

AS 2738:2023



STANDARDS
Australia



Copper and copper alloys — Compositions and designations of refinery products, wrought products, ingots and castings



AS 2738:2023

This Australian Standard ® was prepared by MT-002, Copper And Copper Alloys. It was approved on behalf of the Council of Standards Australia on 08 May 2023.

This Standard was published on 26 May 2023.

The following are represented on Committee MT-002:

- Australian Industry Group
- Australian Plumbing Manufacturers Association
- Consumer Electronics Suppliers Association
- Housing Industry Association
- International Copper Association Australia
- Joint Accreditation System of Australia & New Zealand
- Plastics Industry Pipe Association of Australia
- Plumbing Products Industry Group
- Water Services Association of Australia
- Weld Australia

This Standard was issued in draft form for comment as DR AS 2738:2023.

Keeping Standards up-to-date

Ensure you have the latest versions of our publications and keep up-to-date about Amendments, Rulings, Withdrawals, and new projects by visiting:

www.standards.org.au

ISBN 978 1 76139 194 1

Copper and copper alloys — Compositions and designations of refinery products, wrought products, ingots and castings

Originated in part as AS 2738.1—1984, AS 2738.2—1984 and AS 2738.3—1984.
Revised, amalgamated and redesignated as AS 2738—2000.
Second edition 2023.

© Standards Australia Limited 2023

All rights are reserved. No part of this work may be reproduced or copied in any form or by any means, electronic or mechanical, including photocopying, without the written permission of the publisher, unless otherwise permitted under the Copyright Act 1968 (Cth).

Preface

This Standard was prepared by the Joint Standards Australia/Standards New Zealand Committee MT-002, Copper and Copper Alloys, to supersede AS 2738—2000.

After consultation with stakeholders in both countries, Standards Australia and Standards New Zealand decided to develop this document as an Australian Standard rather than an Australian/New Zealand Standard.

The objective of this document is to list the designations and chemical composition limits for copper and copper alloy refinery, wrought, ingot and cast products in general use.

The major changes in this edition are as follows:

- (a) Alloy tables have been restructured to align with the UNS structure and EN equivalent alloys have been merged from Appendix A into compositional tables.
- (b) The list of alloys currently in use has been updated to accommodate maximum 0.25 wt.% lead-free legislation, as follows:
 - (i) Alloy C14430 replaces the old alloy 149 tin copper to align with the UNS system.
 - (ii) Alloy C62730A replaces the old alloy C62700 to align with the UNS system.
 - (iii) Alloy C64110 replaces the old alloy C64100 to align with the UNS system.
 - (iv) The following current alloys have had the suffix A added as they have a slight chemistry variation compared to the corresponding UNS alloy:
 - (A) C28000 is now C28000A.
 - (B) C33500 is now C33500A.
 - (C) C36000 is now C36000A.
 - (D) C48600 is now C48600A.
 - (v) The following new alloys have been added:

C10300	C27453	C46700	C61000	C67820A	C87600
C10800	C28340	C46750	C62730A	C69300	C87700
C11040	C31400	C49100	C63000	C69400	C87710
C12000	C35200A	C49260	C64110	C69850	C87850
C14430	C37700	C49265	C64200	C79620	C89836
C17200	C38010	C49340	C64210	C83800	C89844
C17300	C38501	C49350	C64700	C84400	C90250A
C19400	C44500	C49355	C65680	C85563	C90700
C27450	C46270	C49360	C67000	C85566	C95815A
C27451	C46500	C60800	C67130	C85706	C95820
- (c) Alloys which, by composition only, can have potential for DR properties have been identified.

The terms “normative” and “informative” are used in Standards to define the application of the appendices or annexes to which they apply. A “normative” appendix or annex is an integral part of a document, whereas an “informative” appendix or annex is only for information and guidance.

Contents

Preface	ii
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Designation systems	1
5 Chemical composition	2
5.1 Specific limits.....	2
5.2 Unnamed elements.....	2
6 Wrought alloys	2
6.1 Coppers (C10100 to C15999).....	2
6.2 High copper alloys (C16000 to C19999).....	6
6.3 Brasses (C20000 to C49999).....	8
6.4 Bronzes (C50000 to C66300).....	14
6.5 Miscellaneous copper-zinc alloys (C66400 to C69900).....	17
6.6 Copper-nickel alloys (C70000 to C73499).....	20
6.7 Copper-nickel-zinc alloys (nickel silvers) (C73500 to C79999).....	22
7 Cast alloys	24
7.1 Coppers, copper alloys and brasses (C80000 to C89999).....	24
7.2 Bronzes (C90000 to C96999).....	28
Bibliography	33

Australian Standard®

Copper and copper alloys — Compositions and designations of refinery products, wrought products, ingots and castings

1 Scope

This document lists the designations and chemical composition limits for copper and copper alloy refinery, wrought, ingot and cast products for use in Australia.

