BS EN 61189-5-4:2015

BSI Standards Publication

Test methods for electrical materials, printed boards and other interconnection structures and assemblies

Part 5-4: General test methods for materials and assemblies — Solder alloys and fluxed and non-fluxed solid wire for printed board assemblies

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National foreword

This British Standard is the UK implementation of EN 61189-5-4:2015. It is identical to IEC 61189-5-4:2015. It supersedes BS IEC 61189-5-4:2015, which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee EPL/501, Electronic Assembly Technology.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Compliance with a British Standard cannot confer immunity from legal obligations.

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Amendments/corrigenda issued since publication

Date	Text affected
30 April 2015	This corrigendum renumbers BS IEC 61189-5-4:2015 as BS EN 61189-5-4:2015.

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English Version

Test methods for electrical materials, printed boards and other interconnection structures and assemblies - Part 5-4: General test methods for materials and assemblies - Solder alloys and fluxed and non-fluxed solid wire for printed board assemblies (IEC 61189-5-4:2015)

Méthodes d'essai pour les matériaux électriques, les cartes imprimées et autres structures d'interconnexion et ensembles - Partie 5-4: Méthodes d'essai générales pour les matériaux et les assemblages - Alliages à braser et brasages solides fluxés et non fluxés pour les assemblages de cartes imprimées (IEC 61189-5-4:2015)

Prüfverfahren für Elektromaterialien, Leiterplatten und andere Verbindungsstrukturen und Baugruppen - Teil 5-4: Allgemeine Prüfverfahren für Materialien und Baugruppen - Lotlegierungen und Lotdraht mit und ohne Flussmittel für bestückte Leiterplatten (IEC 61189-5-4:2015)

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European Committee for Electrotechnical Standardization
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Europäisches Komitee für Elektrotechnische Normung

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Foreword

The text of document 91/1212/FDIS, future edition 1 of IEC 61189-5-4, prepared by IEC/TC 91 "Electronics assembly technology" was submitted to the IEC-CENELEC parallel vote and approved by CENELEC as EN 61189-5-4:2015.

The following dates are fixed:

• latest date by which the document has to be implemented at national level by publication of an identical national standard or by endorsement	(dop)	2015-11-12
• latest date by which the national standards conflicting with the document have to be withdrawn	(dow)	2018-02-12

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Endorsement notice

The text of the International Standard IEC 61189-5-4:2015 was approved by CENELEC as a European Standard without any modification.

In the official version, for Bibliography, the following notes have to be added for the standards indicated:

IEC 60068-2-20	NOTE	Harmonized as EN 60068-2-20.
IEC 61189-1	NOTE	Harmonized as EN 61189-1.
IEC 61189-2:2006	NOTE	Harmonized as EN 61189-2:2006 (not modified).
IEC 61189-3:2007	NOTE	Harmonized as EN 61189-3:2008 (not modified).
IEC 61190-1-1	NOTE	Harmonized as EN 61190-1-1.
IEC 61190-1-2	NOTE	Harmonized as EN 61190-1-2.
IEC 61249-2-7	NOTE	Harmonized as EN 61249-2-7.
IEC 62137:2004	NOTE	Harmonized as EN 62137:2004 (not modified).
ISO 9001	NOTE	Harmonized as EN ISO 9001.
ISO 9455-2	NOTE	Harmonized as EN ISO 9455-2.

Annex ZA
(normative)

Normative references to international publications with their corresponding European publications

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.

NOTE 1 When an International Publication has been modified by common modifications, indicated by (mod), the relevant EN/HD applies.

NOTE 2 Up-to-date information on the latest versions of the European Standards listed in this annex is available here: www.cenelec.eu

Publication	Year	Title	EN/HD	Year
IEC 61189-5	-	Test methods for electrical materials, interconnection structures and assemblies - Part 5: Test methods for printed board assemblies	EN 61189-5	-
IEC 61189-6	-	Test methods for electrical materials, interconnection structures and assemblies - Part 6: Test methods for materials used in manufacturing electronic assemblies	EN 61189-6	-
IEC 61190-1-3	-	Attachment materials for electronic assembly - Part 1-3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solders for electronic soldering applications	EN 61190-1-3	-

CONTENTS

INTRODUCTION

IEC 61189 relates to test methods for materials or component robustness for printed board assemblies, irrespective of their method of manufacture.

The standard is divided into separate parts, covering information for the designer and the test methodology engineer or technician. Each part has a specific focus; methods are grouped according to their application and numbered sequentially as they are developed and released.

In some instances test methods developed by other TCs (for example, TC 104) have been reproduced from existing IEC standards in order to provide the reader with a comprehensive set of test methods. When this situation occurs, it will be noted on the specific test method; if the test method is reproduced with minor revision, those paragraphs that are different are identified.

This part of IEC 61189 contains test methods for evaluating robustness of materials or component for printed board assemblies. The methods are self-contained, with sufficient detail and description so as to achieve uniformity and reproducibility in the procedures and test methodologies.

