

**Wrought and Unwrought Coppers—Compositions, Properties and Uses**

Description	EN Number (Wrought)	EN Number (Unwrought)	EN Symbol	Nearest Old BS Equiv. (Wrought)	Nearest Old BS Equiv. (Unwrought)	Copper %	Range/Max. of 19 Elements (see Exclusions #)	Max. Mass Resistivity ( $\Omega$ g/m <sup>2</sup> ) at 20°C (Annealed)	Nominal Min. Conductivity (% IACS) at 20°C (Annealed)	0.2% Proof Strength (N/mm <sup>2</sup> )	Tensile Strength (N/mm <sup>2</sup> )	Elongation (%)	Hardness (HV)	Characteristics and Uses
Copper Cathode	-	CR001A	Cu-CATH-1	-	Cu-CATH-1	Rem.	0.0065	0.15176	101	-	-	-	-	Flat products for re-melting made by electrolytic deposition.
Copper Cathode	-	CR002A	Cu-CATH-2	-	Cu-CATH-2	99.90 min.*	0.03 excl. Ag	0.15328	100	-	-	-	-	Flat products for re-melting made by electrolytic deposition.
Coppers ex Cu-CATH-1	CW003A	CR003A	Cu-ETP1	C100	Cu-ETP1	Rem.	0.0065 excl. O, 0.04 O	0.15176	101	50-340	200-400	50-5	40-120	For re-draw to wire; suitable for high speed annealing and enameling.
Coppers ex Cu-CATH-1	CW007A	CR007A	Cu-OF1	C103	Cu-OF	Rem.	0.0065 excl. O	0.15176	101	50-340	200-400	50-5	40-120	Oxygen-free version of ETP1 for use in reducing atmospheres.
Coppers ex Cu-CATH-1	CW009A	CR009A	Cu-OFE	C110	Cu-OFE	99.99 min	15 elements listed individually	0.15176	101	50-340	200-400	50-5	40-120	High purity, does not contain elements that can vaporize in a vacuum. Resists hydrogen (steam) embrittlement. Easily soldered and brazed. Used in critical electrical, electronic and communication components.
Coppers ex Cu-CATH-1	CW022A	CR022A	Cu-PHCE	-	-	99.99 min	0.001-0.006 P plus 14 elements listed individually	0.15328	100	50-340	200-400	50-5	40-120	Phosphorus deoxidised. Resists hydrogen (steam) embrittlement. Easier to braze than Cu-ETP1. Used for busbars and cables.
Other Unalloyed Coppers	CW004A	CR004A	Cu-ETP	C101	Cu-ETP-2	99.90 min.*	0.03 excl. Ag, O	0.15328	100	50-340	200-400	50-5	40-120	Most common copper, universal for electrical applications. Subject to hydrogen (steam) embrittlement in reducing atmospheres.
Other Unalloyed Coppers	CW005A	CR005A	Cu-FRHC	C102	Cu-FRHC	99.90 min.*	0.06 excl. Ag, O	0.15328	100	-	-	-	-	Copper that has been refined by melting in a furnace, no electrolysis. Uses include building and automotive wire and power cable.
Other Unalloyed Coppers	CW008A	CR008A	Cu-OF	C103	Cu-OF	99.95 min.*	0.03 excl. Ag	0.15328	100	50-340	200-400	50-5	40-120	Oxygen-free version of Cu-ETP for use in reducing atmospheres.
Other Unalloyed Coppers	CW006A	CR006A	Cu-FRTP	C104	Cu-FRTP	99.90 min.*	0.05 excl. Ag, Ni, O	-	-	50-340	200-400	50-5	40-120	General engineering and building applications, not for use in reducing atmospheres.
Phosphorus-containing Coppers	CW020A	CR020A	Cu-PHC	-	-	99.95 min.*	0.03 excl. Ag & P (0.001-0.006 P)	0.15328	100	50-340	200-400	50-5	40-120	Small amount of phosphorus deoxidizer, electrical and thermal conductivity still high. Excellent soldering and brazing. Resists hydrogen (steam) embrittlement. Electrical, electronic applications including tubular busbars.
Phosphorus-containing Coppers	CW021A	CR021A	Cu-HCP	-	-	99.95 min.*	0.03 excl. Ag & P (0.002-0.007 P)	0.15596	98.3	50-340	200-400	50-5	40-120	Small amount of phosphorus deoxidizer, electrical and thermal conductivity still high. Excellent soldering and brazing. Resists hydrogen (steam) embrittlement. Electrical, electronic applications including tubular busbars.
Phosphorus-containing Coppers	CW023A	CR023A	Cu-DLP	-	-	99.90 min.*	0.03 excl. Ag, Ni & P (0.005-0.013 P)	-	-	50-340	200-400	50-5	40-120	Electrical engineering, strip for lead frames. Minimum electrical conductivity values agreed between purchaser and supplier, typically 95% IACS
