International Standard

ISO 12224-1

Second edition
2024-05

Solder wire, solid and flux-cored — Specification and test methods —

Part 1: Classification and performance requirements

Fils d'apport de brasage tendre, pleins et à flux incorporé — Spécifications et méthodes d'essai —

Partie 1: Classification et exigences de performance

Reference number
ISO 12224-1:2024(en)

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Published in Switzerland

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Foreword

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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 document 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).

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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 and allied processes*, in accordance with the Agreement on technical cooperation between ISO and CEN (Vienna Agreement).

This second edition cancels and replaces the first edition (ISO 12224-1:1997), which has been technically revised.

The main changes are as follows:

— Table 1: greater nominal contents added;

— former 5.5 and Table 3 deleted because the spread test is not commonly used;

— former 5.6.1 deleted because the test method was withdrawn;

— 6.1: reference to ISO 10564, which has been withdrawn, replaced by a recommended method;

— in Table A.1 the column for method D was deleted;

— in Table C.1 withdrawn standards were deleted and flux types were grouped;

— designations aligned with ISO 9454-1.

A list of all parts in the ISO 12224 series can be found on the ISO website.

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.

Solder wire, solid and flux-cored — Specification and test methods —

Part 1:
Classification and performance requirements

1 Scope

This document specifies a coding system for the classification and designation of solid and flux-cored solder wire, and the performance requirements to be met by flux-cored wire and its constituents. Requirements for sampling, labelling and packaging are also specified.

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. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 9453, *Soft solder alloys — Chemical compositions and forms*

ISO 9454-1, *Soft soldering fluxes — Classification and requirements — Part 1: Classification, labelling and packaging*

ISO 9455-15, *Soft soldering fluxes — Test methods — Part 15: Copper corrosion test*

ISO 9455-17, *Soft soldering fluxes — Test methods — Part 17: Surface insulation resistance comb test and electrochemical migration test of flux residues*

ISO 12224-2, *Solder wire, solid and flux-cored — Specification and test methods — Part 2: Determination of flux content*

3 Terms and definitions

No terms and definitions are listed in this document.

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

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at https://www.electropedia.org/

4 Classification and designation

4.1 Solder alloy designation

The solder alloy used for solid wire, and for the solder component of flux-cored solder wire, shall be designated in accordance with the solder alloy designations given in ISO 9453.

4.2 Flux classification

The flux component of flux-cored solder wire shall be classified in accordance with the system, based on the main fluxing ingredients, given in ISO 9454-1.

Annex C gives guidance on the test methods appropriate for the flux types incorporated in flux-cored solder wire.

4.3 Designation of flux-cored solder wire

The designations for solid and flux-cored solder wire shall consist of the following parts:

a) reference to this document (i.e. ISO 12224-1);

b) the appropriate soft solder alloy designation in accordance with ISO 9453;

c) in the case of flux-cored solder wire, the appropriate flux classification in accordance with ISO 9454-1.

The three parts of the designation shall be separated by an oblique stroke (/).

EXAMPLE 1 A solid solder wire, which corresponds to ISO 12224-1, made of 99,3/0,7 tin-copper soft solder, is designated as follows:

ISO 12224-1/Sn99,3Cu0,7

EXAMPLE 2 A flux-filled solder wire, which corresponds to ISO 12224-1, made of 99,3/0,7 tin-copper soft solder with a halogen-activated rosin filling, is designated as follows:

ISO 12224-1/Sn99,3Cu0,7/1.1.2.3

5 Requirements

5.1 Solder alloy composition of solid and flux-cored solder wire

Solid solder wire shall conform to the requirements for the appropriate alloy given in ISO 9453.

The solder component of flux-cored solder wire shall conform to the requirements for the appropriate alloy given in ISO 9453.

5.2 Flux composition of flux-cored solder wire

After solvent extraction of flux from a sample of the flux-cored solder wire, using the method given in Annex A, the flux composition shall conform to the requirements for the appropriate flux type given in ISO 9454-1. The solution so obtained may be used for testing purposes.

5.3 Flux content

Table 1 gives the recommended (or preferred) nominal flux contents which are generally available for flux-cored solder wire.

When tested in accordance with the method given in ISO 12224-2, the flux content of the sample shall be within the permitted range for the appropriate nominal content given in Table 1.

