UDC 669.35'5'4

Cu Zn34 Pb1

Common names: Clock Brass
Medium-Leaded Brass

A copper–zinc–lead alloy with an alpha phase structure containing a dispersion of fine lead particles; small amounts of retained beta phase may also be present. The alloy, which is readily cold formed and machined, has good punching and shearing properties.

COMPOSITION (weight %)

Cu	62.5–66.5
Pb	0.5– 1.5
Zn	rem.

1 SOME TYPICAL USES

Mechanical

Parts requiring good coldforming and machining properties; nuts, rivets, screws and other headed components; instrument parts and end plates; clock and watch components; key blanks.

Miscellaneous

Printers' matrices.

2 PHYSICAL PROPERTIES

		Metric Units	English Units
2.1	Density at 20 °C *68°F*	8.5 g/cm³	0.305 lb/in³
2.2	Melting range	885–925 °C	1 625–1 695 °F
2.3	Coefficient of thermal expansion (linear) at:		
	20 to 100 °C *68 to 212 °F*	0.000 019 per °C	0.000 011 per °F
	20 to 300 °C *68 to 572 °F*	0.000 020 „ „	0.000 011 „ „
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*	0.28 cal cm/cm² s °C	68 Btu ft/ft² h °F
2.6	Electrical conductivity (volume) at:		
	20 °C *68 °F* (annealed)	15 m/ohm mm²	26% IACS
2.7	Electrical resistivity (volume) at:		
	20 °C *68 °F* (annealed)	0.066 ohm mm²/m 6.6 microhm cm	40 ohms (circ mil/ft) 2.6 microhm in
2.8	Temperature coefficient of electrical resistance at:		
	20 °C *68 °F* (annealed)	0.001 5 per °C (26% IACS)	0.000 8 per °F (26% IACS)
	applicable over range from 0 to 100 °C *32 to 212 °F*		
2.9	Modulus of elasticity (tension) at 20 °C *68 °F* (annealed or cold worked)	10 500 kg/mm²	14 900 000 lb/in²
2.10	Modulus of rigidity (torsion) at 20 °C *68 °F* (annealed or cold worked)	3 900 kg/mm²	5 500 000 lb/in²

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

Prepared by
CONSEIL INTERNATIONAL POUR LE DEVELOPPEMENT DU CUIVRE (CIDEC)
100, rue du Rhône – 1204 GENEVE

Distributed by
Copper Development Association
55, South Audley Street—London W1Y 6BJ

DATA SHEET No. E2
Cu Zn34 Pb1

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	1 000–1 030 °C	1 830–1 885 °F
3.2 Annealing temperature range	450– 650 °C	840–1 200 °F
Stress relieving temperature range	250– 350 °C	480– 660 °F
3.3 Hot working temperature range	725– 800 °C	1 335–1 470 °F
3.4 Hot formability	Limited	
3.5 Cold formability	Good	
3.6 Cold reduction between anneals	65% max.	
3.7 Machinability:	See General Data Sheet No. 2	
Machinability rating (free-cutting brass = 100)	70	
3.8 Joining methods:	See General Data Sheet No. 3.5	
Soldering	Excellent	
Brazing	Good	
Oxy-acetylene welding	Not recommended	
Carbon-arc welding	Not recommended	
Gas-shielded arc welding	Not recommended	
Coated metal-arc welding	Not recommended	
Resistance welding: spot and seam	Not recommended	
butt	Fair	

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		
Plate Sheet Strip	Annealed	33	12	45	$5.65\sqrt{S_o}$	65	68	25	—
	Typical Cold Worked Tempers	42	28	25	$5.65\sqrt{S_o}$	95	100	30	0.3–2 mm thick
		52	40	10	$5.65\sqrt{S_o}$	135	140	34	,,
Rod	Annealed	33	12	45	$5.65\sqrt{S_o}$	65	68	25	—
	Typical Cold Worked Tempers	40	25	28	$5.65\sqrt{S_o}$	95	100	28	6–40 mm diam. or equivalent area
		48	38	15	$5.65\sqrt{S_o}$	120	125	32	6–12 mm diam. or equivalent area
		55	46	8	$5.65\sqrt{S_o}$	135	140	36	up to 6 mm diam. or equivalent area

(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, 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 ranges 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—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[a]	Tensile Strength ton/in²	Proof Stress 0.1% offset ton/in²	Elongation		Vickers Hardness	Shear Strength ton/in²	Typical Size Related to Properties Shown[b]
				%	gauge length			
Strip	Annealed	21	7	50	2 in.	70	16	—
	Cold Worked							
	Half Hard	25	18	25	2 in.	125	18	0.01–0.20 in. thick
	Hard	30	25	12	2 in.	150	20	0.01–0.125 in. thick
	Extra Hard	34	30	7	2 in.	170	21	,,

(a) The recognised temper designations used in the relevant or nearest British Standards are also given, to clarify the cold-worked tempers shown.

(b) 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.

5.2 MECHANICAL PROPERTIES AT LOW TEMPERATURE

5.2.1 Tensile Properties—Impact Properties

Form	Temper	Testing Temperature		Tensile Strength			Proof Stress ton/in²	Elongation		Reduction of Area %	Impact Strength	
		°C	°F	kg/mm²	ton/in²	psi		%	gauge length		kg m/cm²	ft lb
Rod[1]	Annealed [a]	18	64	32.5	**20.6**	46 000	**6.9**[b]	**55**	—	**61**	4.7[c]	**27**[c]
		–30	– 22	32	**20.8**	46 500	**6.6**[b]	**65**	—	**69**	4.8[c]	**28**[c]
		–80	–112	35	**22.2**	49 500	**7.0**[b]	**66**	—	**64**	4.8[c]	**28**[c]

(a) Alloy containing Cu 63.8%, Pb 0.43%, Zn remainder (i.e. just outside composition range of Cu Zn34 Pb1).

(b) Quoted as yield point but offset strain not defined.

(c) Charpy test, V-notch; cross-sectional area at the notch 0.8 cm².

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

—All converted values for impact strength are to be taken as indicative only; the impact energy has been converted from ft lb into kg m/cm² taking into account the actual cross-sectional area of the specimen at the notch.

—Data not available:
Proof stress, 0.1% and 0.2% offset,
Yield strength, 0.5% extension under load.

5.3 MECHANICAL PROPERTIES AT ELEVATED TEMPERATURE

5.3.1 Short-Time Tensile Properties—Impact 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

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

Printed in England by the Martin Ca[illegible]ry Printing Group

REFERENCES

MECHANICAL PROPERTIES (SECTION 5)

(1) Teed, P.L. The Properties of Metallic Materials at Low Temperatures, Vol. I. Chapman and Hall, Ltd., London (1950), pp. 162–187.