Phosphorus-containing Coppers	CW024A	CR024A	Cu-DHP	C106	Cu-DHP	99.90 min.*	0.015-0.040 P	-	-	50-340	200-400	50-5	40-120	Non-electrical. Water and gas pipes in sanitary and heating applications (EN1057). Approved for drinking water contact under 4MS. Sheet and strip for building (EN 1172). Architecture, roofing, cladding. Excellent soldering and brazing.
Phosphorus-containing Coppers	-	CR025A	Cu-DXP	-	-	99.90 min.*	0.03 excl. Ag, Ni & P (0.04-0.06 P)	-	-	-	-	-	-	Cu-DXP is used for anodes for electroplating.
Silver-bearing-Tough Pitch Coppers	CW011A	CR011A	Cu-Ag 0.04	C101	Cu-Ag-2	Rem.	0.03 excl. Ag & O (0.03-0.05 Ag, 0.04 O)	0.15328	100	50-340	200-400	50-5	40-120	Silver increases creep strength, uses in large alternators, motors, tram/trolley wires.
Silver-bearing-Tough Pitch Coppers	CW012A	CR012A	Cu-Ag 0.04	C101	Cu-Ag-3	Rem.	0.03 excl. Ag & O (0.06-0.08 Ag, 0.04 O)	0.15328	100	50-340	200-400	50-5	40-120	Silver increases creep strength, uses in large alternators, motors, tram/trolley wires.
Silver-bearing-Tough Pitch Coppers	CW013A	CR013A	Cu-Ag 0.10	C101	Cu-Ag-4	Rem.	0.03 excl. Ag & O (0.08-0.12 Ag, 0.04 O)	0.15328	100	50-340	200-400	50-5	40-120	Silver increases creep strength, uses in large alternators, motors, tram/trolley wires.
Silver-bearing Phosphorus Deoxidised Coppers	CW014A	CR014A	Cu-Ag 0.04P	-	-	Rem.	0.03 excl. Ag & P (0.03-0.05 Ag, 0.001-0.007 P)	0.15596	98.3	50-340	200-400	50-5	40-120	Silver increases creep strength, uses in large alternators, motors, tram/trolley wires.
Silver-bearing Phosphorus Deoxidised Coppers	CW015A	CR015A	Cu-Ag 0.07P	-	-	Rem.	0.03 excl. Ag & P (0.06-0.08 Ag, 0.001-0.007 P)	0.15596	98.3	50-340	200-400	50-5	40-120	Silver increases creep strength, uses in large alternators, motors, tram/trolley wires.
Silver-bearing Phosphorus Deoxidised Coppers	CW016A	CR016A	Cu-Ag 0.10P	-	-	Rem.	0.03 excl. Ag & P (0.08-0.12 Ag, 0.001-0.007 P)	0.15596	98.3	50-340	200-400	50-5	40-120	Silver increases creep strength, uses in large alternators, motors, tram/trolley wires.
Silver-bearing Oxygen Free Coppers	CW017A	CR017A	Cu-Ag 0.04(OF)	C103	Cu-Ag-OF2	Rem.	0.0065 excl. Ag & O (0.03-0.05 Ag)	0.15328	100	50-340	200-400	50-5	40-120	Silver increases creep strength, uses in large alternators, motors, tram/trolley wires.
Silver-bearing Oxygen Free Coppers	CW018A	CR018A	Cu-Ag 0.07(OF)	-	-	Rem.	0.0065 excl. Ag & O (0.06-0.08 Ag)	0.15328	100	50-340	200-400	50-5	40-120	Silver increases creep strength, uses in large alternators, motors, tram/trolley wires.
Silver-bearing Oxygen Free Coppers	CW019A	CR019A	Cu-Ag 0.10(OF)	C103	Cu-Ag-OF4	Rem.	0.0065 excl. Ag & O (0.08-0.12 Ag)	0.15328	100	50-340	200-400	50-5	40-120	Silver increases creep strength, uses in large alternators, motors, tram/trolley wires.

**About this table**

Copper is available in a number of grades, with different properties, to suit different applications. All grades, except for CW024A (used for pipes and roofing) have electrical applications. The types of copper are oxygen free, tough pitch and phosphorus deoxidised, all of which may be alloyed with small amounts of silver which increases the temperature resistance. Compositions, properties and uses of wrought and unwrought coppers are provided in the table below.

The electrical conductivity is shown as % IACS (International Annealed Copper Standard), first used in 1913. Values greater than 100% reflect the higher purity copper now available. The mechanical properties of all the grades are very similar, shown in ranges from soft to hard.

For more detail, the appropriate standard(s) should be consulted.

**Table notes**

\* including silver, up to a maximum of 0.015 (Ag)  
 Unwrought coppers in EN 1976 – Cast Unwrought Copper Products and EN 1978 – Copper Cathodes  
 # 19 elements other than copper are: Ag, As, Bi, Cd, Co, Cr, Fe, Mn, Ni, O, P, Pb, S, Sb, Se, Si, Sn, Te, Zn  
 Compositions are given as either a range or a maximum  
 1N/mm<sup>2</sup> = 1MPa

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