

COPPER No. C10100 (OXYGEN FREE ELECTRONIC)

Composition — percent

	Nominal	Minimum	Maximum
Copper (incl Silver)	99.99	.....
Residual Deoxidants	None	.....
Phosphorus0003
Tellurium0010
Other Named Elements

* The total of the seven following elements, Se, Te, Bi, As, Sb, Sn and Mn not to exceed 40 ppm, (.0040%); Hg, max., 1 ppm, (.0001%); Zn, max., 1 ppm, (.0001%); Cd, max., 1 ppm, (.0001%); S, max., 18 ppm, (.0018%); Pb, max., 10 ppm, (.0010%); Se, max., 10 ppm (.0010%); Bi, max., 10 ppm (.0010%); Oxygen max., 10 ppm, (.0010%).

Nearest Applicable A S T M Specifications

Flat Products	B48, B133, B152, B187 B272, B432, B451, F68
Pipe	B42, B188, F68
Rod	B49, B133 B187, F68
Shapes	B133, B187, F68
Tube	B68, B75, B188, B280 B372, B447, B641, F68
Wire	B1, B2, B3, B33, B48 B189, B246, B272 B298, B355, F68

Physical Properties

	English Units	C. G. S. Units
Melting Point (Liquidus)	1981 F	1083 C
Melting Point (Solidus)	1981 F	1083 C
Density	.323 lb/cu in @ 68 F	8.94 gm/cu cm @ 20 C.
Specific Gravity	8.94	8.94
Coefficient of Thermal Expansion	.0000094 per °F from 68 F to 212 F	.0000170 per °C from 20 C to 100 C
Coefficient of Thermal Expansion	.0000096 per °F from 68 F to 392 F	.0000173 per °C from 20 C to 200 C
Coefficient of Thermal Expansion	.0000098 per °F from 68 F to 572 F	.0000177 per °C from 20 C to 300 C
Thermal Conductivity	226 Btu /sq ft /hr /°F @ 68 F	.934 cal /sq cm /cm /sec /°C @ 20 C
Electrical Resistivity (Annealed)	10.3 Ohms (circ mil /ft) @ 68 F	1.71 Microhm-cm @ 20 C
Electrical Conductivity* (Annealed)	101 % IACS @ 68 F	.586 Megmho-cm @ 20 C
Thermal Capacity (Specific Heat)	.092 Btu /lb °F @ 68 F	.092 cal /gm °C @ 20 C
Modulus of Elasticity (Tension)	17,000 ksi	12,000 Kg /sq mm
Modulus of Rigidity	6,400 ksi	4,500 Kg /sq mm

*Volume and weight basis, minimum value

Typical Uses

ELECTRICAL AND ELECTRONIC: bus bars, bus conductors and other conductors, wave guides, hollow conductors, lead-in wires and anodes for vacuum tubes, vacuum seals, transistor components, glass to metal seals, coaxial cables and coaxial tubes, klystrons, micro-wave tubes, automotive rectifiers

Common Fabrication Processes

Blanking, coining, coppersmithing, drawing, etching, forming and bending, heading and upsetting, hot forging and pressing, piercing and punching, roll threading and knurling, shearing, spinning, squeezing and swaging, stamping

Fabrication Properties

Capacity for Being Cold Worked Excellent
 Capacity for Being Hot Formed Excellent
 Hot Forgeability Rating (Forging Brass = 100)65
 Hot Working Temperature 1400-1600 F or 750-875 C
 Annealing Temperature 700-1200 F or 375-650 C
 Machinability Rating (Free Cutting Brass = 100)20

Suitability for being joined by:
 Soldering Excellent
 Brazing Excellent
 Oxyacetylene Welding Fair
 Gas Shielded Arc Welding Good
 Coated Metal Arc Welding Not Recommended
 Resistance Welding { Spot Not Recommended
 Seam Not Recommended
 Butt Good

Forms and Tempers Most Commonly Used

	Annealed Tempers						Rolled or Drawn Tempers						Hot Finished Tempers										
	Nominal Grain Size mm																						
	.100 (OS100)	.070 (OS070)	.050 (OS050)	.036 (OS036)	.028 (OS028)	.015 (OS015)	Soft Anneal (OS60)	Light Anneal (OS60)	Eighth Hard (H00)	Quarter Hard (H01)	Half Hard (H02)	Three Quarter Hard (H03)	Hard (H04)	Extra Hard (H06)	Spring (H08)	Extra Spring (H10)	Drawn - General Purpose (H55)	Hard Drawn (H80)	Light Drawn - Bending (H55)	As Hot Rolled (M20)	As Extruded (M30)	Special Tempers	
FLAT PRODUCTS
Strip, Rolled
Strip, Drawn
Flat Wire, Rolled
Flat Wire, Drawn
Bar, Rolled
Bar, Drawn
Sheet
Plate
ROD
WIRE
TUBE
PIPE
SHAPES

DRAWN-GENERAL PURPOSE (H55) temper is used for general purpose tube only, usually where there is no real requirement for high strength or hardness on the one hand or for bending qualities on the other.

