Copper alloy rod and wire for precision-machined pins, receptacles & solder terminals (RoHS-2 directive 2011/65/EU, exemption 6c) allows up to 4% lead as an alloy agent in copper. All Mill-Max pin materials are:

**BRASS ALLOYS:** 360 per ASTM B 16, and 385 per ASTM B455

**PHOSPHOR BRONZE** Alloy 544 (UNS C54400) per ASTM B 139

**TELLURIUM COPPER** Alloy 145 (UNS C14500) per ASTM B 301

Spring alloy strip for stamping “multi-finger” spring contacts

**BERYLLIUM COPPER** Alloy 172 (UNS C17200) per ASTM B 194

**BERYLLIUM NICKEL** Alloy 360 (UNS N03360)

**Properties of BRASS Alloy 360 ASTM B 16:**
- Chemical composition: Cu 63% (max), Pb 3.7% (max), Fe .35% (max), Zn remainder
- Temper as machined: H02/H04
- Yield Strength: 25-45 ksi
- Tensile strength: 57-80 ksi
- Hardness as machined: 80-90 Rockwell B
- After machining, brass parts are often annealed (softened) for subsequent bending, swaging or crimping. A partial anneal down to 60±10 RB is recommended for 90° bends, a full anneal down to 35±15 RB is recommended for pins or terminals that are swaged (riveted) to a circuit board or crimped to a wire.
- Electrical conductivity: 26% IACS *
- Melting point: 1000°C/840°C (liquidus/solidus)

**Properties of BRASS Alloy 385 ASTM B 455:**
- Chemical composition: Cu 60% (max), Pb 3.5% (max), Fe .35% (max), Zn remainder
- Temper as machined: H02/H04
- Yield Strength: 16 ksi (min)
- Tensile strength: 48 ksi (min)
- Hardness as machined: 80-90 Rockwell B
- After machining, brass parts are often annealed (softened) for subsequent bending, swaging or crimping. A partial anneal down to 60±10 RB is recommended for 90° bends, a full anneal down to 35±15 RB is recommended for pins or terminals that are swaged (riveted) to a circuit board or crimped to a wire.
- Electrical conductivity: 28% IACS *
- Melting point: 1000°C/840°C (liquidus/solidus)

**Properties of PHOSPHOR BRONZE:**
- Used for pins requiring more durability than brass.
- Stock diameters available: .072/.078"*
- Chemical composition: Cu 88%, Sn 4%, Zn 4%, Pb 4%
- Temper as machined: H04
- Modulus of elasticity: 15 MPSI
- Tensile strength: 70-80 KSI
- Hardness as machined: 83 Rockwell B
- Density: .321 lbs/in3
- Electrical conductivity: 19% IACS *
- Melting point: 1000°C/930°C (liquidus/solidus)

**Properties of TELLURIUM COPPER:**
- Used for pins requiring a higher current carrying capacity than brass or phosphor bronze.
- Stock diameters available: .079/.093/.125/.156"
- Chemical composition: Cu 99.44%, Te .55%, P .008%
- Temper as machined: H02
- Modulus of elasticity: 17 MPSI
- Tensile strength: 43 KSI
- Hardness as machined: 43 Rockwell B
- Density: .323 lbs/in3
- Electrical conductivity: 93% IACS *
- Thermal conductivity: 91% IACS *
- Melting point: 1075ºC/1051ºC (liquidus/solidus)

**Properties of BERYLLIUM COPPER:**
- Chemical composition: Cu 98.1%, Be 1.9%
- Temper as stamped: TD01
- Properties after heat treatment (TH01):
  - Modulus of Elasticity: 19 MPSI
  - Tensile Strength: 175-205 KSI
  - Yield Strength (0.2% offset): 150-185 KSI
  - Elongation: 3-10%
  - Stress Relaxation: 96% of stress remains after 1,000 hours @ 100 ºC
  - 70% of stress remains after 1,000 hours @ 200 ºC
- Hardness: 36-43 Rockwell C
- Density: .298 lbs/in3
- Electrical Conductivity: 22% IACS *
- Melting point: 980°C/865°C (liquidus/solidus)

Since BeCu loses its spring properties over time at high temperatures, it is rated for continuous use up to 150ºC. For “down-hole” and “burn-in” applications up to 300ºC. Mill-Max offers nine contacts (#19, #24, #25, #26, #27, #33, #38, #56, #58) made from Beryllium Nickel Alloy 360 (UNS N03360)

