



## Grade 23 Titanium (Ti6Al4V ELI Titanium Alloy)

Titanium Grade 23, also known as Titanium grade 5 ELI (Extra Low Interstitial), is a Titanium alloy (Ti6Al4V) used in the production of all Ditron Dental Implants and Abutments.

Ditron Dental has methodically chosen Titanium Grade 23 over Titanium grade 4 CP (Commercially Pure) for the following reasons:

### General characteristics

The high strength, low weight ratio and outstanding corrosion resistance inherent to Titanium and its alloys has led to a wide and diversified range of successful applications which demand high levels of reliable performance in surgery and medical devices. Titanium is available in several different grades. Pure Titanium is not as strong as the different Titanium alloys are. Ti6Al4V is the most widely used Titanium alloy. It features good machinability and excellent mechanical properties. Ti6Al4V also has numerous applications in the medical industry. The biocompatibility of Ti6Al4V is excellent, especially when direct contact with tissue or bone is required.

### Special characteristics

Ti6Al4V ELI (Grade 23) is very similar to Ti6Al4V (Grade 5), except that Ti6Al4V ELI contains reduced levels of oxygen, nitrogen, carbon and iron. ELI is short for "Extra Low Interstitials", and these lower interstitials provide improved ductility and better fracture toughness for the Ti6Al4V ELI material.

### Hardness

The 6% aluminum presence increases the hardness, reduces the specific weight and improves the modulus of elasticity "E". Furthermore, association of aluminum and vanadium reduces the thermal conductivity of about 50% and increases the wear resistance by the same percentage.

### Surface resistance

Titanium alloy Ti6Al4V ELI is an alpha-beta alloy containing both elements: alpha stabilizers (aluminum and oxygen) and beta stabilizers (vanadium).

### Fracture toughness & resistance to crack propagation

The Ti6Al4V ELI alloy (Titanium grade 23) used for all Ditron Dental implant lines (MPI, ULT, OPI, API), all require very high fracture toughness. Ti6Al4V ELI (Grade 23) Titanium alloy is treated with a particular process of reduction of interstitial elements (ELI process), which significantly improves the K values (values of effort to which the material can resist in presence of cracks).

### Fatigue resistance

The complex manner in which the microstructure and morphology combine together to vary the properties of the material, brings to a fatigue behavior that is generally evaluated experimentally on a case by case basis, depending on requirements. In general, it can be stated that all changes which result in an increase of the yield strength also induce an improvement in the fatigue resistance.

**Tenacity** - Grade 23 Titanium has a value of 830 MPa, compared to 550 MPa for Titanium grade 4.

**Yield strength** - Grade 23 Titanium has a value of 760 MPa, compared to 480 MPa for Titanium grade 4.