INTERNATIONAL STANDARD 1637

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION • МЕЖДУНАРОДНАЯ ОРГАНИЗАЦИЯ ПО СТАНДАРТИЗАЦИИ • ORGANISATION INTERNATIONALE DE NORMALISATION

Wrought copper and copper alloys — Solid products supplied in straight lengths — Mechanical properties

Cuivre et alliages de cuivre corroyés — Produits pleins livrés en longueurs droites — Caractéristiques mécaniques

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FOREWORD

ISO (the International Organization for Standardization) is a worldwide federation of national standards institutes (ISO Member Bodies). The work of developing International Standards is carried out through ISO Technical Committees. Every Member Body interested in a subject for which a Technical Committee has been set up has the right to be represented on that Committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work.

Draft International Standards adopted by the Technical Committees are circulated to the Member Bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 1637 was drawn up by Technical Committee ISO/TC 26, *Copper and copper alloys,* and circulated to the Member Bodies in December 1971.

It has been approved by the Member Bodies of the following countries :

Australia	Hungary	South Africa, Rep. of
Austria	India	Spain
Belgium	Italy	Sweden
Canada	Japan	Switzerland
Chile	Korea, Rep. of	Thailand
Czechoslovakia	Netherlands	Turkey
Denmark	New Zealand	United Kingdom
Egypt, Arab Rep. of	Norway	U.S.A.
Finland	Portugal	U.S.S.R.
France	Romania	

The Member Body of the following country expressed disapproval of the document on technical grounds :

Germany

Printed in Switzerland

Wrought copper and copper alloys — Solid products supplied in straight lengths — Mechanical properties

1 SCOPE AND FIELD OF APPLICATION

This International Standard specifies the mechanical properties of solid products, supplied in straight lengths, in wrought copper and copper alloys the chemical compositions of which are listed in the appropriate International Standards (see 2.1).

NOTES

1 In order to overcome various national interpretations of the terms "rod" and "bar", these manufactured products having a round or regular polygonal cross-section with a diameter or width across flats exceeding 5 mm or rectangular cross-section having a thickness 2 mm and over are grouped under the general heading : "solid products supplied in straight lengths". By agreement some of these materials can be supplied in coils or on reels.

2 For the mechanical properties of solid products supplied with a diameter or width across flats not exceeding 5 mm and normally supplied in coils or on reels, see ISO 1638.

2 REFERENCES

2.1 Chemical composition and forms of semi-manufactured products

ISO 426, *Wrought copper-zinc alloys — Chemical composition and forms of wrought products —*

Part I : Non-leaded, special and high tensile alloys.

Part II : Leaded alloys.

ISO 427, *Wrought copper-tin alloys. — Chemical composition and forms of wrought products.*

ISO 428, *Wrought copper-aluminium alloys — Chemical composition and forms of wrought products.*

ISO 429, *Wrought copper-nickel alloys — Chemical composition and forms of wrought products.*

ISO 430, *Wrought copper-nickel-zinc alloys — Chemical composition and forms of wrought products.*

ISO/R 1187, *Special wrought copper alloys.*

ISO/R 1336, *Wrought alloyed coppers.*

ISO/R 1337, *Wrought coppers.*

2.2 Designations

ISO/R 1190, *Copper and copper alloys — Code of designation —*

Part I : Designation of materials.

Part II : Designation of tempers.

2.3 Test methods

ISO/R 399, *Vickers hardness test for copper and copper alloys (Test loads from 2.5 to 50 kgf).*

ISO/R 400, *Tensile testing of copper and copper alloys.*

ISO/R 1555, *Copper and copper alloy rolled flat products (Thickness less than 2,5 mm (0.1 in)) — Tensile test.*

ISO . . ., *Copper, copper alloys and alloyed copper — Selection of specimens and test pieces.*[1)]

1) In preparation.

3 ESSENTIAL PROPERTIES REQUIREMENTS

Table 1 embodies the principle that two properties are generally sufficient to define the condition of the material. The properties to be specified vary according to the temper and application of the material as set out in the table.

