

Gold Plated Wire

Technical Information Bulletin

Powders That Shape Your World



Since 1950, Global Tungsten & Powders Corp. has been a leading manufacturer of molybdenum and tungsten wires, electroplated with gold. Plated wires are available in diameters between 0.025 and 0.635mm and feature a maximum of 25% plate by weight.

Plated wire from Global Tungsten & Powders Corp. is sold under the GTP brand for use in a range of applications including electronic tubes, semiconductor devices, linear accelerators, space antennae, and electrophotographic equipment. Plating enhances the properties and performance of the base metal by providing oxidation resistance and improved wettability for soldering.

Unit of Measure

While it is convenient to express wire size as a diameter in inches, mils, millimeters or micrometers, most applications for plated molybdenum and tungsten wires require a more precise method. Specifically, the size and tolerance specification and control of GTP plated wire is based on the weight of a given length expressed in milligrams per 200 millimeters or mg/200 mm. This unit of measure is commonly called the rate or the rating of the wire. Below are some conversion examples:

Plating

The nominal amount of plate is normally expressed as a percent of the rating of the base wire. Specifically, 200 mm lengths are weighed before and after plating and the percent plate is calculated as follows:

$$\% \text{ Plate} = \frac{(\text{mg}/200 \text{ mm of plated wire}) - (\text{mg}/200 \text{ mm of base wire})}{(\text{mg}/200 \text{ mm base wire})} \times 100$$

This result is often verified by chemical analysis and, sometimes, by x-ray diffraction.

When plating thickness is specified, the percent plate is calculated by substituting the proper values in the following formula:

$$\frac{400 \times \rho_{\text{Au}} \times T(D + T)}{\rho_{\text{Base}} D^2}$$

T = Plating thickness in mils

ρ_p = Density of plate material in g/cm³

ρ_b = Density of base wire in g/cm³

d_b = Diameter of base wire in mils

Common Plating Amounts:

Plate	Nominal Percentage Range	
	Molybdenum	Tungsten
Gold	1 - 25	1 - 25
Nominal amounts of plate below 1% are referred to as "flash."		

Plating tolerance is the allowable variation from the nominal percent plate. For example, molybdenum wire specified with a 4% gold plate and a plating tolerance of $\pm 1\%$ is supplied with 3–5% gold. Standard tolerances are:

Diameter Base Wire (Mils)	Standard Plating Tolerance
1-12	$\pm 1\%$
Plating thicknesses above 10% by weight may require wider tolerances.	

The primary inspection method for plating quality is microscopic examination of the surface at 30X magnification under bright light where defects such as lack of plate, loose plate, discoloration, and poor spooling are checked. High magnification inspection of plating quality by scanning electron microscope (SEM) is also available. Other methods are the knife-edge and the leather-thong adherence-tests where wire is either drawn over a 90° knife-edge of 0.010-inch radius or a leather thong. With controlled tension and speed, the wire is pulled at a 45° angle to the plane of the blade or the thong. The plating must not flake or "pipe."



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Typical Density

Material	Density, g/cm ³
Gold	19.3
Molybdenum	10.2
Tungsten	19.3

Spooling

All plated wire is spooled with controlled tension in a manner to give a uniform layer-type winding. There is no "soft spooling" from loose winding and no stretching or sticking from winding too tightly. This combination permits the wire to unreel readily from the top to the bottom of the spool. Each spool is checked for spooling quality and examined for evenness of winding. The wire is unreeled by hand to check for kinks, curls, and twists.

Tensile Properties

GTP plated wires are manufactured to controlled levels of tensile properties. Tensile testers are used to measure and to record ultimate tensile strength, yield strength, and elongation. Normally, strength values are expressed in grams per milligrams per 200 millimeters or g/mg/200 mm. For certain fine wires, a minimum breaking load in grams may be specified.

The tensile properties of plated molybdenum wire are controlled to the values specified in ASTM F290. Both Class II and Class III wire can be supplied.

The standard tensile properties of plated tungsten wire are:

Diameter (Mils)	Tensile Strength g / mg / 200 mm
1-25	65 - 95 - 130

Shipping:

GTP tungsten wire is supplied on returnable spools or as a self-coil depending on the size. This table lists our standard spools:

Container Number	Description	Bore Diameter Inches (mm)	Barrel Diameter Inches (mm)	Traverse Inches (mm)	Container Weight, grams	Container Ca- pacity, grams
1	Hi-Impact Plastic	3/8 (9.5)	1 5/8 (41)	1 (25)	81	360
2	Plastic Spool	3/8 (9.5)	1 5/8 (41)	1 (25)	34	300
9	Plastic Spool	5/8 (16)	3 (76)	3 (76)	78	1336
29	Aluminum Bobbin	7/16 (11)	19/32 (15)	27/64 (11)	4	11
30	Plastic Bobbin	1 9/16 (40)	1 7/8 (48)	5/8 (16)	17	88
40	Plastic Spool	5/8 (16)	4 (102)	3 (76)	236	3800
47	Plastic Band	3 3/4 (95)	4 1/4 (108)	3/4 (21)	58	450
48	Plastic Band	3 7/8 (98)	4 1/4 (108)	1 (25)	93	1000

How to Order:

1. Specify tungsten or molybdenum
2. Final diameter
3. Tensile range
4. Plate thickness / % Plate

Example 1: Molybdenum wire, 2-mil diameter (4.11 mg/200 mm \pm 3%); ASTM F290 Class III properties; 4% gold-plated, No. 47 band, 500–5,000 meters per container.

Example 2: Tungsten wire, 3 \pm 0.12-mil diameter (17.49 mg/200 mm \pm 10%); 8.5–10.5% gold-plated, tensile strength 303,000–620,000 lbs/sq. in. (55–113 g/mg/200 mm); No. 48 container.

