

BS EN ISO 9455-16:2013



BSI Standards Publication

Soft soldering fluxes — Test methods

Part 16: Flux efficacy test, wetting balance method (ISO 9455-16:2013)

bsi.

...making excellence a habit.
AVA Documents™
Document Sharing Hub

National foreword

This British Standard is the UK implementation of EN ISO 9455-16:2013. It supersedes BS EN ISO 9455-16:2001 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee NFE/27/4, Solders and soldering fluxes.

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.

© The British Standards Institution 2013. Published by BSI Standards Limited 2013

ISBN 978 0 580 69808 8

ICS 25.160.50

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

This British Standard was published under the authority of the Standards Policy and Strategy Committee on 30 April 2013.

Amendments issued since publication

Date	Text affected
------	---------------

English Version

Soft soldering fluxes - Test methods - Part 16: Flux efficacy test,
wetting balance method (ISO 9455-16:2013)

Flux de brasage tendre - Méthodes d'essai - Partie 16:
Essai d'efficacité du flux, méthode à la balance de
mouillage (ISO 9455-16:2013)

Flussmittel zum Weichlöten - Prüfverfahren - Teil 16:
Bestimmung der Wirksamkeit des Flussmittels, Verfahren
zur Messung der Benetzungskraft (ISO 9455-16:2013)

This European Standard was approved by CEN on 2 February 2013.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the CEN-CENELEC Management Centre or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the CEN-CENELEC Management Centre has the same status as the official versions.

CEN members are the national standards bodies of Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and United Kingdom.



EUROPEAN COMMITTEE FOR STANDARDIZATION
COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

Management Centre: Avenue Marnix 17, B-1000 Brussels

Foreword

This document (EN ISO 9455-16:2013) has been prepared by Technical Committee ISO/TC 44 "Welding and allied processes" in collaboration with Technical Committee CEN/TC 121 "Welding" the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by October 2013, and conflicting national standards shall be withdrawn at the latest by October 2013.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN ISO 9455-16:2001.

According to the CEN-CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, Former Yugoslav Republic of Macedonia, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Endorsement notice

The text of ISO 9455-16:2013 has been approved by CEN as EN ISO 9455-16:2013 without any modification.

Contents

Page

Foreword	iv
1 Scope	1
2 Normative references	1
3 Symbols	1
4 Principle	2
5 Reagents	2
6 Apparatus	2
7 Test pieces	3
8 Procedure	3
8.1 Preparation of the test pieces.....	3
8.2 Test method.....	3
9 Reference value using standard flux	4
10 Presentation of results	4
11 Calculation and expression of results	6
12 Test report	7
Annex A (normative) Method for the preparation of standard rosin (colophony) based liquid fluxes having 25 % (by mass) non-volatile content	8
Annex B (normative) Method for the production of test pieces with a controlled-contaminated surface for the wetting balance test (artificial sulfidation method)	10

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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. 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.

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.

ISO 9455-16 was prepared by Technical Committee ISO/TC 44, *Welding and allied processes*, Subcommittee SC 12, *Soldering materials*.

This second edition cancels and replaces the first edition (ISO 9455-16:1998), which has been technically revised.

ISO 9455 consists of the following parts, under the general title *Soft soldering fluxes — Test methods*:

- *Part 1: Determination of non-volatile matter, gravimetric method*
- *Part 2: Determination of non-volatile matter, ebulliometric method*
- *Part 3: Determination of acid value, potentiometric and visual titration methods*
- *Part 5: Copper mirror test*
- *Part 6: Determination and detection of halide (excluding fluoride) content*
- *Part 8: Determination of zinc content*
- *Part 9: Determination of ammonia content*
- *Part 10: Flux efficacy test, solder spread method*
- *Part 11: Solubility of flux residues*
- *Part 13: Determination of flux spattering*
- *Part 14: Assessment of tackiness of flux residues*
- *Part 15: Copper corrosion test*
- *Part 16: Flux efficacy test, wetting balance method*
- *Part 17: Surface insulation resistance comb test and electrochemical migration test of flux residues*

Requests for official interpretations of any aspect of this part of ISO 9455 should be directed to the Secretariat of ISO/TC 44/SC 12 via your national standards body. A complete listing of these bodies can be found at www.iso.org.

Soft soldering fluxes — Test methods —

Part 16:

Flux efficacy test, wetting balance method

1 Scope

This part of ISO 9455 specifies a method for the assessment of the efficacy of a soft soldering flux, known as the wetting balance method. It gives a qualitative assessment of the comparative efficacy of two fluxes (for example, a standard and a test flux), based on their capacity to promote wetting of a metal surface by liquid solder. The method is applicable to all flux types in liquid form classified in ISO 9454-1.

NOTE It is hoped that future developments using improved techniques for obtaining a reproducible range of test surfaces will enable this method for assessing flux efficacy to be quantitative. For this reason, several alternative procedures for preparing the surface of the test piece are included in the present method.