Table 1 — Recommended (preferred) nominal flux contents[a]

Percentage mass flux contents

Recommended nominal content (see note)	Permitted range	
	min.	max.
NIL	—	—
0,3	0,15	0,45
0,5	0,35	0,65
1,0	0,85	1,15
1,5	1,2	1,8
2,0	1,7	2,3
2,5	2,2	2,8
3,0	2,7	3,3
3,5	3,2	3,8
4,0	3,7	4,3
4,5	4,2	4,8
5,0	4,7	5,3
5,5	5,2	5,8
6,0	5,7	6,3
6,5	6,2	6,8

[a] Other nominal flux contents may be specified, subject to agreement between purchaser and supplier. In all cases, the permitted range shall be based on a tolerance of ±0,15 % for nominal contents 1,0 % or less and ±0,3 % for nominal contents above 1,0 %.

The flux core(s) shall be continuous and uniform along the length of the flux-cored solder wire.

5.4 Dimensions and tolerances

Table 2 gives the recommended (or preferred) nominal sizes of solid and flux-cored solder wire which are generally available and the associated tolerance values.

When measuring the mean diameter of flux-cored solder wire in accordance with Annex B, the mean diameter at each location shall conform to the tolerances given for the appropriate nominal diameter in Table 2.

Table 2 — Recommended (preferred) nominal diameters and tolerances

Dimensions in mm

Recommended nominal diameter	Tolerance on mean diameter
< 0,5	±0,03
≥ 0,5 to 2,5	±0,05
> 2,5	±0,1

5.5 Copper corrosion test

When the flux-cored solder wire is tested in accordance with ISO 9455-15, there shall be no evidence of corrosion:

— after 21 days, for wire having core of flux type 111 or 121;

— after 3 days, for wire having core of flux type 112, 113, 122, 123, 222 or 223.

5.6 Influence of flux vapours on insulation resistance (applicable only to flux-cored solder wires containing type 1 and type 22 fluxes)

When the flux-cored solder wire is tested in accordance with ISO 9455-17, the insulation resistance of the comb pattern shall not decrease by more than one decade.

6 Sampling

6.1 Sampling for chemical analysis of the solder

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).

The minimum sample amount is 20 g of a flux-cored solder wire. The solder and the flux are separated by melting the solder wire in a suitable crucible and then poured into a mould with a flat bottom, while pouring off as little flux as possible. After the solder has solidified, any flux residues shall be thoroughly removed with a suitable solvent.

6.2 Sampling for tests to determine the properties of the flux core (i.e. tests as described in the ISO 9455 series)

Select a sample at random from each batch of flux-cored solder wire to be tested. The sample size shall be as indicated in Annex A.

Extract the flux from the sample, following the procedure given in Annex A. Adjust the flux concentration of the resulting solution, by dilution or evaporation, to that required in the relevant part(s) of the ISO 9455 series.

6.3 Sampling for tests to determine the flux content and the diameter of the flux-cored solder wire

Select samples from the batch of flux-cored solder wire, as follows:

a) where the batch consists of up to four units of product (i.e. reel, coil or pack), select all units;

b) where the batch consists of over four, up to and including 44 units of product, select at random four units;

c) where the batch consists of n units of product ($n > 44$), select at random 0,1 n units (to the nearest integer above 0,1 n).

From each selected unit, cut back approximately 2 m from the free end of the wire and then cut a test specimen, approximately 2 m in length, for the determination of flux content and wire diameter.

7 Marking, labelling and packaging

Flux-cored solder wire shall be suitably packed to avoid damage or deterioration in handling and storage.

Each package (i. e. each reel, coil or other unit of product) of flux-cored solder wire supplied in accordance with this document shall carry a label bearing the following information:

a) the supplier's name or identification;

b) the designation of the flux-cored solder wire, in accordance with the designation system described in 4.3;

c) the flux content;

d) the nominal wire diameter;

e) the net mass of reel or coil;

f) the batch number and/or date of manufacture.

NOTE Local legislation on health and safety warnings can exist.

Annex A
(normative)

Method for the solvent extraction of the flux from flux-cored solder wire

A.1 General

This method for the solvent extraction of the flux core of the solder wire produces a flux solution which may be used for carrying out tests on the flux core, as described in the ISO 9455 series. The method described yields only sufficient flux test solution for a single determination. Alternatively, a flux sample obtained from a flux supplier may be used.

