UDC 669.35'24

Cu Ni25

Common names: 75/25 Copper-Nickel
75/25 Cupro-nickel
Cupro-nickel, 75/25

A copper-nickel alloy with an alpha phase structure. The alloy has good corrosion, wear and tarnish resistance, together with excellent cold forming and coining characteristics. The most commonly used wrought forms are sheet and strip.

COMPOSITION (weight %)

Ni	24.0–26.0
Mn	0– 0.5
Cu	rem.

1 SOME TYPICAL USES

Coinage
Coins, medals and medallions.

Electrical
Resistance wires.

2 PHYSICAL PROPERTIES

		Metric Units	English Units
2.1	Density at 20 °C *68 °F*	8.95 g/cm³	0.325 lb/in³
2.2	Melting range [a]	1 150–1 220 °C	2 100–2 230 °F
2.3	Coefficient of thermal expansion (linear) at:		
	−183 to 10 °C *−297 to 50 °F*	0.000 013 per °C	0.000 007 per °F
	20 „ 300 °C *68 „ 572 °F*	0.000 016 „ „	0.000 009 „ „
2.4	Specific heat (thermal capacity) at:		
	20 °C *68 °F*	0.09 cal/g °C	0.09 Btu/lb °F
2.5	Thermal conductivity at:		
	20 °C *68 °F*	0.08 cal cm/cm² s °C	19 Btu ft/ft² h °F
2.6	Electrical conductivity (volume) at:		
	20 °C *68 °F* (annealed or cold worked)	3 m/ohm mm²	5% IACS
	200 °C *392 °F* („ „ „ „)	3 „	5 „ „
2.7	Electrical resistivity (volume) at:		
	20 °C *68 °F* (annealed or cold worked)	0.34 ohm mm²/m 34 microhm cm	207 ohms (circ mil/ft) 14 microhm in
	200 °C *392 °F* („ „ „ „)	0.34 ohm mm²/m 34 microhm cm	207 ohms (circ mil/ft) 14 microhm in
2.8	Temperature coefficient of electrical resistance at:		
	20 °C *68 °F* (annealed or cold worked) applicable over range from 0 to 100 °C *32 to 212 °F*	0.000 2 per °C (5% IACS)	0.000 1 per °F (5% IACS)
2.9	Modulus of elasticity (tension) at 20 °C *68 °F*		
	annealed	14 900 kg/mm²	21 200 000 lb/in²
	cold worked [b]	14 100 kg/mm²	20 100 000 lb/in²
2.10	Modulus of rigidity (torsion) at 20 °C *68 °F*		
	annealed	5 500 kg/mm²	7 800 000 lb/in²
	cold worked [b]	5 200 kg/mm²	7 400 000 lb/in²

[a] The melting range covers the highest liquidus and lowest solidus temperatures over the composition range quoted. The values are based on: Hansen, M. and Anderko, K. Constitution of Binary Alloys. 2nd ed. (1958) McGraw-Hill, London, New York; more recent work (Feest, E.A. and Doherty, R.D. The Cu-Ni Equilibrium Phase Diagram. J. Inst. Metals, Vol. 99 (1971), pp. 102–103) indicates that the solidus temperature may be slightly higher.

[b] Approximately 50% cold work.

N.B.: The values shown in Section 2, which have been appropriately rounded in view of the composition range involved, are based on selected literature references.

INDEX NUMBERS RELATE TO LITERATURE REFERENCES (see page 6); INDEX LETTERS RELATE TO FOOTNOTES AT END OF TABLE

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DATA SHEET No. K 5

1972 Edition

3 FABRICATION PROPERTIES

The information given in this table is for general guidance only, since many factors influence fabrication techniques. The values shown are approximate only, since those used in practice are dependent upon form and size of metal, equipment available, techniques adopted and properties required in the material.