2 Normative references

The following referenced documents are indispensable for the application 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*

IEC 60068-2-20:2008, *Environmental testing — Part 2-20: Tests — Test T: Test methods for solderability and resistance to soldering heat of devices with leads*

IEC 60068-2-54, *Environmental testing — Part 2-54: Tests — Test Ta: Solderability testing of electronic components by the wetting balance method*

IEC 60068-2-78:2001, *Environmental testing — Part 2-78: Tests; Test Cab: Damp heat, steady state*

3 Symbols

- d depth of immersion, in millimetres, of the test piece below the undisturbed solder level
- A cross sectional area, in square millimetres, of the test piece at the solder line
- ρ density, in grams per millilitre, of the solder under test at the test temperature
- F wetting force, in millinewtons
- t_0 time at which the test piece first makes contact with the surface of the liquid solder in the bath
- t_1 time at which the solder starts to wet the test piece (point A, see [Figure 1](#)), at which point the trace begins to fall
- t_2 time at which the recorded force is equal to the upward force due to buoyancy
- t_3 time at which the trace crosses the reference line

4 Principle

The efficacy of the liquid flux under test is compared with that of a standard liquid flux, using a wetting balance in conjunction with a specified test piece, appropriate to the class of flux under test.

5 Reagents

Use only reagents of recognized analytical quality and only distilled or deionized water.

5.1 Acid cleaning solution, prepared as follows:

Add cautiously, while stirring, 75 ml of sulfuric acid ($\rho = 1,84 \text{ g/ml}$) to 210 ml of water and mix. Cool the solution to room temperature. Add 15 ml of nitric acid ($\rho = 1,42 \text{ g/ml}$) and mix thoroughly.

5.2 Acetone.

5.3 Propan-2-ol, complying with the following requirements:

- propan-2-ol: 99,5 % (by mass) minimum;
- acid content: 0,002 % (by mass) maximum;
- non-volatile content: 0,2 % (by mass) maximum.

Isopropyl alcohol (also propan-2-ol, 2-propanol or the abbreviation IPA) is a common name for this chemical compound, which has the molecular formula $\text{C}_3\text{H}_8\text{O}$.

6 Apparatus

Usual laboratory apparatus and, in particular, the following.

6.1 Wetting balance and ancillary instrumentation, as described in IEC 60068-2-54.

Calibrate the apparatus in accordance with the manufacturer's instructions.

6.2 Solder bath.

As a minimum, the bath temperature shall be capable of being maintained at a temperature corresponding to the liquidus temperature of the alloy under test plus 35 °C. The test temperature shall be reported in the test report.

The dimensions of the solder bath shall be such that no portion of the test piece (see [Clause 7](#)) is less than 15 mm from the wall of the bath and the depth of the liquid solder in the bath shall be not less than 30 mm.

The solder used for the test and the test temperature shall be one of the following:

- Sn60Pb40 (see ISO 9453) at 235 °C $\pm$ 3 °C;
- Sn96,5Ag3,0Cu0,5 (see ISO 9453) at 255 °C $\pm$ 3 °C;
- any other solder and temperature combinations as agreed between the customer and the flux supplier.

6.3 Acid-free filter paper.

7 Test pieces

The test pieces shall be made of copper.

EXAMPLE Test pieces are cut from a rectangular copper sheet. The dimensions of each test piece are as follows:

- width: 10,0 mm $\pm$ 0,1 mm;
- length: constant between 15 mm and 30 mm, to suit the equipment used;
- thickness: either 0,10 mm $\pm$ 0,02 mm or 0,30 mm $\pm$ 0,05 mm.

When testing fluxes of type 1 or 2 (as defined in ISO 9454-1), full details of the test pieces shall be given in the test report.

The sheet or other article used for preparing the test pieces shall be clean and free from contamination. In order to obtain accurate results, the test pieces shall be cut cleanly without leaving significant burrs.

8 Procedure

8.1 Preparation of the test pieces

8.1.1 Cleaning

The test pieces shall be handled with clean tongs throughout. Select sufficient test pieces (see [Clause 7](#)) to allow 10 per test flux and 10 per standard flux. Degrease them in acetone ([5.2](#)) and allow to dry. Immerse them for 20 s in the acid cleaning solution ([5.1](#)) at room temperature. Remove the test pieces from the acid cleaning solution and wash for about five seconds under running tap water. Rinse with distilled or deionized water then acetone ([5.2](#)) and dry with acid-free filter paper ([6.3](#)).

If required, the test pieces may be stored in acetone after rinsing them in deionized water. When needed, they shall be removed from the acetone and dried with acid-free filter paper ([6.3](#)).

Subject all the test pieces to one of the ageing procedures given in [8.1.2](#) to [8.1.4](#) as agreed between the flux supplier and the customer.

8.1.2 Ageing the surface by sulfidation process

Carry out the procedure given in [Annex B](#) on all the cleaned test pieces (see [8.1.1](#)).

8.1.3 Steam ageing the surface

Carry out the steam ageing procedure given in IEC 60068-2-20:2008, 4.1.1, ageing procedure 1b, for a period of 4 h on all the cleaned test pieces (see [8.1.1](#)).

8.1.4 Damp-heat, steady-state ageing

Subject all the cleaned pieces (see [8.1.1](#)) to the test chamber conditions specified in IEC 60068-2-78:2001, [Clause 4](#), for a period selected from 1 h, 4 h or 24 h.

8.2 Test method

8.2.1 Carry out the following test procedure on each of the 10 test pieces. Complete all 10 tests within 45 min of the preparation stage (see [8.1](#)).