4 DIMENSIONAL LIMITS

Dimensional limitations which can have an effect on the properties obtained are given in table 2; products having dimensions outside these ranges may not comply with these properties.

Where the properties are not affected by dimensions or where the latter are unimportant, a dash (–) is inserted.

Where the product shape is not usually manufactured, a cross (x) is inserted and the properties listed do not apply.

5 MECHANICAL PROPERTIES

Mechanical properties are given in table 2.

6 TEST METHODS

6.1 Tensile test

6.1.1 According to ISO/R 400 for dimensions greater than or equal to 2,5 mm (0.1 in).

6.1.2 According to ISO/R 1555 for thicknesses of rectangles from 2 up to 2,5 mm.

6.2 Vickers hardness test

According to ISO/R 399.

6.3 Selection of test pieces

According to ISO . . .

TABLE 1

Use	Temper designation	0,2 % proof stress $R_{p0,2}$ N/mm²	Tensile strength R_m N/mm²	Elongation A %	Vickers hardness HV
General purposes	M	–	approx.	approx.	max.
	O	–	–	min.	max.
	H	–	min. – max.	approx.	approx.
Structural purposes[1]	M	min.	approx.	min.	–
	H				
	T	min.	approx.	min.	min.

1) Structural purposes are defined as those purposes where the load-bearing properties of the material are the most important.

TABLE 2

Designation		Dimensions			$R_{p0,2}$	R_m	$A^{1)}$	HV
		Diameter	Rectangles					
Alloy	Temper	Width across flats	Thickness	Width				
		mm	mm	mm	N/mm²		%	
Coppers								
Cu-ETP Cu-FRHC Cu-FRTP Cu-OF Cu-DLP Cu-DHP	O	min. 5	2 to 25	max. 150	–	–	min. 35	max. 60
	HA	5 to 40	2 to 25	max. 150	–	250 to 300	approx. 15	approx. 90
	HB	5 to 20	2 to 10	max. 150	–	280 to 360	approx. 5	approx. 105
Alloyed coppers								
Cu Ag0,05 Cu Ag0,1 Cu Ag0,05 (P) Cu Ag0,1 (P)	O	min. 5	2 to 25	max. 150	–	–	min. 35	max. 60
	HA	5 to 40	2 to 25	max. 150	–	250 to 300	approx. 15	approx. 90
	HB	5 to 20	2 to 10	max. 150	–	280 to 360	approx. 5	approx. 105
Cu As(P)	O	min. 5	2 to 25	max. 150	–	–	min. 35	max. 60
	HA	5 to 40	2 to 25	max. 150	–	250 to 300	approx. 15	approx. 90
	HB	5 to 20	2 to 10	max. 150	–	280 to 360	approx. 5	approx. 105
Cu Cd1	HA	18 to 30			–	350 to 430	approx. 10	approx. 110
	HB	5 to 18			–	410 to 490	approx. 8	approx. 125
Cu Cr1	TF	5 to 80			min. 270	approx. 370	min. 18	min. 100
	TH	5 to 25			min. 350	approx. 470	min. 10	min. 125
	TL	5 to 25			min. 440	approx. 500	min. 5	min. 130
Cu S(P0,01) Cu S(P0,03) Cu Te Cu Te(P)	O	min. 5	2 to 25	max. 150	–	–	min. 28	max. 70
	HA	5 to 40	2 to 25	max. 150	–	250 to 340	approx. 10	approx. 90
Copper-zinc alloys (Brasses)								
Cu Zn15	O	min. 5	2 to 25	max. 60	–	–	min. 40	max. 85
	HA	5 to 40	2 to 25	max. 60	–	310 to 370	approx. 25	approx. 100
Cu Zn37	O	min. 5	2 to 25	max. 60	–	–	min. 40	max. 85
	HA	5 to 40	2 to 25	max. 60	–	360 to 440	approx. 35	approx. 110
	HB	5 to 12	2 to 10	max. 60	–	430 to 510	approx. 15	approx. 140
Cu Zn40	O	min. 5	2 to 25	max. 60	–	–	min. 30	max. 95
	M	min. 5	2 to 25	max. 60	–	approx. 370	approx. 40	max. 120
Copper-zinc-lead alloys (Leaded brasses)								
Cu Zn35 Pb2	M	min. 5	–	–	–	approx. 360	approx. 30	max. 100
	HA	5 to 15			–	350 to 450	approx. 20	approx. 120