A.2 Principle

The flux is extracted from the cored wire with an appropriate solvent to give a solution of the flux for testing purposes.

A.3 Reagents

A.3.1 Acetone.

A.3.2 Propan-2-ol. If the flux is not soluble in propan-2-ol, then use another suitable solvent. For example, water should be used in the case of a water-soluble flux.

A.4 Apparatus and materials

The usual laboratory apparatus and, in particular, the following shall be used.

A.4.1 Laboratory balance, with an accuracy of 0,1 mg.

A.4.2 Scalpel.

A.4.3 Soxhlet extraction apparatus, equipped with a sintered glass extraction thimble, porosity 40 µm to 100 µm (i. e. porosity grade P100 specified in ISO 4793).

A.4.4 Drying oven, suitable for use at (100 ± 5) °C.

A.5 Procedure

Ascertain the approximate mass of solid flux required in the ISO 9455 method to be carried out. For instance:

— the determination of the acid value, in accordance with ISO 9455-3, requires 0,5 g of flux;

— the determination of the halide content in accordance with method A of ISO 9455-6 requires a mass of flux in accordance with Table A.1;

— the qualitative test for the presence of ionic halides in accordance with method D of ISO 9455-6 requires a sample of the flux-cored solder weighing approximately 150 g.

Table A.1 — Mass of flux required for determination of the halide content in accordance with method A of ISO 9455-6

Halide mass concentration range %	Method A
0,05 to 0,1	1 g
0,1 to 1,0	0,5 g
1,0 to 2,0	0,25 g

Using Table A.2, take a sufficient sample of the cored wire to provide the required mass of flux.

Table A.2 — Nominal mass flux content of cored wire and corresponding mass of wire containing approximately 1 g of flux

Nominal mass flux content of cored wire %	Mass of wire containing approximately 1 g of flux g
0,3	300
0,5	200
1,0	100
1,5	75
2,0	50
3,0	35
3,5	30

Wipe the surface of the sample clean with a cloth moistened with acetone (A.3.1).

Protecting the solder surface from contamination, cut the sample into 3 mm to 5 mm lengths, using the scalpel (A.4.2), so as not to crimp the cut ends. Carry out this operation on a sheet of glossy paper, or on a white tile on a sheet of paper, so as not to lose any flux debris.

Weigh the sintered glass extraction thimble (A.4.3), carefully transfer all of the cut pieces of wire and flux debris to the thimble and re-weigh, both weighings being carried out to the nearest 0,1 mg. Calculate the mass of the sample used, m, in grams.

Carefully transfer the extraction thimble containing the cored wire pieces to the tube of a clean Soxhlet extraction apparatus (A.4.3).

NOTE Larger samples will possibly need to be split into two or more portions for Soxhlet extraction, depending on the capacity of the Soxhlet apparatus, the resulting extracts being aggregated and mixed.

Pour a quantity of propan-2-ol (A.3.2), or other suitable solvent (A.3.2), into the distillation flask of the apparatus (A.4.3). The volume of solvent to be used shall be sufficient to just overflow the thimble. Extract the flux into the solvent for a minimum of 30 min. The extract should be colourless.

Carefully decant the solvent containing the flux into a graduated 400 ml beaker, rinsing three times with the solvent, to ensure all the flux has been transferred.

Rinse the Soxhlet extraction tube and the sintered glass thimble two or three times with 10 ml amounts of the solvent. Collect all the solvent used and add it to the flux solution in the 400 ml beaker.

Dry the extraction thimble (A.4.3) in the drying oven (A.4.4) at (100 ± 5) °C, cool and reweigh to the nearest 0,1 mg. Calculate the mass of the "defluxed" solder wire sample, m_s, in grams.

The mass of flux, m_f, in grams, in the original sample is given by:

$$m_f = m_w - m_s \quad \text{(A.1)}$$

where

m_f is the mass of flux;

m_w is the mass of wire;

m_s is the mass of solder.

Adjust the non-volatile matter content of the extract in the 400 ml beaker by evaporation, or by dilution with the solvent used during the extraction stage, to (25 ± 2) % by mass to produce the flux test solution.