		Metric Units	English Units
3.1	Casting temperature range	1 300–1 375 °C	2 370–2 505 °F
3.2	Annealing temperature range	650– 825 °C	1 200–1 515 °F
	Stress relieving temperature range	300– 400 °C	570– 750 °F
3.3	Hot working temperature range	900–1 000 °C	1 650–1 830 °F
3.4	Hot formability	Good	
3.5	Cold formability	Good	
3.6	Cold reduction between anneals	70% max.	
3.7	Machinability:	See General Data Sheet No. 2	
	Machinability rating (free cutting brass = 100)	20	
3.8	Joining methods:	See General Data Sheet No. 3.9	
	Soldering	Excellent	
	Brazing	Excellent	
	Oxy-acetylene welding	Fair	
	Carbon-arc welding	Not recommended	
	Gas-shielded arc welding	Excellent	
	Coated metal-arc welding	Good	
	Resistance welding: spot and seam	Good	
	butt	Good	

4 NATIONAL SPECIFICATIONS FOR MANUFACTURED FORMS

and ISO Recommendation

Country	Designation of Standards	Designation of Material in Standards	Specification for Chemical Composition[a]	Plate Sheet Strip	Rod	Wire	Tube	Sections / Shapes	Forgings
Australia	SAA	—	—	—	—	—	—	—	—
Belgium	NBN	Cu Ni25	—	266.31	—	266.31	—	—	—
Canada	CSA	—	—	—	—	—	—	—	—
Chile	NCh (INDITECNOR)	Cu Ni25	NCh 250. of 68	—	—	—	—	—	—
France	—	Cu Ni25	—	—	—	—	—	—	—
Germany	DIN	Cu Ni25	17 664	17 670	—	—	—	—	—
India	IS	Cu Ni31 Mn1 Fe	—	—	—	—	1545	—	—
Italy	UNI	—	—	—	—	—	—	—	—
Japan	JIS	—	—	—	—	—	—	—	—
Netherlands	N or NEN[b]	—	—	—	—	—	—	—	—
South Africa	SABS	—	—	—	—	—	—	—	—
Spain	UNE	—	—	—	—	—	—	—	—
Sweden	SIS	—	—	—	—	—	—	—	—
Switzerland	VSM	Cu Ni25	—	10 803	—	—	—	—	—
United Kingdom	BS	CN105	—	374 2870	—	—	—	—	—
United States	ASTM	—	—	—	—	—	—	—	—
International Organization for Standardization	ISO	Cu Ni25	R 429	—	—	—	—	—	—

(a) Applicable when the chemical composition is not given in the specifications for wrought forms.

(b) Older specifications bear prefix N; for new specifications the NEN prefix is used.

5 MECHANICAL PROPERTIES

5.1 Mechanical properties at room temperature

Tensile properties	see tables 5.1.1/2/3
Hardness	„ „ 5.1.1/2/3
Shear Strength	„ „ 5.1.1/2/3
Modulus of elasticity (tension)	see 2.9
Modulus of rigidity (torsion)	„ 2.10

5.2 Mechanical properties at low temperature

Tensile properties	no data
Impact properties	„ „

5.3 Mechanical properties at elevated temperature

Short-time tensile properties	no data
Creep properties	„ „

5.4 Fatigue properties

Fatigue strength at room temperature	see table 5.4.1

5.1 MECHANICAL PROPERTIES AT ROOM TEMPERATURE[a]

5.1.1 Typical Tensile Properties and Hardness Values—Metric Units

This table is representative of practice in many European countries. For British and American practices, see tables 5.1.2 and 5.1.3, respectively.

The values shown represent reasonable approximations for general engineering use, taking account of variations in composition and manufacturing procedures. For design purposes, national specifications should be consulted.

For a given temper, individual elongation values may show some variation above or below the typical values indicated.

Form	Temper	Tensile Strength kg/mm²	Proof Stress 0.2% offset kg/mm²	Elongation		Hardness		Shear Strength kg/mm²	Typical Size Related to Properties Shown [b]
				%	gauge length	Brinell	Vickers		
Sheet Strip	Annealed	37	16	42	$5.65\sqrt{S_o}$	85	89	28	0.5–5 mm thick

(a) It will be noted that tables 5.1.1, 5.1.2 and 5.1.3, giving typical tensile properties and hardness values in Metric, SI and English, and American units respectively are not directly comparable. This is because the properties quoted reflect to some extent the metalworking techniques, specification practices, and testing procedures in the countries concerned, and in view of the different sizes of products referred to in these tables. Individual manufacturers of semi-fabricated products, can, however, normally meet the requirements of any national standard.

(b) It is possible to obtain sizes outside the range given in this column, but information on their mechanical properties should be obtained from the metal manufacturers.

5.1.2 Typical Tensile Properties and Hardness Values—SI and English Units

This table is based on British practice. For other European and American practices, see tables 5.1.1 and 5.1.3, respectively.

