

# INTERNATIONAL STANDARD

# ISO 9453

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## Soft solder alloys — Chemical compositions and forms

*Alliages de brasage tendre — Composition chimique et formes*

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## Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

International Standard ISO 9453 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*.

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# Soft solder alloys – Chemical compositions and forms

## 1 Scope

This International Standard specifies the requirements for chemical composition for the following families of soft solder alloys:

- tin-lead, with and without antimony;
- tin-silver, with and without lead;
- tin-copper, with and without lead;
- tin-antimony;
- tin-lead-bismuth;
- bismuth-tin;
- tin-lead-cadmium;
- tin-indium;
- lead-silver, with and without tin.

An indication of the forms generally available is also included.

## 2 Definitions

For the purposes of this International Standard, the following definitions apply.

**2.1 soft solder:** A 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.

**2.2 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, as follows:

Form of solder	Unit of product
Ingot, bar, slab, stick or rod	A single ingot, bar, slab, stick or rod
Wire	A single coil or reel
Wrought preforms and rings, pellets or powder	The individual packaged quantity

**2.3 batch:** A collection of one or more units of product, made from a single uniform melt.

## 3 Chemical composition

The chemical composition of the soft solder, sampled and analysed in accordance with clause 5, shall be as given for the appropriate material in table 1 or table 2.

## 4 Forms of delivery

Soft solders complying with this International Standard shall be supplied in one of the following forms: ingot, slab, stick, bar, rod, wire, pellets, preforms or powder.

### NOTES

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

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

## 5 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.

## 6 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 3.

The information in table 3 shall be applied to the product forms as follows:

- Ingots and slabs: by stamping on the surface of each unit of product.
- 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.
- Wire on reels: on a label on each reel.
- Pellets, preforms and powder: 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 1 — Chemical compositions of tin-lead and tin-lead-antimony solder alloys

Group	Alloy No.	Alloy designation	Melting or solidus/liquidus temperature °C	Chemical composition % (m/m)										Sum of all impurities except Sb Bi and Cu
				Sn	Pb	Sb	Cd	Zn	Al	Bi	As	Fe	Cu	
Tin-lead alloys	1	S-Sn63Pb37	183	62,5 to 63,5	Rem	0,12	0,002	0,001	0,001	0,10	0,03	0,02	0,05	0,08
	1a	S-Sn63Pb37E	183	62,5 to 63,5	Rem	0,05	0,002	0,001	0,001	0,05	0,03	0,02	0,05	0,08
	2	S-Sn60Pb40	183-190	59,5 to 60,5	Rem	0,12	0,002	0,001	0,001	0,10	0,03	0,02	0,05	0,08
	2a	S-Sn60Pb40E	183-190	59,5 to 60,5	Rem	0,05	0,002	0,001	0,001	0,05	0,03	0,02	0,05	0,08
	3	S-Pb50Sn50	183-215	49,5 to 50,5	Rem	0,12	0,002	0,001	0,001	0,10	0,03	0,02	0,05	0,08
	3a	S-Pb50Sn50E	183-215	49,5 to 50,5	Rem	0,05	0,002	0,001	0,001	0,05	0,03	0,02	0,05	0,08
	4	S-Pb55Sn45	183-226	44,5 to 45,5	Rem	0,50	0,005	0,001	0,001	0,25	0,03	0,02	0,08	0,08
	5	S-Pb60Sn40	183-235	39,5 to 40,5	Rem	0,50	0,005	0,001	0,001	0,25	0,03	0,02	0,08	0,08
	6	S-Pb65Sn35	183-245	34,5 to 35,5	Rem	0,50	0,005	0,001	0,001	0,25	0,03	0,02	0,08	0,08
	7	S-Pb70Sn30	183-255	29,5 to 30,5	Rem	0,50	0,005	0,001	0,001	0,25	0,03	0,02	0,08	0,08
Tin-lead alloys with antimony	8	S-Pb90Sn10	268-302	9,5 to 10,5	Rem	0,50	0,005	0,001	0,001	0,25	0,03	0,02	0,08	0,08
	9	S-Pb92Sn8	280-305	7,5 to 8,5	Rem	0,50	0,005	0,001	0,001	0,25	0,03	0,02	0,08	0,08
	10	S-Pb98Sn2	320-325	1,5 to 2,5	Rem	0,12	0,002	0,001	0,001	0,10	0,03	0,02	0,05	0,08
	11	S-Sn63Pb37Sb	183	62,5 to 63,5	Rem	0,12 to 0,50	0,002	0,001	0,001	0,10	0,03	0,02	0,05	0,08
	12	S-Sn60Pb40Sb	183-190	59,5 to 60,5	Rem	0,12 to 0,50	0,002	0,001	0,001	0,10	0,03	0,02	0,05	0,08
	13	S-Pb50Sn50Sb	183-216	49,5 to 50,5	Rem	0,12 to 0,50	0,002	0,001	0,001	0,10	0,03	0,02	0,05	0,08
	14	S-Pb58Sn40Sb2	185-231	39,5 to 40,5	Rem	2,0 to 2,4	0,005	0,001	0,001	0,25	0,03	0,02	0,08	0,08
	15	S-Pb69Sn30Sb1	185-250	29,5 to 30,5	Rem	0,5 to 1,8	0,005	0,001	0,001	0,25	0,03	0,02	0,08	0,08
	16	S-Pb74Sn25Sb1	185-263	24,5 to 25,5	Rem	0,5 to 2,0	0,005	0,001	0,001	0,25	0,03	0,02	0,08	0,08
	17	S-Pb78Sn20Sb2	185-270	19,5 to 20,5	Rem	0,5 to 3,0	0,005	0,001	0,001	0,25	0,03	0,02	0,08	0,08

1) All single figure limits are maxima.

