

| | | | | | | |
|--------------------|--------------|---------------|------------------|----------------------|-----------|---------------------|
| Designation | Cu-OF | DIN CW008A | EN Nr. 2.0040 | UNS (ASTM) C10200 | AISI - | LMSA B110 |
|--------------------|--------------|---------------|------------------|----------------------|-----------|---------------------|

Chemical composition

| Cu | Bi | Pb | Others |
|------------|-------------|------------|-----------|
| 99.95 min. | 0.0005 max. | 0.005 max. | 0.03 max. |

Values (Weight %). In order to achieve maximum homogeneity and consistent quality, the actual manufacturing tolerances are tighter and more precisely than the composition indicated.

Main technical properties and features

Cu-OF (Oxygen Free) is a high purity, oxygen free, non-phosphorus deoxidized copper. This pure copper has a guaranteed minimal amount of 99.95 % of copper and a minimal electrical conductivity of 100 % IACS (International Annealed Copper Standard). Cu-OF is produced from a high-purity copper cathode Cu-CATH-1 (CR001A). The high-purity of Cu-OF is maintained during all the fabrication process without any addition of deoxidizing elements, like phosphorus, for example. This high-purity ensures a very high electrical and thermal conductivity. With its very low amount of impurity, it is suited to the high requirements of the electronic industry, superconducting at low temperature and vacuum applications. Due to its higher purity (it is free of elements that can evaporate in vacuum), Cu-OF is more suitable for the vacuum application than Cu-OF. Cu-OF fully complies with the specifications of Cu-OF, the acceptable level of impurities of Cu-OF is just slightly higher. Cu-OF contains no oxygen and is insensitive to hydrogen embrittlement. In contact with hydrogen, the containing oxygen coppers, such as Cu-ETP, can suffer serious damage inside the material, related to the reduction of copper oxides by hydrogen. Cu-OF is insensitive to this phenomenon and can be heat treated in reducing atmospheres. Cu-OF is an easily weldable inert gas; laser welding is more difficult. Its galvanizability is good. Cu-OF can also easily be dip tinned; it is easily solderable. It has excellent hot and cold forming properties and a good corrosion resistance, especially in an industrial atmosphere, pure water vapor, non-oxidizing acids and neutral saline solutions due to a good adherence of the oxide layer. However, Cu-OF is non-resistant to oxidizing acids, hydrous ammonia, hydrogen sulfide and seawater.

Typical uses

Due to its excellent electrical and thermal conductivity, Cu-OF is frequently used in the electronic and superconducting industries: lead frame for semiconductors, heat sinks, coaxial cables, underwater fiber optic cables, waveguides, hollow conductors, vacuum seals, anodes, microwaves tubes, etc.

Typical manufacturing range

| | Thickness (mm) | Width (mm) | Length (mm) |
|--|----------------|--------------|-------------|
| Rolled products Strip in coils ^[1] | 0.010 - 2.000 | 1.5 - 200.0 | - |
| Strip as sheets ^[1] | 0.010 - 1.500 | 10.0 - 200.0 | 100 - 3000 |

^[1] Not all our production possibilities are presented here. Other dimensions or product forms available upon request. Some combinations of thicknesses and widths are not possible.

Mechanical properties of strips

| Temper | R _{p0.2} (N/mm ²) | R _m (N/mm ²) | A _{50mm} (%) | Hardness HV |
|-----------|---|--|--------------------------|----------------|
| R200 H45 | 140 max. | 200 - 260 | 33 min. | 45 - 65 |
| R240 H65 | 180 min. | 240 - 300 | 8 min. | 65 - 95 |
| R240 H90 | 250 min. | 290 - 360 | 4 min. | 90 - 110 |
| R360 H110 | 320 min. | 360 min. | - | 110 min. |

