

Wrought Copper-aluminium, Copper-nickel and copper-nickel-zinc alloys—Compositions, Properties, Standards and Uses

Description	EN Number	EN Symbol	Nearest Old BS Equiv.	Cu %	Al %	Fe %	Mn %	Ni %	Pb %	Si %	Zn %	Others %	0.2% Proof Strength (N/mm ²)	Tensile Strength (N/mm ²)	Elongation (%)	Hardness (HV)	Machinability index (%)	1652 Plate, Strip, Sheet, Circles	1653 Plate, Sheet, Circles	1654 Strip for Springs, Connectors	12163 Rod	12165 Forging Stock	12166 Wire	12167 Profiles, Rectangular Bar	12420 Forgings	12449 Tubes	12451 Tubes for Heat Exchangers	12452 Finned Tubes for Heat Exchangers	Characteristics and Uses
Copper-aluminium (Aluminium Bronze)	CW300G	CuAl5As	-	Rem.	4.0-6.5	0.2	0.2	0.2	0.02	-	0.3	0.1-0.4 As	110 Min	380 Min	30 Min	75-100	20												An alpha phase alloy for tube manufacture. Readily cold worked.
Copper-aluminium (Aluminium Bronze)	CW301G	CuAl6Si2Fe	CA107	Rem.	6.0-6.4	0.5-0.7	0.1	0.1	0.05	2.0-2.4	0.4	-	250-350	500-650	25-10	125-160	50												Ref Def Stan 02-879 Part 1 Annex D. Controlled low magnetic permeability, < 1.005. MOD. Seawater resistant.
Copper-aluminium (Aluminium Bronze)	CW302G	CuAl7Si2	-	Rem.	6.3-7.6	0.3	0.2	0.2	0.05	1.5-2.2	0.5	-	250-350	500-650	25-10	125-160	50												Ref UNS C64200 low magnetic permeability. Seawater resistant.
Copper-aluminium (Aluminium Bronze)	CW303G	CuAl8Fe3	CA106	Rem.	6.5-8.5	1.5-3.5	1	1	0.05	0.2	0.5	-	180-210	460-500	30	125-135	20	HR	R										Seawater resistant. Offshore and marine, fasteners.
Copper-aluminium (Aluminium Bronze)	CW304G	CuAl9Ni3Fe2	CA105	Rem.	8.0-9.5	1.0-3.0	2.5	2.0-4.0	0.05	0.1	0.2	-	180	500	30	125	20		R									Seawater resistant. Available as plate.	
Copper-aluminium (Aluminium Bronze)	CW305G	CuAl10Fe1	-	Rem.	9.0-10.0	0.5-1.5	0.5	1	0.02	0.2	0.5	-	210-480	420-670	22-5	110-205	20												Seawater resistant.
Copper-aluminium (Aluminium Bronze)	CW306G	CuAl10Fe3Mn2	-	Rem.	9.0-11.0	2.0-4.0	1.5-3.5	1	0.05	0.2	0.5	-	330-510	600-720	15-5	130-210	30												High strength alloys for use in aggressive media such as seawater when wear resistance and toughness are needed. Used for pumps, valves, bushes, fasteners.
Copper-aluminium (Aluminium Bronze)	CW307G	CuAl10Ni5Fe4	CA104	Rem.	8.5-11.0	3.0-5.0	1	4.0-6.0	0.05	0.2	0.4	-	400-530	600-760	15-5	170-220	30												10-5-5 is the most common aluminium-bronze composition in UK, ref Def Stan 02-833 Part 2, high strength.
Copper-aluminium (Aluminium Bronze)	CW308G	CuAl11Fe6Ni6	-	Rem.	10.5-12.5	5.0-7.0	1.5	5.0-7.0	0.05	0.2	0.5	-	500-680	750-850	10-5	200-260	30												High strength alloys for use in aggressive media such as seawater when wear resistance and toughness are needed. Used for pumps, valves, bushes, fasteners.
Copper-aluminium (Aluminium Bronze)	CW309G	CuAl5Zn5Sn1	-	Rem.	4.0-6.0	-	-	-	-	-	-	0.3-1.5 Sn 4.0-6.0 Zn	170 Min	400 Min	45 Min	80 Min													Sheet and strip for building (EN 1172).
Copper-nickel	CW350H	CuNi25	CN105	Rem.	-	0.3	0.5	24.0-26.0	0.02	-	0.5	0.1 Co	120 Min	300 Min		70-100	20	HR											UK "silver" coinage alloy. Outer ring of 2 Euro coin.
Copper-nickel	CW351H	CuNi9Sn2	-	Rem.	-	0.3	0.3	8.5-10.5	0.03	0.1	-	1.8-2.8 Sn	200-550	350-620	45-2	80-220	20	HR		BHR									Good elastic properties for electrical contacts. Tarnish resistant.
Copper-nickel	CW352H	CuNi10Fe1Mn	CN102	Rem.	-	1.0-2.0	0.5-1.0	9.0-11.0	0.02	-	0.5	0.1 Co	100-420	290-520	35-8	80-160	20	HR	R										Excellent corrosion resistance, reduced attachment of marine organisms. 90/10 alloy is more cost-effective than 70/30. Used for cooling and firewater systems, heat exchangers, condensers and piping, offshore sheathing, desalination, aquaculture, boat hulls.
