
Soft solder alloys — Chemical compositions and forms

Alliages de brasage tendre — Compositions chimiques et formes

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Contents

Page

Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Chemical composition	1
5 Forms of delivery	1
5.1 General	1
5.2 Unit of product	2
6 Sampling and analysis	2
7 Marking, labelling and packaging	2
Annex A (informative) Comparison between alloy numbers in this document and short names and chemical compositions according to IEC 61190-1-3	10
Bibliography	13

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established 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. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 12, *Soldering materials*, in collaboration with the European Committee for Standardization (CEN) Technical Committee CEN/TC 121, *Welding*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This fourth edition cancels and replaces the third edition (ISO 9453:2014), which has been technically revised.

The main changes compared to the previous edition are as follows:

- alloys 303 and 304 have been added to [Table 3](#) and [Table A.1](#);
- [Table A.1](#) has been updated according to IEC 61190-1-3;
- patent information was updated on the relevant ISO web page and Annex B was removed.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Official interpretations of ISO/TC 44 documents, where they exist, are available from this page: <https://committee.iso.org/sites/tc44/home/interpretation.html>.

Introduction

The International Organization for Standardization (ISO) draws attention to the fact that it is claimed that compliance with this document may involve the use of a patent.

ISO takes no position concerning the evidence, validity and scope of this patent right.

The holder of this patent right has assured ISO that he/she is willing to negotiate licences under reasonable and non-discriminatory terms and conditions with applicants throughout the world. In this respect, the statement of the holder of this patent right is registered with ISO. Information may be obtained from the patent database available at www.iso.org/patents.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights other than those in the patent database. ISO shall not be held responsible for identifying any or all such patent rights.

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Soft solder alloys — Chemical compositions and forms

1 Scope

This document specifies the requirements for chemical composition for soft solder alloys containing two or more of: tin, lead, antimony, copper, silver, bismuth, zinc, indium and/or cadmium.

An indication of the forms generally available is also included.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

soft solder

metallic filler material which is used to join metallic parts and which has a melting temperature (liquidus) lower than that of the parts to be joined and, usually, lower than 450 °C and which wets the parent metals

3.2

batch

collection of one or more units of product, made in a single production operation

4 Chemical composition

The chemical composition of the soft solder, sampled and analysed in accordance with [Clause 6](#), shall be as given for the appropriate material in [Table 2](#) or [Table 3](#).

5 Forms of delivery

5.1 General

Soft solders conforming to this document shall be supplied in one of the following forms: ingot, slab, stick, bar, rod, wire, pellets, preforms, spheres, ribbons, powder or pastes and creams containing powder. Solder shall be uniform in quality and free from detrimental conditions such as contamination or surface oxide that prevent melting and flow in a manner suitable for the intended application.

NOTE 1 Solders supplied in the form of rod, wire, or preforms can be supplied with or without an integral flux, subject to agreement between the supplier and the purchaser.

NOTE 2 Not all the solder compositions given in the tables are necessarily available in all the product forms listed.

5.2 Unit of product

The unit of product used for defining the requirements for the marking of soft solders varies with the form of the solder (see [Table 1](#)).

Table 1 — Variations of unit of product with form of solder

Form of solder	Unit of product
Ingot, bar, slab, stick or rod	A single ingot, bar, slab, stick or rod
Wire or ribbon	A single coil or reel
Preforms and rings, spheres, pellets or powder	The individual packaged quantity
Powder in solder pastes	The individual packaged quantity

6 Sampling and analysis

The recommended method of analysis for soft solder alloys is induced coupled plasma (ICP). The methods used shall be agreed between the supplier and the purchaser.

NOTE Other acceptable analysis methods are Spark optical emission spectrometry (Spark-OES) and atomic absorption spectroscopy (AAS).

7 Marking, labelling and packaging

Each batch of solder supplied in accordance with this document shall be marked with the information indicated by a cross in [Table 4](#).

The information in [Table 4](#) shall be applied to the product forms as follows:

- for ingots and slabs: by stamping or inkjet marking on the surface of each unit of product;
- for sticks, bars, rods and wire in coil: either on a label securely attached to each unit of product, or on a label on the package in which the units of product are contained;
- for wire or ribbon on reels: on a label on each reel;
- for pellets, performs, spheres, powder, paste or cream: on a label on each individually packaged quantity;
- all applicable health and safety markings including lead free marking or lead containing marking;
- any other information which may be pertinent to the particular solder form.

Table 2 — Chemical compositions of lead containing solder alloys
(tin-lead, lead-tin, tin-lead-antimony, tin-lead-bismuth, tin-lead-cadmium, tin-lead-copper, tin-lead-silver, and lead-silver)