The tests shown in this standard are grouped according to the following principles:

- P: preparation/conditioning methods
- V: visual test methods
- D: dimensional test methods
- C: chemical test methods
- M: mechanical test methods
- E: electrical test methods
- N: environmental test methods
- X: miscellaneous test methods

To facilitate reference to the tests, to retain consistency of presentation, and to provide for future expansion, each test is identified by a number (assigned sequentially) added to the prefix (group code) letter showing the group to which the test method belongs.

The test method numbers have no significance with respect to a possible test sequence; that responsibility rests with the relevant specification that calls for the method being performed. The relevant specification, in most instances, also describes pass/fail criteria.

The letter and number combinations are for reference purposes to be used by the relevant specification. Thus "5-4C01" represents the first chemical test method described in IEC 61189-5-4.

In short, in this example, 5-4 is the number of the part of IEC 61189, C is the group of methods, and 01 is the test number.

TEST METHODS FOR ELECTRICAL MATERIALS, PRINTED BOARDS AND OTHER INTERCONNECTION STRUCTURES AND ASSEMBLIES –

Part 5-4: General test methods for materials and assemblies – Solder alloys and fluxed and non-fluxed solid wire for printed board assemblies

1 Scope

This part of IEC 61189 is a catalogue of test methods representing methodologies and procedures that can be applied to test printed board assemblies.

This part of IEC 61189 focuses on test methods for solder alloys, fluxed and non-fluxed solid wire, based on existing IEC 61189-5 and IEC 61189-6. In addition, it includes test methods for solder alloys, fluxed and non-fluxed solid wire, and for lead free soldering.

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.

IEC 61189-5, *Test methods for electrical materials, interconnection structures and assemblies – Part 5: Test methods for printed board assemblies*

IEC 61189-6, *Test methods for electrical materials, interconnection structures and assemblies – Part 6: Test methods for materials used in manufacturing electronic assemblies*

IEC 61190-1-3, *Attachment materials for electronic assembly – Part 1-3: Requirements for electronic grade solder alloys and fluxed and non-fluxed solid solders for electronic soldering applications*

3 Accuracy, precision and resolution

3.1 General

Errors and uncertainties are inherent in all measurement processes. The information given below enables valid estimates of the amount of error and uncertainty to be taken into account.

Test data serve a number of purposes which include

– monitoring of a process;
– enhancing of confidence in quality conformance;
– arbitration between customer and supplier.

In any of these circumstances, it is essential that confidence can be placed upon the test data in terms of

– accuracy: calibration of the test instruments and/or system;
– precision: the repeatability and uncertainty of the measurement;

– resolution: the suitability of the test instrument and/or system.

3.2 Accuracy

The regime by which routine calibration of the test equipment is undertaken shall be clearly stated in the quality documentation of the supplier or agency conducting the test and should meet the requirements of ISO 9001.

The calibration shall be conducted by an agency having accreditation to a national or international measurement standard institute. There should be an uninterrupted chain of calibration to a national or international standard.

Where calibration to a national or international standard is not possible, round-robin techniques may be used and documented to enhance confidence in measurement accuracy.

The calibration interval shall normally be one year. Equipment consistently found to be outside acceptable limits of accuracy shall be subject to shortened calibration intervals. Equipment consistently found to be well within acceptable limits may be subject to relaxed calibration intervals.

A record of the calibration and maintenance history shall be maintained for each instrument. These records should state the uncertainty of the calibration technique (in ± % deviation) in order that uncertainties of measurement can be aggregated and determined.

A procedure shall be implemented to resolve any situation where an instrument is found to be outside calibration limits.

3.3 Precision

The uncertainty budget of any measurement technique is made up of both systematic and random uncertainties. All estimates shall be based upon a single confidence level, the minimum being 95 %.

Systematic uncertainties are usually the predominant contributor and will include all uncertainties not subject to random fluctuation. These include

– calibration uncertainties,
– errors due to the use of an instrument under conditions which differ from those under which it was calibrated,
– errors in the graduation of a scale of an analogue meter (scale shape error).

Random uncertainties result from numerous sources but can be deduced from a repeated measurement of a standard item. Therefore, it is not necessary to isolate the individual contributions. These may include

– random fluctuations such as those due to the variation of an influence parameter. Typically, changes in atmospheric conditions reduce the repeatability of a measurement,
– uncertainty in discrimination, such as setting a pointer to a fiducial mark or interpolating between graduations on an analogue scale.

Aggregation of uncertainties: Geometric addition (root-sum-square) of uncertainties may be used in most cases. Interpolation error is normally added separately and may be accepted as being 20 % of the difference between the finest graduations of the scale of the instrument.

$$U_t = \pm\sqrt{(U_s^2 + U_r^2)} + U_i$$

where

U_t is the total uncertainty;

U_s is the systematic uncertainty;

U_r is the random uncertainty;

U_i is the interpolation error.

