INTERNATIONAL STANDARD

ISO 12224-1

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

Part 1:
Classification and performance requirements

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

Partie 1: Classification et exigences de performance

Reference number
ISO 12224-1:1997(E)

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.

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 12224-1 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 12, *Soldering and brazing materials*.

ISO 12224 consists of the following parts, under the general title *Solder wire, solid and flux cored — Specification and test methods*:

— *Part 1: Classification and performance requirements*

— *Part 2: Determination of flux content*

— *Part 3: Wetting balance test*

Annexes A and B form an integral part of this International Standard. Annexes C and D are for information only.

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

Part 1:
Classification and performance requirements

1 Scope

This part of ISO 12224 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.

Annex A specifies a method for the solvent extraction of flux incorporated in flux cored solder wire. The solution so obtained may be used for testing purposes.

Annex B specifies the method for measuring the mean diameter of flux cored solder wire.

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

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this part of ISO 12224. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this part of ISO 12224 are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

ISO 9453:1990, *Soft solder alloys — Chemical compositions and forms.*

ISO 9454-1:1990, *Soft soldering fluxes — Classification and requirements — Part 1: Classification, labelling and packaging.*

ISO 9455-10:—[1)], *Soft soldering fluxes — Test methods — Part 10: Flux efficacy test, solder spread method.*

ISO 9455-12:1992, *Soft soldering fluxes — Test methods — Part 12: Steel tube corrosion test.*

ISO 9455-15:1996, *Soft soldering fluxes — Test methods — Part 15: Copper corrosion test.*

ISO 9455-17:—[1)], *Soft soldering fluxes — Test methods — Part 17: Surface insulation resistance comb test and electrical migration test of flux residues.*

ISO 10564:1993, *Soldering and brazing materials — Methods for the sampling of soft solders for analysis.*

ISO 12224-2:—[1)], *Solder wire, solid and flux cored — Specification and test methods — Part 2: Determination of flux content.*

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1) To be published.

3 Classification and designation

3.1 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.

3.2 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.

3.3 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 part of ISO 12224 (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 wire, conforming to this part of ISO 12224, in 60/40 tin/lead solder, is designated as follows:

ISO 12224-1/S-Sn60Pb40

EXAMPLE 2

A flux cored solder wire, conforming to this part of ISO 12224, consisting of 60/40 tin/lead solder having a core of halide activated colophony flux, is designated as follows:

ISO 12224-1/S-Sn60Pb40/1.1.2

4 Requirements

4.1 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.

4.2 Flux composition of flux cored solder wire

After extraction 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.

4.3 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

Percentage mass flux contents

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

NOTE — 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 less than 0,5 %, and ± 0,3 % for nominal contents 0,5 % and above.

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

4.4 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 tested in accordance with annex B, the mean diameter (i.e. the average of the maximum and minimum diameters at any one cross-section of the wire) 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 (see note)	**Tolerance on mean diameter**
0,3	± 0,03
0,4	
0,5	± 0,05
0,6	
0,7	
0,8	
1	
1,2	
1,5	
1,6	
2	
2,3	
2,5	
3	± 0,1

NOTE — Other nominal diameters may be specified, and the associated tolerance, subject to agreement between the purchaser and the supplier.

4.5 Wetting efficiency of flux cored solder wire – spread test

4.5.1 Applicability

The spread test shall only be applicable to flux cored solder wires of 1,5 mm nominal diameter, having a nominal flux content not less than 2,0 %, and a solder component consisting of one of the alloys: S-Sn63Pb37, S-Sn63Pb37E, S-Sn60Pb40, S-Sn60Pb40E or S-Sn62Pb36Ag2.

4.5.2 Minimum area of spread or ratio of spread

For flux cored solder wires to which the area of spread test or ratio of spread test is applicable (see 4.5.1), when tested in accordance with the method given in ISO 9455-10, the minimum area or ratio of spread shall conform to the appropriate requirement in table 3.

Table 3 — Minimum areas of spread for specific flux cored solder wire

Flux core type (ISO 9454-1:1990)	Minimum area of spread mm^2	Minimum ratio of spread %
1.1.1 and 1.2.1	80	65
1.1.2 and 1.2.2	200	85
1.1.3 and 1.2.3	110	80
2.1.1 and 2.2.1	80	65
2.1.2 and 2.2.2	150	85
2.1.3 and 2.2.3	100	80
3.1.1 and 3.1.2	180	85[1)]
3.3.1	120	70[1)]

1) Figures to be confirmed.

NOTE — A test for assessing the wetting efficiency of a flux, using a wetting balance, is being developed.

4.6 Corrosion by residues (applicable only to flux cored solder wires containing type 1, type 2.2.2 and type 2.2.3 fluxes)

4.6.1 Steel tube corrosion test

When the flux cored solder wire is tested in accordance with the method given in ISO 9455-12, there shall be no evidence of corrosion of the steel tube.

4.6.2 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 1.1.1 or 1.2.1;

— after 3 days, for wire having core of flux type 1.1.2, 1.1.3, 1.2.2, 1.2.3, 2.2.2 or 2.2.3.

4.7 Influence of flux vapours on insulation resistance (applicable only to flux cored solder wires containing type 1, type 2.2.2 and type 2.2.3 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.

5 Sampling

5.1 Sampling for chemical analysis of the solder

Select samples from the batch of flux cored solder wire and prepare analysis samples in accordance with the procedure given in ISO 10564.

5.2 Sampling for tests to determine the properties of the flux core (i.e. Tests as described in the various parts of ISO 9455)

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 ISO 9455.

5.3 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 4 units of product (i.e. reel, coil or pack), select all units;

b) where the batch consists of over 4, up to and including 44 units of product, select at random 4 units;

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

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.

6 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 part of ISO 12224 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 3.3;

c) the flux content;

d) the nominal wire diameter;

e) the nett weight of reel or coil;

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

g) any hazard or health and safety warnings required by local legislation.

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 various parts of ISO 9455. The method described yields only sufficient flux test solution for a single determination.

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.

NOTE — 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

Ordinary laboratory apparatus and

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 would require 0,5 g of flux;

— the determination of the halide content, in accordance with ISO 9455-6 would require a mass of flux in accordance with table A.1.

Table A.1

Halide mass concentration range %	Method A	Method D
0,05 to 0,1	1 g	0,5 g
0,1 to 1,0	0,5 g	0,25 g
1,0 to 2,0	0,25 g	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 %	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 may 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 (see note to 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 minutes.

NOTE — 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.