

# TIMETAL<sup>®</sup> 17

## HIGH STRENGTH FORGING ALLOY

TIMETAL<sup>®</sup> 17 is a high strength deep hardenable forging alloy primarily used for jet engines. Metallurgically it is a near- $\beta$  alloy capable of being heat treated to a variety of strength levels in sections up to 6 inches. This is the major advantage of TIMETAL<sup>®</sup> 17 offering good ductility and toughness, as well as good low-cycle and high cycle fatigue properties and high creep resistance at intermediate temperatures.

TABLE 1

CHEMICAL COMPOSITION			
ELEMENT	WEIGHT %		
	Min.	Max.	Nominal
Aluminum	4.5	5.5	5.0
Tin	1.6	2.4	2.0
Zirconium	1.6	2.4	2.0
Molybdenum	3.5	4.5	4.0
Chromium	3.5	4.5	4.0
Carbon	-	0.05	
Nitrogen	0.08	0.13	
Oxygen	-	0.2	0.16
Hydrogen	-	0.0125	
Residuals (each)		0.1	
Residuals (total)		0.3	

TABLE 2

PHYSICAL PROPERTIES		
PROPERTY	VALUE	
	English	SI
Density	0.168 lb/in <sup>3</sup>	4.65 g/cm <sup>3</sup>
Beta Transus	1635 ± 15 °F	890.5 ± 15 °C
Tensile Modulus	16-16.5 Msi	110-113 GPa

TABLE 3

HEAT TREATMENT	
STA (Solution Treat & Age)	1475°F for 4 hr, water quench, 1175°F for 8 hr, air cool
Stress Relieve (before finish machining)	1020°F for 4 hr, air cool

TABLE 4

TYPICAL LOW CYCLE FATIGUE, STA CONDITION				
$\Delta\epsilon$ (Strain Control, $A^* = 1.0$ )				
Temperature, °F (°C)	Plastic	Elastic	Total	Cycles to Failure
75 (24)	0.38	1.49	1.87	3,180
75 (24)	0.10	1.365	1.465	5,040
75 (24)	0.03	1.23	1.26	9,650
75 (24)	0.02	1.135	1.155	15,400
75 (24)	0.01	1.04	1.05	25,700
75 (24)	0.025	0.97	0.995	60,600
600 (315)	0.23	1.30	1.54	3,600
600 (315)	0.133	1.20	1.34	5,500
600 (315)	0.044	0.982	1.03	>12,700
600 (315)	0.055	0.92	0.98	>56,300
600 (315)	0.017	0.9075	0.93	>86,000
600 (315)	0.045	0.88	0.93	>16,000
Load Control, $A^* = 1.0$				
Temperature, °F (°C)	Stress Range, ksi			Cycles to Failure
75 (24)	160			5,000
75 (24)	155			10,000
75 (24)	145			25,000
75 (24)	135			35,000
75 (24)	130			170,000
75 (24)	120			290,000
600 (315)	130			5,000
600 (315)	125			6,000
600 (315)	122			7,000
600 (315)	121			13,000
600 (315)	120			64,000

$A^* = \text{Alternating Stress} \div \text{mean stress}$

**TABLE 5**

<b>TYPICAL HIGH CYCLE FATIGUE, STA CONDITION (LOAD CONTROL, A* = 0.95)</b>			
Temperature, °F (°C)	Maximum Stress, ksi (MPa)	Alternating Stress, ksi (MPa)	Cycles to Failure
75 (24)	140 (965)	68.2 (470)	21,000
75 (24)	120 (827)	58.5 (403)	75,000
75 (24)	110 (758)	53.6 (369)	7,000,000
75 (24)	105 (724)	51.2 (353)	6,000,000
600 (315)	110 (758)	53.6 (369)	37,000
600 (315)	100 (689)	48.7 (335)	50,000
600 (315)	98 (676)	47.7 (329)	88,000
600 (315)	95 (655)	46.3 (319)	>15,000,000
600 (315)	90 (621)	43.8 (302)	>12,000,000

A\* = Alternating Stress ÷ mean stress

**TABLE 6**

<b>TYPICAL TENSILE AND NOTCHED TENSILE PROPERTIES, STA CONDITION</b>						
Temperature, °F (°C)	0.2% YS, ksi (MPa)	UTS, ksi (MPa)	% El	% RA	Notched tensile strength (ksi)	Notched tensile strength ÷ ultimate tensile strength
77 (25)	150-170 (1034-1172)	160-180 (1103-1241)	8-15	25-45	At 75°F= 200-220	At 75°F = 1.3
200 (93.3)	135-145 (931-998)	150-160 (1034-1103)	8-15	30-45	210-220	1.4
400 (204)	115-125 (793-862)	135-145 (931-998)	8-15	30-45	200-210	1.4
600 (315)	110-120 (758-827)	135-145 (931-998)	8-15	30-45	185-195	1.4
700 (371)	100-110 (689-758)	125-135 (862-931)	8-15	30-45	185-195	1.4

**TABLE 7**

<b>FRACTURE TOUGHNESS</b>	
Yield Strength, ksi (MPa)	KIC, ksi√in (MPa√m)
168 (1158)	26-31 (28.6-34.1)
161 (1110)	53-65 (58.3-71.5)
153 (1054)	53-57 (58.3-62.7)

**TABLE 9**

<b>TYPICAL CREEP PROPERTIES, STA</b>		
Temperature, °F(°C)	Stress, ksi (MPa)	Time to 0.2 %, hr
400 (204)	115 (793)	2,200
400 (204)	118 (813)	400
400 (204)	120 (827)	0.01
600 (315)	100 (689)	1,000
600 (315)	105 (724)	500
600 (315)	108 (745)	125
800 (427)	35 (241)	150
800 (427)	45 (310)	75
800 (427)	50 (345)	75
800 (427)	60 (414)	30

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 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](http://www.timet.com)



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**TABLE 8**

<b>TYPICAL STRESS RUPTURE PROPERTIES (STA)</b>		
Temperature, °F(°C)	Stress, ksi (MPa)	Time to rupture, hr
400 (204)	137	>1,000
400 (204)	140	800
400 (204)	142.5	600
400 (204)	145	0.01
600 (315)	130	>1,000
600 (315)	133	0.01
600 (315)	135	0.01
800 (427)	100	>500
800 (427)	110	25
800 (427)	115	10

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