Group	Alloy No. ^a	Alloy designation	Melting or solidus/liquidus temperature ^b °C	Chemical composition, mass fraction in % ^{c,d}													
				Sn	Pb	Sb	Bi	Cd	Cu	Au	In	Ag	Al	As	Fe	Ni	Zn
Tin-lead binary alloys solidus temperature 183 °C	101	Sn63Pb37	183	62,5 to 63,5	Rem	0,20	0,10	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	102	Sn63Pb37E	183	62,5 to 63,5	Rem	0,05	0,05	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	103	Sn60Pb40	183/190	59,5 to 60,5	Rem	0,20	0,10	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	104	Sn60Pb40E	183/190	59,5 to 60,5	Rem	0,05	0,05	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
Lead-tin binary alloys solidus temperature 183 °C	111	Pb50Sn50	183/215	49,5 to 50,5	Rem	0,20	0,10	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	112	Pb50Sn50E	183/215	49,5 to 50,5	Rem	0,05	0,05	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	113	Pb55Sn45	183/226	44,5 to 45,5	Rem	0,50	0,25	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	114	Pb60Sn40	183/238	39,5 to 40,5	Rem	0,50	0,25	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	115	Pb65Sn35	183/245	34,5 to 35,5	Rem	0,50	0,25	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	116	Pb70Sn30	183/255	29,5 to 30,5	Rem	0,50	0,25	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	117	Pb80Sn20	183/280	19,5 to 20,5	Rem	0,50	0,25	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
^a For information on IEC short alloy names, see Table A.1 .																	
^b The temperatures are for information purposes and are not specified requirements for the alloy.																	
^c All single figure limits are maximum values.																	
^d Elements shown as “Rem” (i.e. Remainder) are calculated as differences from 100 %.																	

Table 2 (continued)

Group	Alloy No. ^a	Alloy designation	Melting or solidus/liquidus temperature ^b °C	Chemical composition, mass fraction in % ^{c,d}													
				Sn	Pb	Sb	Bi	Cd	Cu	Au	In	Ag	Al	As	Fe	Ni	Zn
Lead-tin binary alloys solidus temperature >183 °C	121	Pb85Sn15	226/290	14,5 to 15,5	Rem	0,50	0,25	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	122	Pb90Sn10	268/302	9,5 to 10,5	Rem	0,50	0,25	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	123	Pb95Sn5	300/314	4,5 to 5,5	Rem	0,50	0,10	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	124	Pb98Sn2	320/325	1,8 to 2,2	Rem	0,12	0,10	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
Tin-lead-antimony	131	Sn63Pb37Sb	183	62,5 to 63,5	Rem	0,20 to 0,50	0,10	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	132	Sn60Pb40Sb	183/190	59,5 to 60,5	Rem	0,20 to 0,50	0,10	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	133	Pb50Sn50Sb	183/216	49,5 to 50,5	Rem	0,20 to 0,50	0,10	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	134	Pb58Sn40Sb2	185/231	39,5 to 40,5	Rem	2,0 to 2,4	0,25	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	135	Pb69Sn30Sb1	185/250	29,5 to 30,5	Rem	0,5 to 1,8	0,25	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
Tin-lead-bismuth	136	Pb74Sn25Sb1	185/263	24,5 to 25,5	Rem	0,5 to 2,0	0,25	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	137	Pb78Sn20Sb2	185/270	19,5 to 20,5	Rem	0,5 to 3,0	0,25	0,005	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	141	Sn60Pb38Bi2	180/185	59,5 to 60,5	Rem	0,20	2,0 to 3,0	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
Tin-lead-cadmium	142	Pb49Sn48Bi3	178/205	47,5 to 48,5	Rem	0,20	2,5 to 3,5	0,002	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	151	Sn50Pb32Cd18	145	49,5 to 50,5	Rem	0,20	0,10	17,5 to 18,5	0,08	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001

^a For information on IEC short alloy names, see [Table A.1](#).

^b The temperatures are for information purposes and are not specified requirements for the alloy.

^c All single figure limits are maximum values.

^d Elements shown as “Rem” (i.e. Remainder) are calculated as differences from 100 %.

Table 2 (continued)

Group	Alloy No. ^a	Alloy designation	Melting or solidus/liquidus temperature ^b °C	Chemical composition, mass fraction in % ^{c,d}													
				Sn	Pb	Sb	Bi	Cd	Cu	Au	In	Ag	Al	As	Fe	Ni	Zn
Tin-lead-copper	161	Sn60Pb39Cu1	183/190	59,5 to 60,5	Rem	0,20	0,10	0,002	1,2 to 1,6	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
	162	Sn50Pb49Cu1	183/215	49,5 to 50,5	Rem	0,20	0,10	0,002	1,2 to 1,6	0,05	0,10	0,10	0,001	0,03	0,02	0,01	0,001
Tin-lead-silver	171	Sn62Pb36Ag2	179	61,5 to 62,5	Rem	0,20	0,10	0,002	0,08	0,05	0,10	1,8 to 2,2	0,001	0,03	0,02	0,01	0,001
Lead-silver	181	Pb98Ag2	304/305	0,25	Rem	0,20	0,10	0,002	0,08	0,05	0,10	2,0 to 3,0	0,001	0,03	0,02	0,01	0,001
	182	Pb95Ag5	304/370	0,25	Rem	0,20	0,10	0,002	0,08	0,05	0,10	5,0 to 6,0	0,001	0,03	0,02	0,01	0,001
Lead-silver-tin	191	Pb93Sn5Ag2	296/301	4,8 to 5,2	Rem	0,20	0,10	0,002	0,08	0,05	0,10	1,2 to 1,8	0,001	0,03	0,02	0,01	0,001

^a For information on IEC short alloy names, see [Table A.1](#).

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