Copper-nickel	CW353H	CuNi30Fe2Mn2	CN108	Rem.	-	1.5-2.5	1.5-2.5	29.0-32.0	0.02	-	0.5	0.1 Co	175	450	35	110	20												Withstands high flow velocities, excellent seawater resistance, reduced attachment of marine organisms. Used for seawater cooling and firewater systems, heat exchangers, condensers and piping, offshore sheathing, desalination, aquaculture, boat hulls.
Copper-nickel	CW354H	CuNi30Mn1Fe	CN107	Rem.	-	0.4-1.0	0.5-1.5	30.0-32.0	0.02	-	0.5	0.1 Co	130-330	350-520	35-12	90-130	20	HR	R										Excellent seawater resistance, withstands high flow velocities, reduced attachment of marine organisms. Used for seawater cooling and firewater systems, heat exchangers, condensers and piping, offshore sheathing, desalination, aquaculture, boat hulls.
Copper-nickel-zinc (Nickel Silver)	CW400J	CuNi7Zn39Pb3Mn2	-	47.0-50.0	-	0.3	1.5-3.0	6.0-8.0	2.3-3.3	-	Rem.	-	180-880	360-880	50-2	80-210	30	GHR											Two-phase, alpha-beta alloys, when hot formability is required for production of forgings or hot extruded architectural profiles. Used for tableware, telecommunication components, decorative building, musical instruments and food manufacturing equipment.
Copper-nickel-zinc (Nickel Silver)	CW401J	CuNi10Zn27	NS103	61.0-64.0	-	0.3	0.5	9.0-11.0	0.05	-	Rem.	-	180-800	360-880	50-2	80-210	30	GHR		HR	HMR		GHMR	HMR		HR			Alpha phase alloys with good corrosion resistance. Colour becomes whiter as nickel content increases. Used for tableware, telecommunication components, decorative building, musical instruments and food manufacturing equipment.
Copper-nickel-zinc (Nickel Silver)	CW402J	CuNi10Zn42Pb2	NS101	45.0-48.0	-	0.3	0.5	9.0-11.0	1.0-2.5	-	Rem.	-	260-650	380-730	20-2	110-210	75	HR											Two-phase, alpha-beta alloys, when hot formability is required for production of forgings or hot extruded architectural profiles. Used for tableware, telecommunication components, decorative building, musical instruments and food manufacturing equipment.
Copper-nickel-zinc (Nickel Silver)	CW403J	CuNi12Zn24	NS104	63.0-66.0	-	0.3	0.5	11.0-13.0	0.03	-	Rem.	-	450-720	520-820	4-2	170-240	30												Alpha phase alloys with good corrosion resistance. Colour becomes whiter as nickel content increases. Used for tableware, telecommunication components, decorative building, musical instruments and food manufacturing equipment.
Copper-nickel-zinc (Nickel Silver)	CW404J	CuNi12Zn25Pb1	NS111	60.0-63.0	-	0.3	0.5	11.0-13.0	0.5-1.5	-	Rem.	-	300-440	410-550	15-2	110-190	80							HMR	HMR				Alpha phase alloys with good corrosion resistance. Colour becomes whiter as nickel content increases. Lead improves machinability. Used for tableware, telecommunication components, decorative building, musical instruments and food manufacturing equipment.
Copper-nickel-zinc (Nickel Silver)	CW405J	CuNi12Zn29	-	57.0-60.0	-	0.3	0.5	11.0-13.5	0.03	-	Rem.	-	320-460	450-600	15-2	120-200	75							HMR	HMR				Alpha phase alloys with good corrosion resistance. Colour becomes whiter as nickel content increases. Lead improves machinability. Used for tableware, telecommunication components, decorative building, musical instruments and food manufacturing equipment.
