

# HAYNES<sup>®</sup> Ti-3Al-2.5V alloy

## Principal Features

### Lightweight, High Strength

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HAYNES<sup>®</sup> Ti-3Al-2.5V alloy (UNS R56320) is both lightweight and strong. It has a high strength-to-weight ratio which provides a major design advantage – saving weight. Ti-3Al-2.5V alloy is about 43 percent lighter than 21-6-9 stainless steel. Comparative typical weights per foot for 1 in (25.4 mm) x 0.035 in (0.89 mm) wall tubing are as follows:

21-6-9	0.36 lb (0.16 kg)
Ti-3Al-2.5V	0.21 lb (0.09 kg)

### Developed as Tubing Alloy

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In the initial examination of titanium alloys for specific aircraft/aerospace tasks, commercially pure titanium was alloyed with selected elements to improve the performance characteristics and to obtain higher strength levels. Specific alloying additives, notably aluminum, raise the temperature at which the alloy transforms completely to the beta phase. This point on the temperature scale is known as the beta transus temperature. The addition of vanadium, on the other hand, lowers the temperature of transformation of alpha to beta phases.

Titanium 6% aluminum 4% vanadium (Ti-6Al-4V) was chosen as an ideal aircraft/aerospace alloy because it had a good strength-to-weight ratio as annealed combined with resistance to cracking during forging, fair to good weldability, and was heat treatable to higher strengths.

But, because Ti-6Al-4V alloy did not have good cold forming characteristics, the titanium alloy with 3% aluminum and 2.5% vanadium (Ti-3Al-2.5V) was developed for tubing and foil applications. This alloy is intermediate in strength between commercially pure titanium and Ti-6Al-4V. It has properties 30 to 50 percent higher than pure titanium, but more importantly, has the excellent cold formability needed to make seamless tubing.

### Good Weldability

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HAYNES<sup>®</sup> Ti-3Al-2.5V alloy tubing is readily welded by the standard gas tungsten arc process with inert gas shielding and by the use of automatic welding tools with built-in gas purge chambers. Machine settings similar to those used for stainless steels are used when welding Ti-3Al-2.5V tubing.

### Applications

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Seamless tubing of HAYNES<sup>®</sup> Ti-3Al-2.5V alloy was developed for aircraft hydraulic and fuel systems. Its performance has been proven in high technology military aircraft and spacecraft as well as in commercial aircraft. Another application for HAYNES<sup>®</sup> Ti-3Al-2.5V alloy is tubing for bicycle frames. The high strength and light weight characteristics are ideal for this product.

### Strict Quality Controls

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The latest in quality control equipment is available at Haynes International, Inc. To provide maximum product integrity. Tubing lots are 100% visually, dimensionally and ultrasonically tested. Samples also are examined metallographically as well as tested for conformance to the chemical composition and mechanical property requirements of the applicable specification.

## **Heat-treatment**

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HAYNES® Ti-3Al-2.5V alloy seamless tubing is normally supplied in either the annealed or cold worked and stress received condition. Temperatures used generally range from 700°F to 1450°F (371°C to 790°C) depending on the degree of re-crystallization or stress relief that is required for a given end use.

Heat-treatment is done in vertical vacuum annealing furnaces. Vertical annealing has two advantages over horizontal annealing. Tubes hung vertically can be arranged so that each tube receives uniform furnace heat. Also, tubes annealed vertically tend to remain straight and round.

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