

## **Alloys of Titanium**

### **Alpha Titanium Alloys**

Commercially pure titanium and alpha alloys of titanium are non-heat treatable and are generally very weldable. They have:

- Low to medium strength
- Good notch toughness
- Reasonably good ductility
- Excellent mechanical properties at cryogenic temperatures

Pure titanium and alpha alloys possess the highest corrosion resistance.

More highly alloyed near-alpha alloys offer optimum high temperature creep strength and oxidation resistance.

### **Alpha + Beta Titanium Alloys**

These alloys have a characteristic two phase (alpha+beta) microstructure formed by the addition of up to 6.5% Aluminium and varying amounts of beta forming constituents like Vanadium, Chromium and Molybdenum.

Alpha Beta alloys are heat treatable and most are weldable. Typical properties include:

- Strength levels are medium to high
- High temperature creep strength is not as good as most alpha alloys
- Cold forming may be limited but hot forming qualities are normally good
- Many alloys can be superplastically formed

These alloys are formed by rolling/forging under controlled parameters to produce fine grained microstructure.

The most commonly used alpha beta alloy is Ti6Al4V, developed in many variations of the basic formulation for the widest possible choice of key properties and for many widely differing applications.

### **Beta Titanium Alloys**

The Ni-Ti alloys contain a large amount of beta phase in the microstructure, stabilized by alloying additions such as chromium, and they are formed under strictly controlled forging parameters.

Beta or near beta alloys are:

- Fully heat treatable
- Generally weldable
- Capable of high strengths
- Possess good creep resistance up to intermediate temperatures
- Excellent formability can be expected in the beta alloys in the solution treated condition

Beta-type alloys have good combinations of properties in sheet, as fasteners and are ideal for spring applications. Some alloys offer uniform property levels through heavy sections.

#### ALLOY COMPOSITION

ASTM Grades	Alloy Composition	UTS(Min) Mpa	Welding Filler Alloys/Requirements
1	Ti-0.15% O <sub>2</sub>	240	ERTi-1 Commercial Pure
2	Ti-0.20% O <sub>2</sub>	340	ERTi-2
4	Ti-0.35% O <sub>2</sub>	550	ERTi-4
5	Ti-6Al-4V	900	ERTi-5 Most Widely used alloy
7	Ti-0.20% O <sub>2</sub> -0.2%Pd	340	ERTi-7
9	Ti-3Al-2.5V	615	ERTi-9 Tubular Components
23	Ti-6Al-4V	900	ERTi-5ELI Low Interstitials
25	Ti-6Al-4V-0.06Pd	900	ERTi-25 Corrosion Resistant

CounterSteer would provide the following alloys:

Grade 1, Grade 2, Grade 5, Grade 9, Grade 23