd

TIMETAL® 3-2.5 & 3-2.5 .05Pd

COLD WORKABLE MEDIUM STRENGTH ALLOYS

TIMETAL 3-2.5 and 3-2.5 .05Pd are intermediate strength, heat treatable, alpha/beta titanium alloys possessing excellent fabricability. The alloys are cold formable and easily welded, much like the commer cially pure (unalloyed) grades of titanium. Yet the alloys offer nearly double the strength (both room and elevated) over *TIMETAL* 50A. *TIMETAL* 3-2.5 is ASME Boiler and Pressure Vessel code approved. The corrosion resistance of *TIMETAL* 3-2.5 is very close to that of commercially pure titanium, exhibiting complete resistance to sea water, and excellent resistance to general, crevice, pitting and stress crack corrosion. As with the commercially pure grades, palladium can be added to the alloy (*TIMETAL* 3-2.5 .05Pd) to further enhance its corrosion behavior. Typical applications in the aerospace industry include hydraulic tubing and lightweight honeycomb structures. *TIMETAL* 3-2.5 is also being used for industrial applications such as pr essure vessels and piping, and in a growing number of consumer products (the most notable being bicycle tubing). *TIMETAL* 3-2.5 offers the highest structural efficiency of any of the common engineering metals appr oved by ASME. The alloy is available in all common product forms including billet, bar, plate, sheet, strip, tubing and pipe.

TABLE 1

CHEMICAL COMPOSITION

ELEMENT	WEIGHT %			
	TIMETAL 3-2.5 ASTM Grade 9 UNS Desig. R56320		*TIMETAL 3-2.5 .05Pd ASTM Grade 18 UNS Desig. R56322*	
	Min.	*Max.*	*Min.*	*Max.*
Aluminum	2.5	3.5	2.5	3.5
Vanadium	2.0	3.0	2.0	3.0
Nitrogen	—	0.03	—	0.03
Carbon	—	0.08	—	0.08
Oxygen	—	0.15	—	0.15
Iron	—	0.25	—	0.25
Hydrogen	—	0.015	—	0.015
Palladium	—	—	0.04	0.08
Residual Elements, each	—	0.1	—	0.1
Residual Elements, total	—	0.4	—	0.4

TABLE 2

PHYSICAL PROPERTIES

PROPERTY	VALUE
Density(a)	0.162 lb/in.^{3} (4.48 g/cm^3)
Beta Transus	1715±25°F (935±15°C)
Melting (liquidus) Point	3100°F (1700°C)
Thermal Conductivity(a)	4.8 Btu/ft·h·°F (8.3 W/m·K)
Electrical Resistivity(a)	1.27 μΩ·m
Magnetic Permeability	Nonmagnetic
Thermal Coefficient of Linear Expansion(b)	5.34x10^{-6} in/in°F (9.61x10^{-6} m/m°C)

(a) Typical values at room temperature of about 20 to 25°C (68 to 78°F).
(b) Mean coefficient from room temperature to 95°C (200°F)

PROPERTY (ELASTIC)	VALUE
Young's Modulus	
At RT	14-15x10^6 psi (95-105 GPa)
At 230°C (450°F)	11-12x10^6 psi (75-85 GPa)
Shear Modulus	
At RT	6.2-6.5x10^6 psi (43-45 GPa)
Poisson's Ratio	Typically 0.30

TABLE 3

MINIMUM ROOM TEMPERATURE MECHANICAL PROPERTIES

Condition	*U.T.S. ksi (MPa)*	*YS ksi (MPa)*	*Elongation %*	*R.A. %*	*Bend Radius*
Annealed	90 (620)	70 (483)	15	30	5-6T
Aged	120 (828)	100 (690)	8	—	—
CWSR	125 (862)	105 (724)	10	—	—

TABLE 4

TYPICAL ELEVATED TEMPERATURE MECHANICAL PROPERTIES (ANNEALED CONDITION)

TEMPERATURE	UTS	YS
	ksi (MPa)	*ksi (MPa)*
200°F (93°C)	97 (669)	77 (531)
600°F (316°C)	79 (545)	55 (380)
800°F (427°C)	71 (490)	50 (345)

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TABLE 5

TYPICAL HEAT TREATMENTS

Stress Relief	600°-1200°F (316°-649°C) for 0.5-3 hrs, AC
Anneal	1200°-1400°F (649°-760°C) for 1-3 hrs, AC
Solution Treat	1600°-1700°F (871°-927°C) for 0.25-1 hr, WQ
Aging	900°-1000°F (482°-538°C) for 2-8 hrs, AC