Determination of random uncertainties: Random uncertainty can be determined by repeated measurement of a parameter and subsequent statistical manipulation of the measured data. The technique assumes that the data exhibits a normal (Gaussian) distribution.

$$U_r = \frac{t \times \sigma}{\sqrt{n}}$$

where

U_r is the random uncertainty;

n is the sample size;

t is the percentage point of the t distribution as shown in Table 1;

σ is the standard deviation (σ_{n-1}).

3.4 Resolution

It is paramount that the test equipment used is capable of sufficient resolution. Measurement systems used should be capable of resolving 10 % (or better) of the test limit tolerance.

It is accepted that some technologies will place a physical limitation upon resolution (for example, optical resolution).

3.5 Report

In addition to requirements detailed in the test specification, the report shall detail:

a) the test method used;
b) the identity of the sample(s);
c) the test instrumentation;
d) the specified limit(s);
e) an estimate of measurement uncertainty and resultant working limit(s) for the test;
f) the detailed test results;
g) the test date and operators' signature.

3.6 Student's *t* distribution

Table 1 gives values of the factor t for 95 % and 99 % confidence levels, as a function of the number of measurements.

Table 1 – Student's *t* distribution

Sample size	*t* value 95 %	*t* value 99 %		Sample size	*t* value 95 %	*t* value 99 %
2	12,7	63,7		14	2,16	3,01
3	4,3	9,92		15	2,14	2,98
4	3,18	5,84		16	2,13	2,95
5	2,78	4,6		17	2,12	2,92
6	2,57	4,03		18	2,11	2,9
7	2,45	3,71		19	2,1	2,88
8	2,36	3,5		20	2,09	2,86
9	2,31	3,36		21	2,08	2,83
10	2,26	3,25		22	2,075	2,82
11	2,23	3,17		23	2,07	2,81
12	2,2	3,11		24	2,065	2,8
13	2,18	3,05		25	2,06	2,79

3.7 Suggested uncertainty limits

The following target uncertainties are suggested:

a) Voltage <1 kV: ±1,5 %
b) Voltage >1 kV: ±2,5 %
c) Current <20 A: ±1,5 %
d) Current >20 A: ±2,5 %

Resistance

e) Earth and continuity: ±10 %
f) Insulation: ±10 %
g) Frequency: ±0,2 %

Time

h) Interval <60 s: ±1 s
i) Interval >60 s: ±2 %
j) Mass <10 g: ±0,5 %
k) Mass 10 g to 100 g: ±1 %
l) Mass >100 g: ±2 %
m) Force: ±2 %
n) Dimension <25 mm: ±0,5 %
o) Dimension >25 mm: ±0,1 mm
p) Temperature <100 °C: ±1,5 %
q) Temperature >100 °C: ±3,5 %
r) Humidity (30 to 75) % RH: ±5 % RH

Plating thicknesses

s) Backscatter method: ±10 %

t) Microsection: ±2 μm

u) Ionic contamination: ±10 %

4 C: Chemical test methods

4.1 Test 5-4C01: Determination of the percentage of flux on/in flux-coated and/or flux-cored solder

4.1.1 Object

This test method provides a procedure for determining the flux percentage on flux-coated and/or in flux-cored solder.

4.1.2 Test specimen

For test A, use approximately 200 g of flux-coated and/or flux-cored solder; for test B, use approximately 30 g of flux-coated and/or flux-cored solder. For solders whose flux percentage is expected to be 1 % or more, the test specimen may be approximately 100 g. For solders whose flux percentage is expected to be 2 % or more, the test specimen may be approximately 50 g.

4.1.3 Apparatus

a) One hot plate capable of being set to (50^{+5}_{0}) °C above the liquidus temperature of the solder specimen alloy.

b) One suitably sized pyrex or equivalent beaker.

4.1.4 Test procedure

4.1.4.1 Test procedure A

a) Determine the liquidus temperature of the solder alloy from IEC 61190-1-3.

b) Weigh the solder specimen to the nearest 0,01 g ($W1$).

c) Carefully pack the solder specimen as tightly as possible in the bottom of the beaker. Weigh the beaker and solder specimen to the nearest 0,01 g ($W2$).

d) Preheat the hot plate to (50^{+5}_{0}) °C above the liquidus temperature of the solder specimen alloy.

e) Place the beaker with the solder specimen on the hot plate. Remove the beaker as soon as all of the solder has melted and allow it to cool at room temperature for about 30 min.

f) Using highly pure propan-2-ol, or other suitable solvent recommended by the solder manufacturer, some slight agitation, and gentle heat, thoroughly extract the flux residues from the beaker. Decant the extraction solution through coarse filter paper, taking care that no solder escapes the beaker. Repeat the extraction procedure as necessary to remove all traces of flux residue. Evaporate the remaining solvent from the beaker by warming under a gentle stream of air until the residue in the beaker is completely dry.

g) Weigh the beaker and melted solder metal to the nearest 0,01 g ($W3$).

h) Repeat the flux residue extraction procedure until a constant final weight $W3$ is obtained.