1) The elongation values listed are based on a gauge length $L_o = 5{,}65\sqrt{S_o}$ for dimensions greater than 2,5 mm (0.1 in) in accordance with ISO/R 400.

For thicknesses of rectangles from 2 up to 2,5 mm, the elongation values based on a fixed gauge length $L_o = 50$ mm (see ISO/R 1555) are to be agreed between the interested parties.

TABLE 2 (*continued*)

Designation		Dimensions			$R_{p0,2}$	R_m	$A^{1)}$	HV
		Diameter	Rectangles					
Alloy	Temper	Width across flats	Thickness	Width				
		mm	mm	mm	N/mm²	N/mm²	%	
Cu Zn36 Pb1	M	min. 5	–	–	–	approx. 360	approx. 30	max. 100
	HA	5 to 15			–	350 to 450	approx. 20	approx. 120
Cu Zn36 Pb3	M	min. 5	5 to 50	max. 150	–	approx. 360	approx. 30	max. 100
	HA	5 to 75	5 to 25	max. 100	–	310 to 420	approx. 20	approx. 105
	HB	5 to 15			–	410 to 490	approx. 15	approx. 125
Cu Zn38 Pb2	M	min. 5	–	–	–	approx. 360	approx. 35	max. 100
	HA	5 to 15	2 to 10	max. 100	–	350 to 450	approx. 20	approx. 120
Cu Zn40 Pb	M	min. 5	–	–	–	approx. 370	approx. 35	max. 120
	HA	5 to 50			–	350 to 450	approx. 25	approx. 120
	HB	5 to 15			–	440 to 510	approx. 15	approx. 140
Cu Zn39 Pb2	M	min. 5	5 to 50	max. 150	–	approx. 370	approx. 25	max. 120
	HA	–	5 to 25	max. 100	–	390 to 510	approx. 15	approx. 130
Cu Zn39 Pb3	M	min. 5			–	approx. 380	approx. 24	max. 130
	HA	5 to 75			–	360 to 470	approx. 18	approx. 120
	HB	5 to 15			–	440 to 540	approx. 12	approx. 145
Special copper-zinc alloys (Special brasses)								
Cu Zn38 Sn1	M	min. 5	–	–	–	approx. 390	approx. 35	max. 120
High tensile copper-zinc alloys (High tensile brasses)								
Cu Zn39 Al Fe Mn	M	min. 5	–	–	min. 180	approx. 470	min. 18	–
	HA	75 to 150			min. 200	approx. 500	min. 18	–
	HB	5 to 75			min. 250	approx. 540	min. 18	–
	HC	5 to 38			min. 270	approx. 570	min. 12	–
Copper-tin alloys, Special copper-tin alloys (Phosphor-bronzes, Special tin bronzes)								
Cu Sn4	HA	5 to 100	2 to 25	max. 60	min. 250	approx. 380	min. 20	–
	HB	5 to 50			min. 360	approx. 490	min. 12	–
	HC	5 to 15			min. 390	approx. 510	min. 10	–
Cu Sn6	HA	5 to 50			min. 290	approx. 450	min. 20	–
	HB	5 to 15			min. 410	approx. 520	min. 10	–
Cu Sn8	HA	5 to 50			min. 340	approx. 490	min. 20	–
	HB	5 to 15			min. 470	approx. 550	min. 10	–
Cu Sn10	HA	15 to 50			min. 360	approx. 540	min. 15	–
	HB	5 to 15			min. 490	approx. 590	min. 10	–
Cu Sn4 Zn4	M	min. 5	–	–	–	approx. 360	approx. 50	max. 110