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

3) The temperatures given under the heading "Melting or solidus/liquidus temperature" are for information purposes and are not specified requirements for the alloys.

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Table 2 Chemical compositions of soft solder alloys other than tin-lead and tin-lead-antimony alloys

Group	Alloy No.	Alloy designation	Melting or solidus/liquidus temperature °C	Chemical composition % (m/m)													Sum of all impurities	
				Sn	Pb	Sb	Bi	Cd	Cu	In	Ag	Al	As	Fe	Zn			
Tin-antimony	18	S-Sn95Sb5	230-240	Rem	0,10	4,5 to 5,5	0,10	0,002	0,10	0,05	0,05	0,03	0,02	0,001	0,03	0,02	0,001	0,2
Tin-lead-bismuth and bismuth-tin alloys	19	S-Sn60Pb38Bi2	180-185	Rem	2,0 to 3,0	0,10	0,002	0,10	0,05	0,05	0,05	0,03	0,02	0,001	0,03	0,02	0,001	0,2
	20	S-Pb49Sn48Bi3	178-205	Rem	2,5 to 3,5	0,10	0,002	0,10	0,05	0,05	0,05	0,03	0,02	0,001	0,03	0,02	0,001	0,2
	21	S-Bi57Sn43	138	Rem	Rem	0,10	0,002	0,10	0,05	0,05	0,05	0,03	0,02	0,001	0,03	0,02	0,001	0,2
Tin-lead-cadmium	22	S-Sn50Pb32Cd18	145	Rem	0,10	0,10	17,5 to 18,5	0,10	0,05	0,05	0,05	0,03	0,02	0,001	0,03	0,02	0,001	0,2
Tin-copper and tin-lead-copper alloys	23	S-Sn99Cu1	230-240	Rem	0,10	0,05	0,002	0,45 to 0,90	0,05	0,05	0,05	0,03	0,02	0,001	0,03	0,02	0,001	0,2
	24	S-Sn97Cu3	230-250	Rem	0,10	0,05	0,002	2,5 to 3,5	0,05	0,05	0,05	0,03	0,02	0,001	0,03	0,02	0,001	0,2
	25	S-Sn60Pb38Cu2	183-190	Rem	0,10	0,10	0,002	1,5 to 2,0	0,05	0,05	0,05	0,03	0,02	0,001	0,03	0,02	0,001	0,2
	26	S-Sn50Pb49Cu1	183-215	Rem	0,10	0,10	0,002	1,2 to 1,6	0,05	0,05	0,05	0,03	0,02	0,001	0,03	0,02	0,001	0,2
Tin-indium	27	S-Sn50In50	117-125	0,05	0,10	0,05	0,002	0,05	Rem	0,01	0,03	0,03	0,02	0,001	0,03	0,02	0,001	0,2
Tin-silver and tin-lead-silver alloys	28	S-Sn96Ag4	221	Rem	0,10	0,10	0,002	0,05	0,05	3,5 to 4,0	0,03	0,03	0,02	0,001	0,03	0,02	0,001	0,2
	29	S-Sn97Ag3	221-230	Rem	0,10	0,10	0,002	0,10	0,05	3,0 to 3,5	0,03	0,03	0,02	0,001	0,03	0,02	0,001	0,2
	30	S-Sn62Pb36Ag2	178-190	Rem	0,10	0,05	0,002	0,05	0,05	1,8 to 2,2	0,03	0,03	0,02	0,001	0,03	0,02	0,001	0,2
	31	S-Sn60Pb36Ag4	178-180	Rem	0,10	0,05	0,002	0,05	0,05	3,0 to 4,0	0,03	0,03	0,02	0,001	0,03	0,02	0,001	0,2
Lead-silver and lead-tin-silver alloys	32	S-Pb98Ag2	304-305	Rem	0,10	0,10	0,002	0,05	0,05	2,0 to 3,0	0,03	0,03	0,02	0,001	0,03	0,02	0,001	0,2
	33	S-Pb95Ag5	304-365	Rem	0,10	0,10	0,002	0,05	0,05	4,5 to 6,0	0,03	0,03	0,02	0,001	0,03	0,02	0,001	0,2
	34	S-Pb93Sn5Ag2	296-301	Rem	0,10	0,10	0,002	0,05	0,05	1,2 to 1,8	0,03	0,03	0,02	0,001	0,03	0,02	0,001	0,2

NOTES

- 1 All single figure limits are maxima.
- 2 Elements shown as "Rem" (i.e. Remainder) are calculated as differences from 100 %.
- 3 The temperatures given under the heading "Melting or solidus/liquidus temperature" are for information purposes and are not specified requirements for the alloys.

**Table 3 – Marking requirements for soft solders**

Mark	Ingots	Slabs	Sticks	Bars	Rods	Wire	Pellets	Preforms	Powder
Alloy number or alloy designation	x	x	x	x	x	x	x	x	x
Batch No.	x	x	x	x	x	x	x	x	x
Date of manufacture								x	x
Storage conditions								x	x
Mass and quantity (where applicable)						x	x	x	x
Manufacturer's name or trade mark						x	x	x	x

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**Descriptors :** fillers, solders, alloys, chemical composition, form specifications, specifications.

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