NOTE Copper and copper alloy products used for the conveyance of drinking water (potable), non-drinking water (e.g. recycled) and waste water may be subject to specific requirements as specified in relevant product Standards or specifications.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document.

NOTE Documents referenced for informative purposes are listed in the Bibliography.

AS/NZS 3500.0, *Plumbing and drainage, Part 0: Glossary of terms*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in AS/NZS 3500.0 and the following apply.

3.1

may

indicates the existence of an option

3.2

shall

indicates that a statement is mandatory

3.3

should

indicates a recommendation

4 Designation systems

The alloy designation shall be in accordance with the Unified Numbering System (UNS), which comprises six characters commencing with the letter C.

The suffix letter A in [Tables 2 to 10](#) indicates a deviation in chemical composition from the corresponding UNS composition.

NOTE 1 The “related designations” for an alloy are intended to denote the closest related alloys, and minor variations in chemical composition may exist.

NOTE 2 Refer to CEN/TS 13388 and EN 1982 for information on related alloy designations.

NOTE 3 Alloys which are designated as “Potential DR” are those which, by composition alone, may be dezincification resistant, pending appropriate manufacturing processes. Alloys with the “Potential DR” column left blank have a higher potential for dezincification.

NOTE 4 Alloys which are designated as category 1 alloys in AS 2345, and do not require testing for dezincification resistance, are marked as N/A (not applicable) in the “Potential DR” column of [Tables 2 to 10](#).

5 Chemical composition

5.1 Specific limits

The method of expressing the limits of each specified element or impurity in a copper or a copper alloy, in terms of the number of decimal places, shall be in accordance with [Table 1](#).

NOTE The percentage content of elements shown as “REM” (remainder) is normally calculated by difference.

5.2 Unnamed elements

The limits specified in the chemical composition tables in [Clauses 6](#) and [7](#) of this document do not preclude the possible presence of other unnamed elements. However, analysis shall regularly be made for the minor elements listed in the tables, plus all major elements except one. For any major element which is not analysed, the percentage shall be determined by the difference between the sum of those elements analysed and 100 %.

Unless specified otherwise, the sum of copper (Cu) and named elements for an alloy shall be minimum 99.5 %.

NOTE By agreement between the parties, analysis may be required and limits established for elements not specified.

Table 1 — Convention for expressing chemical composition limits

Alloy designation	Elements	Convention for expressing limits as a percentage
C10000 to C15999 (wrought) and C80000 to C81199 (cast)	Copper	XX.XX
	Alloying elements and impurities	
	≥ 0.1	0.XX
	≥ 0.01 < 0.1	0.0XX
	≥ 0.001 < 0.01	0.00X
	< 0.001	0.000X
C16000 to C79999 (wrought) and C81300 to C99999 (cast)	Copper	XX.X
	Alloying elements and impurities	
	≥ 0.6	0.X, X.X, XX.X
	≥ 0.1 < 0.6	0.XX
	≥ 0.01 < 0.1	0.0X
	≥ 0.001 < 0.01	0.00X
	< 0.001	0.000X
NOTE X is the appropriate digit.		

6 Wrought alloys

NOTE The sampling requirements and the methods of chemical analysis for wrought products are specified in AS 1566, AS/NZS 1567, AS/NZS 1568, AS 1569, AS 1571, AS 1572, AS/NZS 1573, AS/NZS 1574 and other relevant Standards.

6.1 Coppers (C10100 to C15999)

[Table 2](#) shows the chemical composition of coppers, which contain a minimum of 99.3 % copper.

Table 2 — Chemical composition of coppers

Alloy designation	Range	Cu	Pb	Zn	Fe	P	As	Sb	Ag	O	Te	Other elements	Potential DR	Related designations
C10100i, k, l Oxygen-Free-Electronic OFE	MIN	99.99											N/A	CW009A
	MAX		0.0005	0.0001	0.001	0.0003	0.0005	0.0004	0.0025	0.0005	0.0002			
C10200i, m, n Oxygen-Free OF	MIN	99.95											N/A	CW008A
	MAX									0.001				
C10300n, o Oxygen-Free Copper OFXLP	MIN	99.95				0.001							N/A	CW020A
	MAX					0.005								
C10800n, o OFLP	MIN	99.95				0.005							N/A	CW020A
	MAX					0.012								
C11000a, i, n, q, r Electrolytic Tough Pitch ETP	MIN	99.9											N/A	CW004A
	MAX													
C11040i	MIN	99.9								0.010			N/A	CW003A
	MAX		0.0005		0.001		0.0005	0.0004	0.0025	0.065	0.0002			
C11600a, i, n, p, q, r Tough Pitch with Ag STP	MIN	99.9							0.085				N/A	CW013A
	MAX													
C12000i Phosphorus-Deoxidized, Low Residual P DLP	MIN	99.9				0.004							N/A	CW023A
	MAX					0.012								
C12200i, n, s Phosphorus-Deoxidized, High Residual P DHP	MIN	99.9				0.015							N/A	CW024A
	MAX					0.040								
C14300b, n, t Cadmium Copper, Deoxidized	MIN	99.9										0.05 Cd	N/A	
	MAX											0.15 Cd		
14410c, n, u	MIN	99.9				0.005						0.10 Sn	N/A	CW129C
	MAX		0.05		0.05	0.020						0.20 Sn		
14430a, g, h in Bearing Copper	MIN	Rem				0.01						0.25 Sn	N/A	CW129C
	MAX					0.03						0.35 Sn		