Physical properties

| | | |
|-------------------------------|-----------------------|----------------------|
| Modulus of elasticity | kN/mm ² | 127 |
| Poisson ratio | | 0.34 |
| Density | g/cm ³ | 8.94 |
| Melting point / Melting range | °C | 1084 |
| Linear dilatation coefficient | 10 ⁻⁶ ./°C | 17.7 from 0 to 300°C |
| Thermal conductivity at 20°C | W/m °K | 394 |
| Electrical resistivity | μΩcm | 1.7 |
| Electrical conductivity | MS/m | 58 |
| Electrical conductivity | % IACS | 100 |
| Specific heat at 20°C | J/(kg. K) | 385 |
| Magnetic properties | | Non magnetic |

Tolerances (strip and foil)

| Thickness | Thickness (mm) | | EN Standard | | Lamineries MATTHEY | | |
|---|---|---------|--------------------|-----------------|--------------------|----------------|--------------|
| | ≥ | < | 10140 Precision | 10258 Precision | LMSA Standard | LMSA Precision | LMSA Extreme |
| <p>The table shown is an outline of our typical thickness tolerances available. They are tighter than industry standards.</p> <p>Our "LMSA Precision" and "LMSA Extreme" tolerances are available upon request.</p> | - | 0.025 | - | - | - | - | ± 0.001 |
| | 0.025 | 0.050 | - | - | ± 0.003 | ± 0.002 | ± 0.0015 |
| | 0.050 | 0.065 | - | ± 0.003 | ± 0.003 | ± 0.0025 | ± 0.002 |
| | 0.065 | 0.100 | - | ± 0.004 | ± 0.004 | ± 0.0035 | ± 0.003 |
| | 0.100 | 0.125 | ± 0.005 | ± 0.006 | ± 0.005 | ± 0.004 | ± 0.003 |
| | 0.125 | 0.150 | ± 0.005 | ± 0.006 | ± 0.005 | ± 0.005 | ± 0.004 |
| | 0.150 | 0.250 | ± 0.010 | ± 0.008 | ± 0.008 | ± 0.006 | ± 0.004 |
| | 0.250 | 0.300 | ± 0.010 | ± 0.009 | ± 0.009 | ± 0.007 | ± 0.005 |
| | 0.300 | 0.400 | ± 0.010 | ± 0.010 | ± 0.010 | ± 0.007 | ± 0.005 |
| | 0.400 | 0.500 | ± 0.015 | ± 0.012 | ± 0.012 | ± 0.008 | ± 0.006 |
| | 0.500 | 0.600 | ± 0.015 | ± 0.014 | ± 0.014 | ± 0.010 | ± 0.007 |
| | 0.600 | 0.800 | ± 0.015 | ± 0.015 | ± 0.015 | ± 0.010 | ± 0.007 |
| | 0.800 | 1.000 | ± 0.015 | ± 0.018 | ± 0.018 | ± 0.012 | ± 0.009 |
| | 1.000 | 1.200 | ± 0.020 | ± 0.020 | ± 0.020 | ± 0.015 | ± 0.012 |
| | 1.200 | 1.250 | ± 0.020 | ± 0.020 | ± 0.020 | ± 0.015 | ± 0.012 |
| 1.250 | 1.500 | ± 0.020 | ± 0.020 | ± 0.020 | ± 0.015 | ± 0.014 | |
| Width | Our width tolerances "Standard" is +0.2, -0.0 (or ± 0.1 mm upon request). They are available for slit widths < 125 mm and thicknesses < 1.00 mm. Special tolerances upon request. | | | | | | |
| Camber | Width (mm) | | Camber max. (mm/m) | | | | |
| <p>Our tolerance "LMSA Standard" respects the EN Standard 1654 (Length of measurement 1000 mm). Other tolerances upon request.</p> | | | LMSA Standard | | LMSA Extreme | | |
| | > | ≤ | ≤ 0.5 mm | > 0.5 mm | ≤ 0.5 mm | > 0.5 mm | |
| | 3 | 6 | 12 | - | 6 | - | |
| | 6 | 10 | 8 | 10 | 4 | 5 | |
| | 10 | 20 | 4 | 6 | 2 | 3 | |
| 20 | 250 | 2 | 3 | 1 | 1.5 | | |
| Surface | Special surface qualities upon request | | | | | | |
| Flatness | Special requirement on the longitudinal or transversal flatness upon request | | | | | | |

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