HARD DRAWN (H80) temper is used only where there is need for a tube as hard or as strong as is commercially feasible for the size in question.

LIGHT DRAWN-BENDING (H55) temper is used only where a tube of some stiffness, but yet capable of readily being bent (or otherwise moderately cold worked) is needed.

Mechanical Properties

Form	Size Section In.	Temper	Tensile Strength			Elongation in 2 in. %	Yield Strength			Rockwell Hardness	Shear Strength	Fatigue Strength	
			Tensile Strength (ksi)	(.5% Ext. under Load)	(.2% Offset)		0.2% Yield Strength (ksi)	0.1% Yield Strength (ksi)	ksi			ksi	Million Cycles
FLAT PRODUCTS	.040 in.	.050 mm	32.0	10.0	45	40	-	-	22.0
		.025 mm	34.0	11.0	45	45	-	-	23.0
		Eighth Hard	36.0	78.0	30	60	10	25	25.0
		Quarter Hard	38.0	30.0	25	70	25	36	25.0
		Half Hard	42.0	36.0	14	84	40	50	26.0	13.0	100
		Hard	50.0	45.0	6	90	50	57	28.0	13.0	100
	.250 in.	Spring	55.0	50.0	4	94	60	63	29.0	14.0	100
		Extra Spring	57.0	53.0	4	95	62	64	29.0
		As Hot Rolled	34.0	10.0	45	45	-	-	23.0
		.050 mm	32.0	10.0	40	40	-	-	22.0
		Eighth Hard	36.0	28.0	40	60	10	25	25.0
		Quarter Hard	38.0	30.0	35	70	25	25	25.0
1.0 in.	Hard	50.0	45.0	.....	12	90	50	28.0	.....	.....	.....	.....
	As Hot Rolled	32.0	10.0	.....	50	40	-	-	22.0	.....	.....	.....
	Hard	45.0	40.0	.....	20	85	45	26.0	.....	.....	.....	.....
ROD	1.0 in.	.050 mm	32.0	10.0	55	40	-	-	22.0
		Hard (40%)	55.0	50.0	.....	10	94	60	29.0	.....	.....	.....
	2.0 in.	Hard (35%)	48.0	44.0	.....	16	87	47	27.0	.....	.....	.....
		Hard (15%)	45.0	40.0	.....	20	85	45	26.0	.....	.....	.....
		As Hot Rolled	32.0	10.0	55	40	-	-	22.0
WIRE	.080 in.	.050 mm	35.0	.....	.....	35*	-	-	24.0	.....	.....	.....
		Hard	55.0	.....	.....	1.5**	-	-	29.0	.....	.....	.....
		Hard	66.0	.....	.....	1.5**	-	-	33.0	.....	.....	.....
		Spring	66.0	.....	.....	.....	.....	.....	.....	.....	.....	.....
TUBE	1.0 in. OD	.050 mm	32.0	10.0	.....	45	40	-	-	22.0	.....	.....
		.025 mm	34.0	11.0	.....	45	45	-	-	23.0	.....	.....
		Light Drawn (15%)	40.0	32.0	.....	25	77	35	45	26.0	.....	.....
		Hard Drawn (40%)	55.0	50.0	.....	8	95	60	63	29.0	.....	.....
SHAPES	.500 in.	.050 mm	32.0	10.0	.....	50	40	-	-	22.0	.....	.....
		Hard (15%)	40.0	32.0	.....	30	-	35	-	26.0	.....	.....
		As Hot Rolled	32.0	10.0	.....	50	40	-	-	22.0	.....	.....
		As Extruded	32.0	10.0	.....	50	40	-	-	22.0	.....	.....

* Elongation in 10 inches.

** Elongation in 60 inches.

The values listed above represent reasonable approximations suitable for general engineering use. Due to commercial variations in composition and to manufacturing limitations, they should not be used for specification purposes. See applicable A.S.T.M. specification references.