The values shown represent reasonable approximations for general engineering use, taking account of variations in composition and manufacturing procedures. For design purposes, national specifications should be consulted.

For a given temper, individual elongation values may show some variation above or below the typical values indicated.

Form	Temper	Tensile Strength		Proof Stress 0.1% offset		Elongation		Vickers Hardness	Shear Strength		Typical Size Related to Properties Shown [a]
		hbar	ton/in²	hbar	ton/in²	%	gauge length		hbar	ton/in²	
Sheet Strip	Annealed	36	23	14	9	40	50 mm (2 in.)	90	26	17	—
	Typical Cold Worked Tempers	45	29	39	25	15	50 mm (2 in.)	145	29	19	0.2–3 mm (0.008–0.125 in.) thick
		59	38	53	34	3	50 mm (2 in.)	170	32	21	,,
Wire	Annealed [b]	34	22	—	—	35	100 mm (4 in.)	—	25	16	2.5–5 mm (0.1–0.2 in.) diam.
		37	24	—	—	30	100 mm (4 in.)	—	28	18	0.5–2 mm (0.02–0.08 in.) diam.
		40	26	—	—	25	100 mm (4 in.)	—	31	20	0.2–0.4 mm (0.008–0.016 in.) diam.

[a] It is possible to obtain sizes outside the ranges given in this column, but information on their mechanical properties should be obtained from the metal manufacturers.

[b] The principal application for wire of this composition is as a material of controlled electrical resistance; it is usually supplied in the annealed condition.

5.1.3 Typical Tensile Properties and Hardness Values—American Units

This table is based on American practice and the temper designations shown are those referred to in ASTM and other American Standards. For British and other European countries' practices, see tables 5.1.2 and 5.1.1, respectively.

The values shown represent reasonable approximations for general engineering use, taking account of variations in composition and manufacturing procedures. For design purposes, national specifications should be consulted.

For a given temper, individual elongation values may show some variation above or below the typical values indicated.

Form	Temper	Tensile Strength psi	Yield Strength 0.5% extension under load psi	Elongation		Rockwell Hardness			Shear Strength psi	Typical Size Related to Properties Shown [a]
				%	gauge length	F	B	30 T		
Flat Products (Plate, Sheet, Strip)	Annealed	46 000	18 000	35	2 in.	—	35	—	35 000	0.040 in. thick
	Cold Worked Hard	65 000	55 000	10	2 in.	—	75	—	42 000	0.040 in. thick

[a] It is possible to obtain sizes different from those given in this column, but information on their mechanical properties should be obtained from the metal manufacturers.

5.2 MECHANICAL PROPERTIES AT LOW TEMPERATURE

5.2.1 Tensile Properties—Impact Properties

At the date of publication of this sheet, no data relating to this material have been traced.

5.3 MECHANICAL PROPERTIES AT ELEVATED TEMPERATURE

5.3.1 Short-Time Tensile Properties

At the date of publication of this sheet, no data relating to this material have been traced.

5.3.2 Creep Properties

At the date of publication of this sheet, no data relating to this material have been traced.

5.4 FATIGUE PROPERTIES

5.4.1 Fatigue Strength at Room Temperature

Form	Temper	Number of Cycles $\times 10^6$	Metric Units kg/mm²		English Units ton/in²		American Units psi	
			Tensile Strength	Fatigue Strength	Tensile Strength	Fatigue Strength	Tensile Strength	Fatigue Strength
Wire [1] **2 mm diam. 0.072 in. diam.**	Cold Worked 88%	100	65.5	27.5 [a]	41.5	17.5 [a]	**93 000**	**39 000** [a]

[a] Rotating-wire-arc test.

N.B.: — Original values are printed in **bold type**; other values are converted.

— Further data can be obtained from the following paper:

■ Bierlein, J.C. and Dodd, R.A. Fatigue Properties of Some FCC Copper-Based Solid Solutions. Trans. Met. Soc. AIME, Vol. 242 (1968), pp. 1431–1436.

REFERENCE

MECHANICAL PROPERTIES (Section 5)

[1] Burghoff, H. L. and Blank, A. I. Fatigue Tests on Some Copper Alloys in Wire Form. Proc. ASTM, Vol. 43 (1943), pp. 774–784.

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