TABLE 6

AWS COMPOSITION FOR WELDING RODS AND ELECTRODES

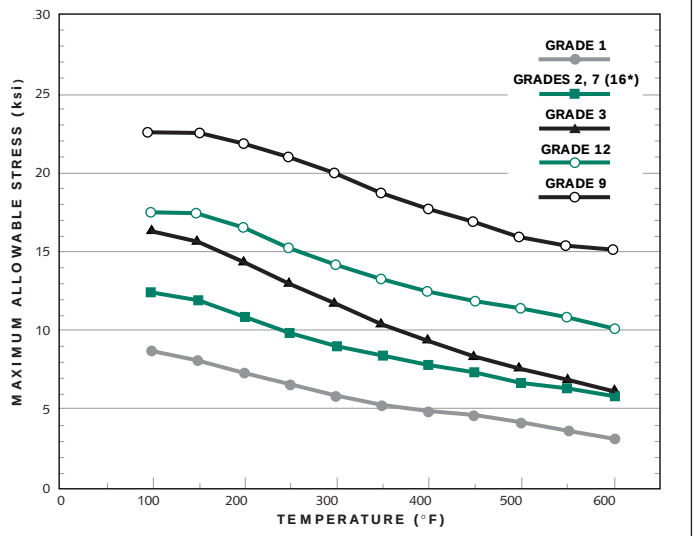
ELEMENT	WEIGHT %			
	ERTi 3Al-2.5V		*ERTi 3Al-2.5V ELI**	
	Min.	*Max.*	*Min.*	*Max.*
Aluminum	2.5	3.5	2.5	3.5
Vanadium	2.0	3.0	2.0	3.0
Nitrogen	—	0.02	—	0.012
Carbon	—	0.05	—	0.04
Oxygen	—	0.12	—	0.10
Iron	—	0.25	—	0.25
Hydrogen	—	0.008	—	0.005
Titanium	Balance		Balance	

* Titanium welds typically pick up 0.030% oxygen during welding. ER Ti 3Al-2.5V ELI is used where maximum weld ductility is required.

FIGURE 1

MAXIMUM ALLOWABLE STRESS IN TENSION

TITANIUM GRADES ASME BOILER AND PRESSURE VESSEL CODE, SECTION VIII-DIVISION 1



*Note: Grade 16 not yet approved by ASME. Anticipated values shown.

FIGURE 2

STRUCTURAL EFFICIENCY OF *TIMETAL* 3-2.5 COMPARED WITH OTHER METALS

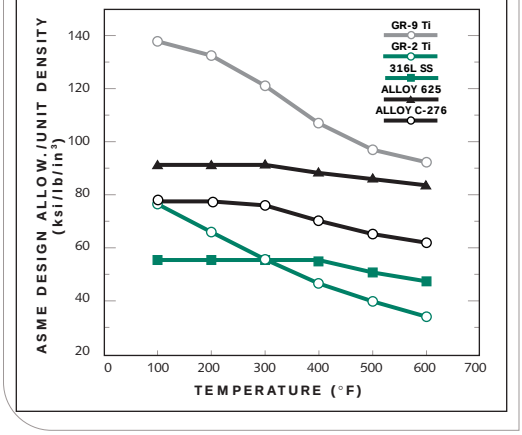
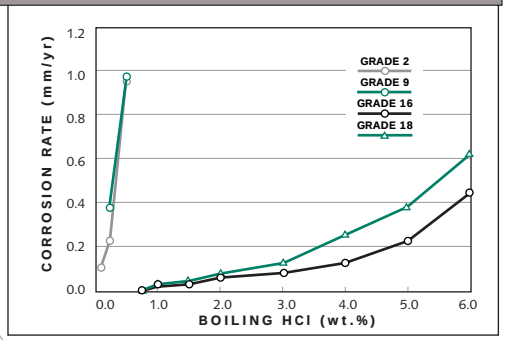


FIGURE 3

CORROSION BEHAVIOR OF *TIMETAL* 3-2.5 AND *TIMETAL* 3-2.5 .05Pd



The data and other information contained herein are derived from a variety of sources which TIMET believes are reliable. Because it is not possible to anticipate specific uses and operating conditions, TIMET urges you to consult with our technical service personnel on your particular applications.

For more information, please contact the TIMET Sales Office/Service Center nearest you, TIMET's Technical Laboratories or TIMET's Website @ www.timet.com

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