4.1.4.2 Test procedure B

a) Clean the specimen of the flux cored solder wire under test with a tissue soaked in the degreasing solvent.

b) Using the balance weigh 30 g of the cleaned wire to the nearest 0,01 g. Place the specimen into the glycerine. Heat to (50 ± 5) °C above the liquidus temperature of the wire under test.

c) Remove the flux from the resin flux cored wire completely. Allow the flux to cool and solidify.

d) Remove the solidified solder pellet and wash it in water. Immerse the pellet in alcohol for approximately 5 min. Re-wash the pellet in water and allow it to dry at room temperature.

e) Using the balance, measure the mass of the pellet to constant weight, to the nearest 0,01 g.

4.1.4.3 Evaluation

Calculate the flux content F_A of the specimen as percentage by mass for procedure A from the following formula:

$$F_A\ (\%) = 100 \times (W3 - W2)\ /\ W1$$

Calculate the flux content F_B of the specimen as percentage by mass for procedure B from the following formula.

$$F_B\ (\%) = \frac{m_1 - m_2}{m_1} \times 100 = \%\ (\text{mass})$$

where

m_1 is the mass, in g, of the flux cored solder wire used in the test;

m_2 is the mass, in g, of the solder pellet.

4.2 Test 5-4CXX

Under consideration.

5 X: Miscellaneous test methods

5.1 Test 5-4X01: Spread test, extracted cored wires or preforms

5.1.1 Object

This test method gives an indication of activity of cored solder or preform fluxes. The test method offers two methods.

Method A measures the solder spread area.

Method B measures the solder spread ratio.

5.1.2 Method A

5.1.2.1 Test specimen

a) 10 ml of the extracted material.

b) Vacant.

5.1.2.2 Apparatus and reagents

a) Five replicates 0,25 mm thick 70/30 brass of a size of approximately 40 mm × 75 mm.

b) Degreased very fine steel wool (for example, #00).

c) Solder wire from Sn63Pb37A, or Sn96.5Ag3Cu0.5, or any other solder alloy wire agreed between user and supplier according to IEC 61190-1-3 with a diameter with 1,5 mm.

d) A solder pot not less than 25 mm in depth containing at least 2 kg solder.

5.1.2.3 Test specimen preparation

a) Clean five brass coupons with steel wool.

b) Flatten the brass coupon by bending the opposite sides of the coupon. The two bends should be parallel to the curve of the metal coil in which the brass was provided in order to stiffen and flatten the test specimen.

c) Cut a 30 mm length of solid wire solder.

d) Wrap the cut length of solder around a 3 mm mandrel.

e) Cut the coil into individual rings to make a preform of the solder.

f) Adjust 25 mass % test solution with propan-2-ol or suitable solvent and measure and take (0,05 ± 0,005) ml by using micro syringe or micro pipet.

5.1.2.4 Test

a) Maintain the solder bath at (260 ± 3) °C for Sn60Pb40, or at (255 ± 3) °C for Sn96.5Ag3Cu0.5, or at (35 ± 3) °C higher than the liquidus temperature for any other solder alloy agreed between the user and the supplier.

b) Place the preformed solder in the centre of the test specimen.

c) Place one drop (0,05 ml) of flux in the centre of the preform of the test specimen.

d) Carefully place the coupon on the surface of the solder bath for 15 s.

e) Remove the coupon in a horizontal position and place on a flat surface allowing the adhered solder to solidify undisturbed.

f) Remove all flux residue with a suitable solvent.

5.1.2.5 Evaluation

Measure the solder spread area by comparing to circles (pre-drawn) with areas similar to those listed in Table 2. The mean of the spread of all five specimens tested shall be reported.

Table 2 is intended as an aid in defining areas in mm^2.

Table 2 – Typical spread areas defined in mm^2

Diameter mm	**Area** mm^2
10,00	78,54
10,70	90,00
11,28	100,00

5.1.3 Method B

5.1.3.1 Test specimen

a) Extracted flux from cored wire or preforms

b) For solid flux, 25 mass % propan-2-ol or other appropriate solvent solution.

c) Solder wire of Sn63Pb37, or Sn96.5Ag3Cu0.5, or any other solder alloy agreed between the user and the supplier specified in IEC 61190-1-3 shall be wrapped on a ring bar with a diameter of 3,3 mm.