Copper-nickel-zinc (Nickel Silver)	CW406J	CuNi12Zn30Pb1	-	56.0-58.0	-	0.3	0.5	11.0-13.0	0.5-1.5	-	Rem.	-	200-800	380-900	40-2	85-230	30	GHR		BHR	HMR		GHMR	HMR		HR			Alpha phase alloys with good corrosion resistance. Colour becomes whiter as nickel content increases. Lead improves machinability. Used for tableware, telecommunication components, decorative building, musical instruments and food manufacturing equipment.
Copper-nickel-zinc (Nickel Silver)	CW407J	CuNi12Zn38Mn5Pb2	-	42.0-45.0	-	0.3	4.5-6.0	11.0-13.0	1.0-2.5	-	Rem.	-	280-680	400-820	45-2	90-230	30	HR		HR									Two-phase, alpha-beta alloys, when hot formability is required for production of forgings or hot extruded architectural profiles. Used for tableware, telecommunication components, decorative building, musical instruments and food manufacturing equipment.
Copper-nickel-zinc (Nickel Silver)	CW408J	CuNi18Zn19Pb1	NS113	59.5-62.5	-	0.3	0.7	17.0-19.0	0.5-1.5	-	Rem.	-	250-620	460-720	20-2	120-220	90							HM	HMR	HMR	X		Alpha phase alloys with good corrosion resistance. Colour becomes whiter as nickel content increases. Lead improves machinability. Used for tableware, telecommunication components, decorative building, musical instruments and food manufacturing equipment.
Copper-nickel-zinc (Nickel Silver)	CW409J	CuNi18Zn20	NS106	60.0-63.0	-	0.3	0.5	17.0-19.0	0.03	-	Rem.	-	250-500	460-660	15-2	120-220	90												Alpha phase alloys with good corrosion resistance. Colour becomes whiter as nickel content increases. Used for tableware, telecommunication components, decorative building, musical instruments and food manufacturing equipment.
Copper-nickel-zinc (Nickel Silver)	CW410J	CuNi18Zn27	NS107	53.0-56.0	-	0.3	0.5	17.0-19.0	0.03	-	Rem.	-	400-450	600-660	8	165-190	80												Alpha phase alloys with good corrosion resistance. Colour becomes whiter as nickel content increases. Used for tableware, telecommunication components, decorative building, musical instruments and food manufacturing equipment.

About this table

This table shows the compositions, typical mechanical properties, and relevant BS EN standards and uses for copper-aluminium (aluminium bronze), copper-nickel and copper-nickel-zinc (nickel silver) wrought copper alloys. Information on general characteristics and uses, and machinability, is also provided. Information is ordered by description and EN number.

Note that not all elements listed as impurities are shown here. For the full chemical composition you should refer to the standard or the Copper and copper alloys. Compendium of compositions and products PD CEN/TS 13388.

For more detail, the appropriate standard(s) should be consulted. Visit our page with details of standards and links to the BSI shop.

Table notes

Compositions are given as either a range or a maximum. The material conditions defined by the standards are given and—where mandatory—this is indicated

1652, 12163 and 12449 are for general purposes.
1653 is for boilers, pressure vessels and hot water storage units.
1N/mm² = 1MPa

- B – mandatory spring bending limit
- G – mandatory grain size
- H – mandatory hardness
- M – as manufactured
- R – mandatory tensile strength
- X – no mandatory tensile properties

Disclaimer

While this data has been prepared with care, European Copper Institute provides no warranty with regards to the content and shall not be liable for any direct, incidental or consequential damages that may result from the use of the information or the data contained.

© European Copper Institute 2020

copperalliance.eu