TABLE 2 (*continued*)

Designation		Dimensions			$R_{p0,2}$	R_m	$A^{1)}$	HV
		Diameter	Rectangles					
Alloy	Temper	Width across flats	Thickness	Width				
		mm	mm	mm	N/mm²	N/mm²	%	
Copper-aluminium alloys, Special copper-aluminium alloys (Aluminium bronzes, Special aluminium bronzes)								
Cu Al8	M	min. 5	–	–	min. 150	approx. 440	min. 40	–
	HB	5 to 50			min. 390	approx. 570	min. 20	–
	HC	5 to 15			min. 440	approx. 610	min. 18	–
Cu Al8 Fe3	M	min. 5	–	–	min. 200	approx. 510	min. 25	–
	HA	5 to 50			min. 220	approx. 540	min. 20	–
	HB	5 to 15			min. 250	approx. 590	min. 20	–
Cu Al10 Fe3	M	min. 10	–	–	min. 200	approx. 540	min. 20	–
	HA	5 to 50			min. 250	approx. 590	min. 15	–
Cu Al10 Fe5 Ni5	M	min. 10	–	–	min. 290	approx. 690	min. 12	–
	HA	5 to 50			min. 340	approx. 740	min. 10	–
Cu Al9 Mn2	M	min. 5	–	–	min. 180	approx. 490	min. 20	–
	HA	5 to 50			min. 200	approx. 510	min. 20	–
	HB	15 to 50			min. 250	approx. 610	min. 15	–
Copper-nickel alloys								
Cu Ni30 Mn1 Fe	O	min. 5	–	–	–	–	min. 40	max. 110
	HB	5 to 15			–	420 to 520	approx. 20	approx. 120
Copper-nickel-zinc alloys								
Cu Ni18 Zn20	HA	5 to 50			–	470 to 570	approx. 22	approx. 150
	HB	5 to 15			–	540 to 640	approx. 8	approx. 175
Cu Ni15 Zn21	O	min. 5			–	–	min. 36	max. 120
	HB	5 to 15			–	440 to 540	approx. 18	approx. 140
Cu Ni12 Zn24	HA	5 to 50			–	440 to 540	approx. 22	approx. 150
	HB	5 to 15			–	540 to 640	approx. 5	approx. 185
Cu Ni18 Zn19 Pb1	HA	5 to 50			–	430 to 510	approx. 30	approx. 140
	HB	5 to 15			–	490 to 590	approx. 10	approx. 170
Cu Ni10 Zn28 Pb1	HA	5 to 50			–	410 to 550	approx. 15	approx. 150
	HB	5 to 15			–	480 to 690	approx. 8	approx. 170
	HB	–	max. 100	max. 300	–	470 to 610	approx. 8	approx. 170
Cu Ni10 Zn42 Pb2	HA	5 to 50			–	460 to 560	approx. 15	approx. 150
	HB	5 to 15			–	540 to 640	approx. 8	approx. 170

1) See page 3.

TABLE 2 (*concluded*)

Designation		Dimensions			$R_{p0,2}$	R_m	$A^{1)}$	HV
		Diameter	Rectangles					
Alloy	Temper	Width across flats	Thickness	Width				
		mm	mm	mm	N/mm²	N/mm²	%	
Special copper alloys								
Cu Si3 Mn1	M	min. 5	–	–	min. 120	approx. 410	min. 30	–
Cu Co2 Be	TF	max. 60	–	–	min. 500	approx. 700	min. 8	min. 195
Cu Ni1 Si	TD	max. 30			min. 290	approx. 450	min. 9	min. 110
	TH	max. 30			min. 540	approx. 630	min. 12	min. 160
Cu Ni2 Si	TD	max. 30			min. 340	approx. 450	min. 8	min. 130
	TH	max. 30			min. 590	approx. 670	min. 10	min. 180

1) See page 3.