5.1.3.2 Apparatus and reagents

a) Solder bath: A solder bath with a depth of not less than 30 mm, 100 mm × 150 mm or more in width and length, provided with a temperature controller up to (50 ± 2) °C above the liquidus temperature of the tested solder.

b) Dryer: An air convection oven with a temperature controller up to (150 ± 3) °C and capable of maintaining the temperature.

c) Tongue of other proper tool suitable to lift up the test piece from the solder bath.

d) Scrubber: Suitable to remove easily the oxidized film of solder in the bath.

e) Spatula.

f) Metal mask: Thickness of 2,5 mm with a hole of 6 mm diameter.

g) Micrometer: Measurable to 0,001 mm.

h) Micro syringe or micro pipet: Measurable of 0,05 ml.

i) General experimental device: All-glass device.

j) Abrasive paper (waterproof).

k) Alcohol: Ethyl alcohol (reagent grade).

l) Propan-2-ol (reagent grade).

m) Washing solvent: Proper solvent to remove the flux residue after soldering.

n) Copper plate: A plate of 50 mm × 50 mm × 0,5 mm dimensions of dephosphate copper (to prevent surface oxidation).

o) Solder: Sn63Pb37, or Sn96.5Ag3Cu0.5, or any other solder alloy agreed between the user and the supplier specified in IEC 61190-1-3 as reference specimen.

5.1.3.3 Test specimen preparation

5.1.3.3.1 Procedure of test

a) Preparation of an oxidated copper plate: The surface shall be cleaned with alcohol. One side of the plate shall be polished by abrasive paper, cleaned with alcohol, and dried thoroughly at room temperature. Put this plate into a dryer set at (150 ± 3) °C for 1 h and oxidate the plate. Four corners of the plate could be bent for easy application of a tongue.

b) Test specimen shall be one bar of 3,2 mm diameter on which wire solder of Sn63Pb37, or Sn96.5Ag3Cu0.5, or any other solder alloy agreed between the user and the supplier with 1,6 mm diameter is wound.

c) Resin/rosin flux cored solder. The product itself shall be used.

5.1.3.3.2 Preparation of test piece

a) Resin/rosin flux cored solder: After washing the face with acetone and rinsing with deionized water and then with propan-2-ol, measure and cut off (0,30 ± 0,03) g of specimen, swirl it, and place it at the centre of the copper plate. Five test specimens shall be prepared.

b) Extracted flux from cored solder or preforms: Adjust 25 mass % test solution with propan-2-ol or suitable solvent and measure and take (0,05 ± 0,005) ml by using a micro syringe or micro pipet, and drop it into the centre of the copper plate. Place the solder piece on it. Five test specimens shall be prepared.

5.1.3.4 Test

a) The test piece shall be heated while floating on a solder bath kept at (233 ± 3) °C for Sn63Pb37, or at (255 ± 3) °C for Sn96.5Ag3Cu0.5, or at (35 ± 3) °C higher than the liquidus temperature for any other solder alloy agreed between the user and the supplier, and kept at this temperature for 30 s after having fused.

b) Lift the test piece from the bath and cool it down.

c) Remove the flux residue by proper solvent.

5.1.3.5 Evaluation

The height of the spread solder fused shall be measured by a micrometer or other proper equipment. From this height, the spreading ratio shall be calculated from the formula shown below.

This procedure shall be repeated on five of the test pieces and a mean value shall be obtained, giving this as the spreading ratio of the flux representing solder under test.

$$S_R = 100 \times (D - H)/D$$

where

S_R is the spreading ratio (%);

H is the height of the spread solder (mm);

D is the diameter of the solder (mm), when it is assumed to be a sphere (mm) (D = 1,24 $V^{1/3}$);

V is the mass/density of the tested solder.

In the case of resin flux cored solder and solder paste, the mass of solder used for the test shall be the mass of the specimen subtracting the flux contained.

5.1.4 Additional information

Safety: Observe all appropriate precautions on material safety data sheets (MSDS) for chemicals involved in this test method.

ASTM B-36 brass plate, sheet, strip, and rolled bar (according to ASTM-B-36 C2600 HO2) [3]

5.2 Test 5-4X02: Spitting test of flux-cored wire solder

5.2.1 Object

This test method provides a measurement of the spitting characteristics of flux-cored wire and ribbon solder.

5.2.2 Method A

5.2.2.1 Test specimen

The test specimen shall consist of a 5 m length of flux-cored wire or ribbon solder (may be cut into several smaller lengths for convenient handling).

5.2.2.2 Apparatus

a) One laboratory stand with a soldering iron support clamp and metal support ring or tray with a suitable hole in its centre.

b) One 20 cm × 20 cm piece of aluminium foil with a (11 ± 0,5) mm diameter hole in its centre.

c) One small metal tray with a suitable hole in its centre, to catch molten solder running down from the soldering iron tip.

d) One soldering iron with a clean chisel point which has been coated with solder and wiped clean.

5.2.2.3 Test procedure

5.2.2.3.1 Preparation of test

a) Using additional pieces of solder identical to the test specimen, determine the flux content of the flux cored solder in accordance with IEC 61189-5-4, Test 5-4C01, and expressed in percentage units (F, see 4.1.4.3).

b) Set up test configuration as shown in Figure 1. The soldering iron should be positioned so that its tip extends approximately 6 mm through the aluminium foil.

c) Weigh the aluminium foil ($P1$) and place it on the laboratory stand tray/ring so that the 11 mm hole is centred around the tip of the soldering iron.

d) Weigh the solder sample ($W1$).

e) Turn on the soldering iron and allow the tip temperature to stabilize.