Table 2 (continued)

Alloy designation	Range	Cu	Pb	Zn	Fe	P	As	Sb	Ag	O	Te	Other elements	Potential DR	Related designations
C14510d, n, v Tellurium-Bearing	MIN	99.85				0.01					0.30		N/A	CW118C
	MAX		0.05			0.03					0.70			
C14530e	MIN	99.9				0.001					0.003	0.003 Sn	N/A	
	MAX					0.010					0.023	0.023 Sn		
C14700f, n, Sulfur-Bearing	MIN	99.9				0.002						0.20 S	N/A	CW114C
	MAX					0.005						0.50 S		

a Oxygen by agreement.

b Deoxidized with lithium or other suitable elements as agreed upon.

c Copper includes Ag + Sn.

d Copper includes tellurium.

e Copper includes Ag + Sn + Te + Se. Other elements: Te + Se 0.003–0.023.

f Includes oxygen-free or deoxidized grades with deoxidizers (such as boron or lithium) in an agreed amount. Copper includes sulfur and phosphorus.

g Electrolytic tough pitch copper (C11000) with a controlled addition of tin.

h Previously designated as Alloy 149.

i The sampling requirements and the methods of chemical analysis for refinery products are specified in AS/NZS 1279.

j This is a high conductivity copper which has, in the annealed condition, a minimum conductivity of 100 % IACS, except for Alloy C10100, which has a minimum conductivity of 101 % IACS.

k Cu is determined by the difference between the impurity total and 100 %. For alloy C10100, the Cu value is exclusive of Ag.

l The following additional impurity maximum limits shall apply: Bi 1 ppm (0.0001 %); Cd 1 ppm (0.0001 %); Mn 0.5 ppm (0.00005 %); Ni 10 ppm (0.0010 %); Se 3 ppm (0.0003 %); S 15 ppm (0.0015 %); Sn 2 ppm (0.0002).

m Cu is determined by the difference between the impurity total and 100 %.

n Cu value includes Ag.

o Cu value includes P.

p Ag 0.085 % min is the equivalent of Ag 25 Troy Oz min.

q This is a high conductivity copper which has, in the annealed condition, a minimum conductivity of 100 % IACS.

Oxygen and trace elements may vary depending on the process.

This includes oxygen-free Cu which contains P in an amount agreed upon. (25) = 0.025 Te + Se.

Cu value includes Cd. Deoxidized with Li or other suitable elements as agreed upon.

Table 2 (continued)

Alloy designation	Range	Cu	Pb	Zn	Fe	P	As	Sb	Ag	O	Te	Other elements	Potential DR	Related designations
u	Cu value includes Cu + Ag + Sn.													
v	Cu value includes Te + P.													

6.2 High copper alloys (C16000 to C19999)

[Table 3](#) shows the chemical composition of high copper alloys. High copper alloys have a copper content of 96 % to 99.3 %, and do not fall into other copper alloy groups.

Table 3 — Chemical composition of high copper alloys

Alloy designation	Range	Cu	Fe	Al	Be	Co	Si	Other elements	Potential DR	Related designations
C16200a, b Cadmium Copper	MIN							0.70 Cd	N/A	CW131C
	MAX	Rem	0.02					1.20 Cd		
C17000a, b, c Copper Beryllium	MIN				1.60	0.20			N/A	CW100C
	MAX	Rem		0.20	1.85		0.20			
C17200a, b, c Copper Beryllium	MIN				1.80	0.20			N/A	CW100C
	MAX	Rem		0.20	2.00		0.20			
C19400	MIN	97.0	2.1					0.05 Zn 0.015 P	N/A	CW107C
	MAX		2.6					0.20 Zn 0.150 P 0.03 Pb		

a Cu + sum of named elements, 99.5 % min.

b Cu value includes Ag.

c Ni + Co 0.20 % min. Ni + Fe + Co 0.6 % max.