

# Unalloyed Commercially Pure (CP) Titanium

Unalloyed Commercially Pure (CP) Titanium is represented by four distinct grades, specifically 1, 2, 3 and 4. CP titanium is ordered in relation to the corrosion resistance, formability (ductility) and strength requirements of a specific application. CP titanium ranges from grade 1, which has the highest corrosion resistance, formability and lowest strength, to grade 4, which offers the highest strength and moderate formability. CP titanium end users utilize excellent corrosion resistance, formability and weldable characteristics for many critical applications.

Chemistry	ASTM F67			
	Grade 1	Grade 2	Grade 3	Grade 4
Nitrogen, max.	0.03	0.03	0.05	0.05
Carbon, max.	0.10	0.10	0.10	0.10
Hydrogen, max.	0.0125	0.0125	0.0125	0.0125
Iron, max.	0.20	0.30	0.30	0.50
Oxygen, max.	0.18	0.25	0.35	0.40
Titanium	Balance	Balance	Balance	Balance

FWM chemistry is for reference only, and is not to be used for specification purposes.

## Physical Properties

Density	0.163 lbs/in <sup>3</sup>
Modulus of Elasticity	14.9 psi x 10 <sup>6</sup>
Electrical Resistivity	0.42-0.52 μohms-m
Thermal Conductivity	16-22 W/mK

## Surface Conditions

CP titanium has a tendency to stick, fret or cold weld with drawing dies during processing. Common industry practice to avoid this condition usually employs heavy etching or pickling at finish size resulting in a coarse or very textured surface. Fort Wayne Metals has developed processing techniques with enhanced surface treatments that require minimal etching at finish size to remove most residual oxide, yielding a cleaner and smoother surface finish. Material can be purchased with this improved surface finish or with a retained water soluble lubricant for applications where lubricity on the wire is required (i.e. weaving applications).

## Diameter Tolerances

Enhanced surface treatments and processing techniques allow Fort Wayne Metals to offer tighter and more controlled tolerances. The chart in the right column details standard diameter tolerances for CP Titanium in wire and coil forms. Most diameters can be produced to tighter tolerances.

## Applications

Fort Wayne Metals manufactures CP titanium in straightened and cut bar, coil, strands and cables, flat wire and wire form to support a variety of critical medical and industrial based applications.

End uses include:

- Orthopaedic applications
- Needles
- Pacing leads
- Woven wire mesh
- Sutures
- Ligature clips
- Orthodontic appliances
- Eye glass frames

Grade	ASTM F67		
	U.T.S. min., ksi (MPa)	Y.S. min., (2% offset) ksi (MPa)	% Elongation (2" gage length) minimum
1	35 (240)	25 (170)	24
2	50 (345)	40 (275)	20
3	65 (450)	55 (380)	18
4	80 (550)	70 (483)	15

Values are typical and may not represent all diameters. Test method will affect results.

Approximate FWM Tensile Properties		
Grade	Condition	U.T.S. ksi (MPa)
1	Cold Worked	85-115 (586-793)
1	Annealed	45-75 (310-517)
2	Cold Worked	110-140 (758-965)
2	Annealed	65-90 (448-621)
4	Cold Worked	135-165 (931-1138)
4	Annealed	95-120 (655-827)

Values are typical and may not represent all diameters. Test method will affect results.

CP Titanium in centerless ground bar, coil, and wire can be offered in annealed or cold worked conditions.

Diameter in. (mm)		
Including	Under	Std. Tolerance +/-
0.0010 (0.0254)	0.0048 (0.1219)	0.0001 (0.0025)
0.0048 (0.1219)	0.0080 (0.2032)	0.0002 (0.0051)
0.0080 (0.2032)	0.0120 (0.3048)	0.0003 (0.0076)
0.0120 (0.3048)	0.0240 (0.6096)	0.0004 (0.0102)
0.0240 (0.6096)	0.0330 (0.8382)	0.0005 (0.0127)
0.0330 (0.8382)	0.0440 (1.1176)	0.0008 (0.0203)
0.0440 (1.1176)	0.2510 (6.3754)	0.0010 (0.0254)

**Product Capability**

**Wire**

Fort Wayne Metals utilizes state-of-the-art equipment and processing techniques to provide precision drawn CP Titanium. Wire is typically provided on standard FWM spools (see packaging and spooling data sheet). Custom packaging or spools will be considered based on our equipment capabilities.

Diameter Range

0.001" (0.0254mm) to 0.062" (1.5748mm)

**Coil**

Fort Wayne Metals provides precision loose wound coils for many critical applications, coil weights can reach a maximum of 100 pounds, nominal 50 pound weight depending on diameter.

Diameter Range

.040" (1.016mm) to .250" (6.35mm)

Packaging (coil I.D.)

0.040" (1.016mm) to 0.125" (3.175mm) = 20" (508mm) nominal

.100" (2.54mm) to 0.250"(6.35mm) = 28" (711mm) nominal

**Centerless and Precision Ground Bar**

Fort Wayne Metals provides straightened and cut bar product in centerless and precision ground conditions. Customers can order discrete lengths, however, material is typically manufactured in 10' (3048mm) to 12' (3657mm) random lengths. Most diameters can be produced to tighter tolerances.

Diameter Range

.0787" (2.0mm) to .250" (6.35mm)

	Standard Tolerance	Surface Roughness (RMS)
Centerless Ground Bar	+/- 0.001" (0.0254mm)	24 or better
Precision Ground Bar	+/- 0.0005" (0.0127mm)	16 or better

**Other Titanium & Titanium Alloys Available**

- CPTi Gr.1      · Ti 6Al-4V ELI
- CPTi Gr.2      · Ti 6Al-7Nb
- CPTi Gr.3      · Ti 3Al-2.5V
- CPTi Gr.4      · Ti 3Al-8V-6Cr-4Mo 4Zr (Ti Beta C)

Other titanium and titanium alloys will be considered upon request.