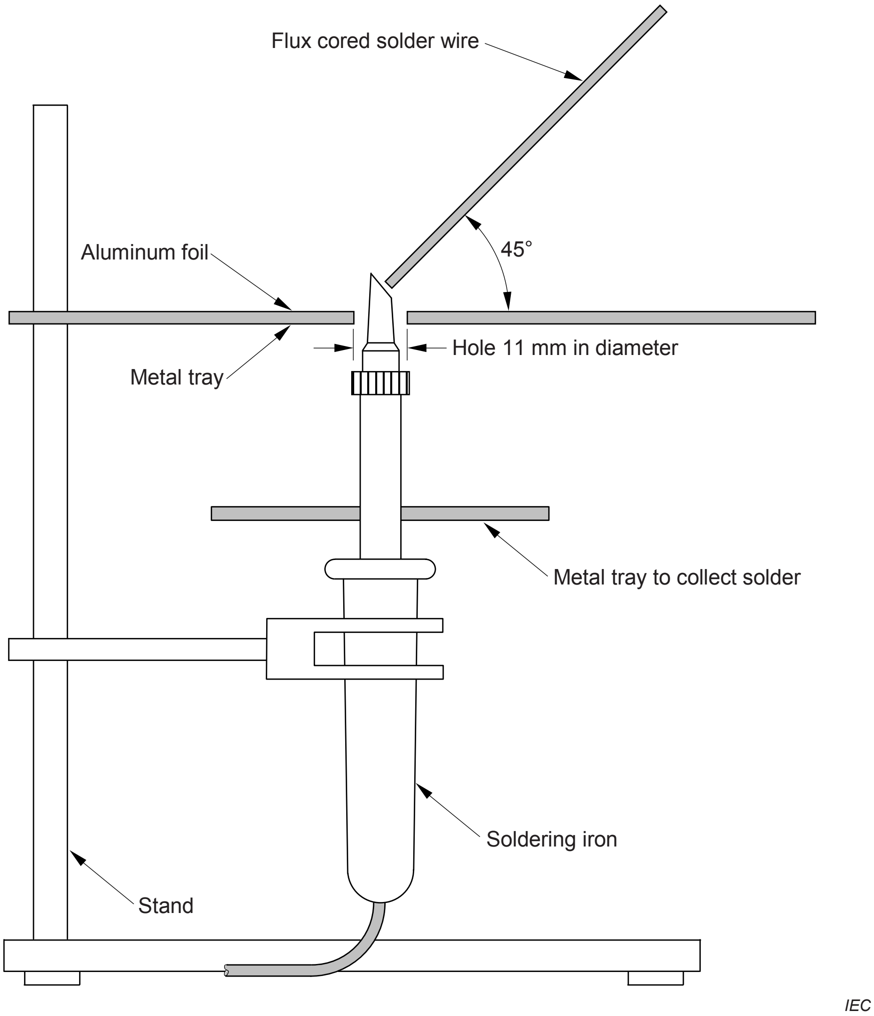


Figure 1 – Test apparatus for spitting test

5.2.2.3.2 Test

Apply the solder sample to the heated soldering iron tip at an even rate, approximately 1 cm at a time, keeping the soldering iron tip temperature steady.

5.2.2.3.3 Evaluation

a) Weigh the stub(s) of the solder specimen not melted in the test ($W2$).

b) Weigh the aluminum foil containing the spattered flux ($P2$).

c) Calculate the weight in percentage of the spattered flux as follows:

$$\text{Percent by weight of the spattered flux} = \frac{(P2 - P1)}{F \times (W1 - W2)}$$

5.2.3 Method B

5.2.3.1 Test specimen

Three lengths of 50 cm of the flux cored solder wire or ribbon solder (may be cut into several smaller lengths for convenient handling).

5.2.3.2 Apparatus

a) One laboratory stand with a soldering iron support clamp and a metal support tray with a suitable hole in its centre.

b) One A4 or letter size collecting paper with a (9,5 ± 0,5) mm diameter hole in its centre and printed concentric circles with 1 cm pitch. (See Figure 3).

c) One small metal tray under the metal tray to catch molten solder running down from the soldering iron tip.

d) One soldering iron with a clean chisel point which has been coated with solder and wiped clean.

5.2.3.3 Preparation for test

a) Using additional pieces of solder identical to the test specimen, determine the flux content of the flux cored solder in accordance with IEC 61189-5-4, Test 5-4C01 and expressed in percentage units ($\%F$).

b) Set up test configuration as shown in Figure 2.

c) The soldering iron should be positioned so that the flux cored solder wire is fed to it at approximately 7 mm higher than the collecting paper. Angle of soldering iron and/or flux cored solder wire against the collecting paper can be changed if the customer and supplier agree.

d) Place the collecting paper on the metal tray.

e) Turn on the soldering iron and allow the tip temperature to stabilize. The test temperature shall be at 350 °C, or at any other temperature as agreed upon between the customer and the supplier.

