
**Soft solder alloys — Chemical
compositions and forms**

Alliages de brasage tendre — Compositions chimiques et formes

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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. 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. 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 on the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the WTO principles in the Technical Barriers to Trade (TBT), see the following URL: Foreword - Supplementary information

The committee responsible for this document is ISO/TC 44, *Welding*, Subcommittee SC 12, *Soldering materials*.

This third edition cancels and replaces the second edition (ISO 9453:2006), which has been technically revised.

Request for an official interpretation of technical aspects of this International Standard should be directed to the relevant secretariat of ISO/TC 44/SC 12 "Soldering materials" via the user's national standardization body; a listing of these bodies can be found at: <http://www.iso.org>.

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 patents concerning soft solder alloy compositions given in [Table 3](#).

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

The holder of this patent right has ensured the ISO that he/she is willing to negotiate licences either free of charge or 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 [Annex B](#).

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

ISO (www.iso.org/patents) maintains online databases of patents relevant to their standards. Users are encouraged to consult the databases for the most up to date information concerning patents.

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Soft solder alloys — Chemical compositions and forms

1 Scope

WARNING — National or regional regulations may limit the employment of certain alloys.

This International Standard 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

The following documents, in whole or in part, are normatively referenced in this document and are indispensable for its application. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3677, *Filler metal for soft soldering, brazing and braze welding — Designation*

3 Terms and definitions

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

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 1](#) or [Table 2](#).

5 Forms of delivery

5.1 General

Soft solders conforming to this International Standard shall be supplied in one of the following forms: ingot, slab, stick, bar, rod, wire, pellets, preforms, rings, spheres, ribbons, powder or soldering pastes. 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.

NOTE 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 soldering pastes	The individual packaged quantity

6 Sampling and analysis

Pending the publication of International Standards for sampling and for methods of analysis for soft solder alloys, the methods used shall, in cases of dispute, be agreed between the supplier and the purchaser.

NOTE Preferred analysis methods are Spark-OES and AAS.

7 Marking, labelling and packaging

Each batch of solder supplied in accordance with this International Standard 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:

- a) for ingots and slabs: by stamping, or inkjet marking on the surface of each unit of product;
- b) 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;
- c) for wire or ribbon on reels: on a label on each reel;
- d) for pellets, preforms, spheres, powder, soldering paste: on a label on each individually packaged quantity.

All product forms shall also be labelled with any health and safety warnings required by the relevant rules and regulations of the country of manufacture, or as specified in the order.

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 Designation according to ISO 3677 ^b	Melting or solidus/liquidus temperature °C ^c	Chemical composition, mass fraction in % ^{d,e}													
			Sn	Pb	Sb	Bi	Cd	Cu	Au	In	Ag	Al	As	Fe	Ni	Zn
Tin-lead binary alloys solidus temperature 183 °C	101	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	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	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	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	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	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	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	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
Lead-tin binary alloys solidus temperature > 183 °C	115	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	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	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
	121	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
Lead-tin binary alloys solidus temperature > 183 °C	122	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	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	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

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

^b In the proposed revision of ISO 3677, "S-" should be deleted from the alloy designation.

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

^d All single figure limits are maximum values.

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

Table 2 (continued)

Group	Alloy Designation according to ISO 3677 ^b	Melting or solidus/liquidus temperature °C ^c	Chemical composition, mass fraction in % ^{d,e}													
			Sn	Pb	Sb	Bi	Cd	Cu	Au	In	Ag	Al	As	Fe	Ni	Zn
Tin-lead-antimony	131	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	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	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	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	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	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	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
Tin-lead-bismuth	141	180/185	59,5 to 60,5	Rem	0,20 to 3,0	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
	142	178/205	47,5 to 48,5	Rem	0,20 to 3,5	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

^a For information on IEC short alloy names see Table A.1.

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

Table 2 (continued)

Group	Alloy No. ^a	Alloy Designation according to ISO 3677 ^b	Melting or solidus/liquidus temperature °C ^c	Chemical composition, mass fraction in % ^{d,e}													
				Sn	Pb	Sb	Bi	Cd	Cu	Au	In	Ag	Al	As	Fe	Ni	Zn
Tin-lead-cadmium	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
	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
Tin-lead-copper	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
	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
Tin-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](#).

^b In the proposed revision of ISO 3677, "S-" should be deleted from the alloy designation.

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

^d All single figure limits are maximum values.

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