**Properties of BERYLLIUM NICKEL:**
- Chemical composition: Ni 97.6%, Be 1.9%, Ti 0.5%
- Modulus of Elasticity: 27-30 MPSI
- Tensile Strength: 245 KSI min.
- Yield Strength (0.2% offset): 200 KSI min.
- Elongation: 9% min.
- Hardness: 49 Rockwell C
- Density: .294 lbs/in3
- Electrical Conductivity: 7% IACS *
- Melting point: 1,325°C/1,195°C (liquidus/solidus)

* International Annealed Copper Standard, i.e.: as a % of pure copper.
PROPERTIES OF PLASTICS USED BY MILL-MAX

Standard plastics used for catalog products:
Injection Molded
PCT Polyester, High Temp (Thermx CG933, black)
Nylon46, High Temp (Stanyl TE250F6 (30% glass) or TE250F9 (45% glass), black)
PPS, High Temp (Ryton R-4-200)
Machined
G-30 Polyimide/Glass Laminate, .062” thick (natural color, brown)

TEMPERATURE COMPARISON OF MOLED INSULATORS

<table>
<thead>
<tr>
<th>MATERIAL</th>
<th>BRAND</th>
<th>GRADE</th>
<th>HEAT DEFLECTION TEMP. (per ASTM D 648)</th>
</tr>
</thead>
<tbody>
<tr>
<td>PCT Polyester</td>
<td>Thermx</td>
<td>CG-933</td>
<td>529°F (276°C) @ 66 psi</td>
</tr>
<tr>
<td>Nylon 4</td>
<td>Stanyl</td>
<td>TE250-F6 or F9</td>
<td>554°F (290°C) @ 264 psi</td>
</tr>
<tr>
<td>PPS</td>
<td>Ryton</td>
<td>R-4-200</td>
<td>&gt;500°F (&gt;260°C) @ 264 psi</td>
</tr>
</tbody>
</table>

Note: Materials with HDT above 446°F (230°C) are considered suitable for “eutectic” reflow soldering. For “lead-free” reflow soldering, choose materials with an HDT above 500°F (260°C).

PCT is the standard plastic used with RoHS “lead-free” plated pins.

MILL-MAX STANDARD PLATINGS (FINISHES):

GOLD per ASTM B 488, Type 1 (99.7% min. gold),
Code C (130-200 HK (Knoop hardness)),
Class (thickness) per customer’s requirements
SILVER per ASTM B 700, Type 1 (99.9% min. silver),
Grade B (Bright),
Class S (anti-tarnish treatment),
Thickness (7.5μm/300μ”) used for solder terminals
TIN/LEAD (93/7) per ASTM B 545 (Appendix X6.3.2.5 to eliminate whisker growth)
Class A (2.5μm/100μ”),
or Class B (5μm/200μ”),
Bright finish (Matte available to order)
ELECTRO-SOLDER (60/40) per ASTM B 579, SC2 (8μm/300μ”),
Bright finish (Matte available to order)

Standard finishes available for RoHS “lead-free” applications:
GOLD per ASTM B 488, Type 1 (99.7% min. gold),
Code C (130-200 HK (Knoop hardness)),
Class (thickness) per customer’s requirements
TIN (100%) per ASTM B 545, Class A (2.5μm/100μ”) or
Class B (5μm/200μ”),
Matte finish (With whisker and oxide inhibitors & a nickel underplate)

ALL MILL-MAX PARTS REQUIRE AN UNDERPLATE:
Brass parts need a barrier plate to prevent zinc diffusion, 50μ” min. nickel or 100μ” min. copper is recommended by ASTM B 545 and 579. ASTM B 488 also recommends a 50μ” min. nickel barrier plate beneath gold to prevent copper diffusion inherent with all copper alloy products.

MILL-MAX STANDARD UNDERPLATES:
NICKEL per ASTM B 689, Type 2 (Bright),
Class 1 (1.25μm/50μ”) or Class 2 (5μm/100μ”)
Also available for military and “non-magnetic” applications:
COPPER per ASTM B 734, Class 2 (2.5μm/100μ”) or
Class 5 (5μm/200μ”)