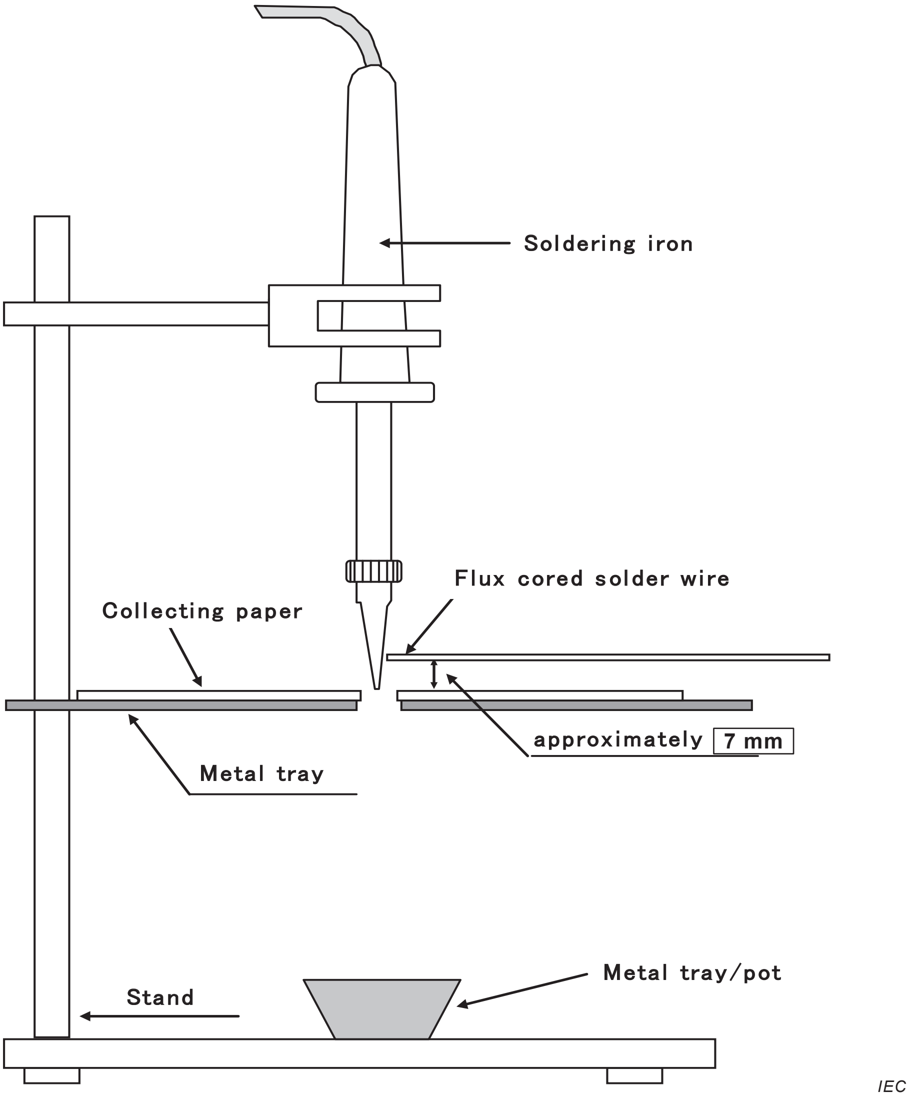
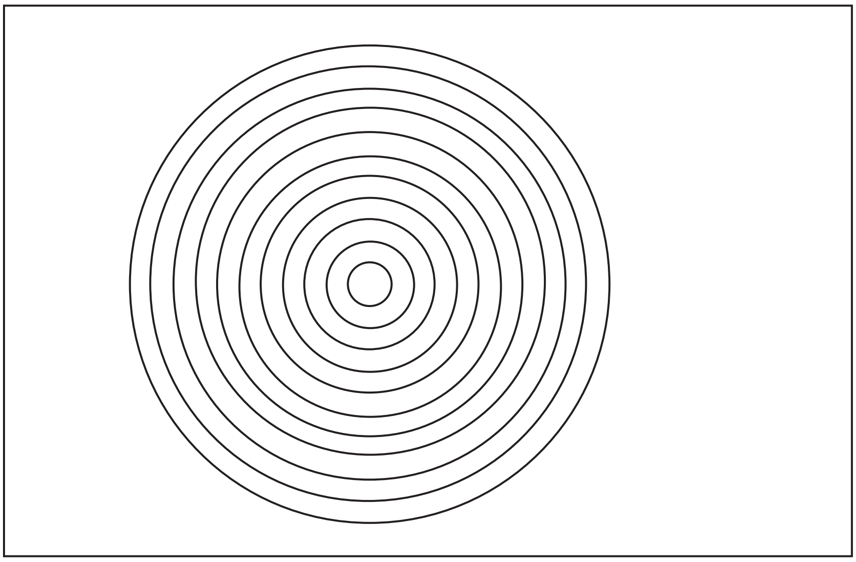


Figure 2 – Test apparatus for spitting test, method B



NOTE See Table 1,

Figure 3 – Collecting paper with printed concentric circles with 1 cm pitch

5.2.3.4 Test

Apply 30 cm of the solder sample to the heated soldering iron tip approximately at an even rate, 1 cm at a time, keeping the soldering iron tip temperature steady.

