TITANIUM

WASHINGTON ALLOY 6AL/4V
AWS A5.16-90 Class ERTi-5 (formerly AWS A5.16-70 Class ERTi-6AL-4V) AMS 4954E

Washington Alloy 6AL/4V is a TIG, MIG and submerged arc filler metal used for welding 6% Aluminum - 4% Vanadium alloys. The weld deposits of Washington Alloy 6AL/4V exhibit high fatigue strength, toughness, ductility and are heat treatable. Widely used in the cryogenic, petrochemical and aircraft industry. Aircraft uses would include the airframes; turbine engine parts such as the blades, discs, wheels and spacer rings. Other applications would include industrial fans, pressure vessels, compressor blades and rocket motor cases.

FILLER METAL CHEMISTRY (%)

C	0.050 max.
O	0.180 max.
H	0.015 max.
N	0.030 max.
Fe	0.300 max.
Ti	Balance
Al	5.5-6.7
V	3.5-4.5
Yt	0.005 max.

MINIMUM MECHANICAL PROPERTIES

Tensile strength (psi).....130,000
Yield strength (0.2% offset) (psi) 120,000
Elongation (%).....10

WASHINGTON ALLOY 6 AL/4V ELI
AWS A5.16-90 Class ERTi-5ELI (formerly AWS A5.16-70 Class ERTi-6AL-4V-1) AMS 4956C

Washington Alloy 6AL/4V ELI is basically a modified version of 6Al/4V. ELI refers to "extra low interstitial" content - primarily oxygen. By maintaining or controlling these ELI gases, the fracture toughness of the weld deposit is greatly increased. Washington Alloy 6AL/4V ELI is commonly used for surgical implants, airframe components and to weld liquid hydrogen tanks.

FILLER METAL CHEMISTRY (%)

C	0.030
O	0.100
H	0.005
N	0.012
Fe	0.150
Ti	Balance
Al	5.5-6.5
V	3.5-4.5
Yt	0.005

MINIMUM MECHANICAL PROPERTIES

Tensile strength (psi).....130,000
Yield strength (0.2% offset) (psi) .120,000
Elongation (%).....10

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WASHINGTON ALLOY– COMMERCIAL PURE TITANIUM
AWS A5.16Classes ERTi-1,2,3 and 4/AMS 4951D

Washington Alloy Commercial Pure Titanium is a TIG, MIG and submerged arc filler metal used for welding commercial pure titanium alloys commonly found in applications requiring high temperature resistance and resistance to chemical reagents. Although there are four grades of Commercial Pure Titanium filler metals, C.P. Grade 2 (ERTi-2) is the most popular because of its good balance of strength, formability and weldability.

The most common application of Commercial Pure Titanium is the aircraft industry, where tensile strength and weight ratios are so critical. Other uses would include cryogenic and petrochemical applications such as chemical process heat exchangers, pressure vessels and piping systems, pulp bleaching systems, electro chemical and chemical storage tanks.

FILLER METAL CHEMISTRY (%)

	ERTi-1
C	0.030
O	0.100
H	0.005
N	0.015
Fe	0.100
Ti	Balance
	ERTi-2
C	0.030
O	0.100
H	0.008
N	0.020
Fe	0.200
Ti	Balance
	ERTi-3
C	0.030
O	0.10-0.15
H	0.008
N	0.020
Fe	0.200
Ti	Balance
	ERTi-4
C	0.030
O	0.15-0.25
H	0.008
N	0.020
Fe	0.300
Ti	Balance
	AMS4951D
C	0.080
O	0.180
H	0.005
N	0.050
Fe	0.200
Ti	Balance

*All single values of chemical compositions shown are maximum percentage.

MINIMUM MECHANICAL PROPERTIES

	ERTi-1	ERTi-2	ERTi-3
Tensile strength (psi)	35,000	50,000	65,000
Yield strength (0.2% offset) psi	25,000	40,000	55,000
Elongation (%)	24	20	18

	ERTi-4	AMS4951D
Tensile strength (psi)	80,000	50,000
Yield strength (0.2% offset) psi	70,000	25,000
Elongation (%)	15	35

CALL FOR QUOTE

Argon is the recommended shielding gas, however an argon-helium mixture will give greater penetration although at the expense of arc stability.

MANUAL GTA WELDING

Wire Diameter (in.)	Current (A)	Voltage (V)	Travel Speed in./min.	Deposition Rate lb./h
0.062 1/16	180	16	5 to 15	0.50 to 0.70
0.093 3/32	190	17	5 to 15	0.80 to 0.90
0.125 1/8	205	19	5 to 15	1.20 to 1.36

Courtesy: Penton Publishing Co.: Welding & Fabricating Data Book 1990/91.

TIPS FOR WELDING WITH TITANIUM Welding with titanium requires extreme cleanliness. Grind or file off mill scale. Clean surface oxides with a 35% nitric - 5% hydrofluoric acid solution at room temperature, then rinse with water and air dry. Grease or oils should be cleaned with a nonchlorinated degreasing solvent, acetone or methanol. Light oil can be washed away with a normal household detergent, then air-dried.

Titanium is a reactive metal and as such it is sensitive to embrittlement by oxygen, nitrogen and hydrogen, within the weld zone area, at temperatures above 500°F. Consequently the weld metal must be protected against atmospheric contamination that may be caused by these elements. This can be most easily attained by holding the shielding gas over the weld area until it cools to approximatel 600°F.