

# COPPER No. C10200 (OXYGEN FREE)

**Composition — percent**

	Nominal	Minimum	Maximum
Copper (incl. Silver)	.....	99.95	.....
Residual Deoxidants	.....	None	.....

**Nearest Applicable A S T M Specifications**

Flat Products	B48, B133, B152, B187, B272, B370, B432, B451, B506
Pipe	B42, B188
Rod	B49, B124, B133, B187
Shapes	B133, B187
Tube	B68, B75, B88, B111, B188, B280, B359, B372, B395, B447, B640, B641
Wire	B1, B2, B3, B33, B47, B48, B49, B116, B189, B246, B286, B298, B355, B566, F9
Nipples	B687

**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/ft/°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

**Typical Uses**

**ELECTRICAL:** bus bars and bus conductors, and other electrical conductors, wave guides, copper to glass seals in electronic appliances

**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**

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)	.035 (OS035)	.025 (OS025)	.015 (OS015)	Soft Anneal (O60)	Light Anneal (O50)	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 (H88)	Hard Drawn (H80)	Light Drawn — Bending (H65)	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 (H58) 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 (H65) 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 ksi	Yield Strength		Elongation in 2 in. %	Rockwell Hardness F   B   30T	Shear Strength ksi	Fatigue Strength		
				(.5% Ext. under Load) ksi	(.2% Offset) 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	11.0	100	
		Eighth Hard	36.0	28.0	.....	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.	.050 mm	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	.....	.....
			Hard	32.0	10.0	.....	50	40 - -	22.0	.....	.....
			Quarter Hard	36.0	28.0	.....	40	60 10 -	25.0	.....	.....
			Hard	38.0	30.0	.....	35	70 25 -	25.0	.....	.....
1.0 in.	.050 mm	Hard	50.0	45.0	.....	12	90 50 -	28.0	.....	.....	
		As Hot Rolled	32.0	10.0	.....	50	40 - -	22.0	.....	.....	
ROD	1.0 in.	Hard	45.0	40.0	.....	20	85 45 -	26.0	.....	.....	
		.050 mm	32.0	10.0	.....	55	40 - -	22.0	.....	.....	
		Hard (40%)	55.0	50.0	.....	10	94 60 -	29.0	.....	.....	
		Hard (35%)	48.0	44.0	.....	16	87 47 -	27.0	17.0	100	
WIRE	.080 in.	Hard (16%)	45.0	40.0	.....	20	85 45 -	26.0	.....	.....	
		As Hot Rolled	32.0	10.0	.....	55	40 - -	22.0	.....	.....	
		.050 mm	35.0	.....	.....	35*	- - -	24.0	.....	.....	
		Hard	55.0	.....	.....	1.5**	- - -	29.0	.....	.....	
TUBE	1.0 in. OD X .065 in.	Spring	66.0	.....	.....	1.5**	- - -	33.0	.....	.....	
		.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	.....	.....	
SHAPES	.500 in.	Hard Drawn (40%)	55.0	50.0	.....	8	95 60 63	29.0	.....	.....	
		.050 mm	32.0	10.0	.....	50	40 - -	22.0	.....	.....	
		Hard (15%)	40.0	32.0	.....	30	40 - 35	26.0	.....	.....	
		As Hot Rolled	32.0	10.0	.....	50	40 - -	22.0	.....	.....	
As Extruded	32.0	10.0	.....	50	40 - -	22.0	.....	.....			

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.