5.2.3.5 Evaluation

a) Count the number of spitting of flux and solder with eyes.

b) Record the results in Table 3.

5.2.4 Additional information

Safety: Observe all appropriate safety precautions.

Table 3 – Example of a test report – Spitting of flux-cored wire

Date Sample name Diameter (mm) Flux content (%) Test temperature (°C)		
Spitting (pcs)		
mm	Flux	Solder
10 to 20		
20 to 30		
30 to 40		
40 to 50		
50 to 60		
60 to 70		
70 to 80		
80 to 90		
90 to 100		

5.3 Test 5-4X03: Solder pool test

5.3.1 Object

This solder pool test method provides a measurement of wetting characteristics of flux on/in flux-coated and/or flux-cored solder.

5.3.2 Test specimen

a) Three pieces of flux-cored wire solder, approximately 30 mm in length and 1,5 mm in diameter, three pieces of flux-coated, flux-cored, or flux-coated and flux-cored ribbon solder, weighing approximately 2 g each, or three flux-coated, flux-cored, or flux-coated and flux-cored solder preforms, also weighing approximately 2 g each.

b) Approximately 10 ml of flux extracted and prepared in accordance with IEC 61190-1-3, and three pieces of 1,5 mm, non-fluxed wire solder per IEC 61190-1-3.

5.3.3 Apparatus and reagents

a) Three flat pieces of 0,25 mm thick 70/30 brass approximately 75 mm × 40 mm.

b) Degreased fine steel wool, for example, #00.

c) Solder pot containing not less than 4 kg of molten solder at a stabilized temperature of (60 ± 10) °C above the liquidus temperature of the alloy used in the solder specimens, and having a solder surface diameter of not less than 80 mm and a solder depth of not less than 25 mm.

d) Mandrel having a diameter of (3 ± 0,5) mm.

e) One pair laboratory forceps suitable for use in handling hot brass coupons.

f) Timer with a seconds display.

5.3.4 Test procedure

5.3.4.1 Preparation for test

Thoroughly clean three brass coupons with steel wool and bend one corner of each coupon up at an angle of approximately 60º to facilitate the handling of the coupons with forceps.

5.3.4.2 Preparation of test specimen

a) When using fluxed wire or ribbon solder specimens, individually coil each piece of the solder specimen around mandrel and place one coiled piece in the approximate center of each brass test specimen.

b) When using fluxed solder pre-form specimens, deposit one about 2 g in the approximate centre of each brass test specimen.

c) When using extracted flux and non-fluxed wire solder, individually coil each piece of the non-fluxed solder specimen around the mandrel, place one drop of flux (approximately 0,05 ml) approximately in the centre of each brass test specimen, and place one coiled piece of non-fluxed solder in the centre of the flux drop on each brass test specimen.

5.3.4.3 Test

CAUTION: When moving the brass test specimens, take extreme care to move coupons slowly and keep their test surface horizontal, so that the tests are not prejudiced by movement of flux or solder unrelated to the fluxing action.

a) Scrape the surface of the molten solder in the solder pot to remove any dross.

b) Carefully place one test specimen on the surface of the molten solder, leave for (15 ± 1) s, and remove it to a flat, level surface allowing the solder pool to solidify undisturbed.

c) Repeat steps a) and b) with the remaining two test specimens.

5.3.5 Evaluation

a) Visually examine the surface of the test specimens for any evidence of flux spattering as evidenced by spots of flux and/or flux residue outside of the main pool of solder and flux residue.

b) Using a suitable solvent, remove the flux residues from the three coupons sufficiently to clearly see the solidified solder pool and the remaining brass coupon surface.

c) Visually examine the thickness of the solder pool edge on the surface test specimens for any evidence of non-wetting or de-wetting.

d) The fluxed solder and/or the solder from which the flux was extracted shall fail this solder pool test if there is any evidence of non-wetting, de-wetting, or flux spattering or if the solder pool does not feather out to a thin edge. Irregularly shaped solder pools do not necessarily indicate de-wetting or non-wetting.

5.3.6 Additional information

Safety: Observe all appropriate safety precautions. Consult material safety data sheets (MSDS) for safety precautions for chemicals involved in this test method.

ASTM B-36 Brass Plate, Sheet, Strip, and Rolled Bar (see Bibliography)

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