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Brazing — Specification and qualification of brazing procedures for metallic materials

Brasage fort — Descriptif et qualification d'un mode opératoire de brassage fort pour les matériaux métalliques

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Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	2
4 Preliminary brazing procedure specification (pBPS)	3
5 Brazing procedure test	3
6 Test piece	3
6.1 General.....	3
6.2 Shape and dimensions of test pieces.....	3
6.3 Brazing of test pieces.....	4
7 Examination and testing	4
7.1 Extent of testing.....	4
7.2 Test specimens.....	4
7.3 Non-destructive testing.....	5
7.4 Destructive testing.....	5
7.4.1 General.....	5
7.4.2 Bend testing.....	5
7.4.3 Peel testing.....	5
7.4.4 Shear testing.....	5
7.4.5 Transverse tensile testing.....	5
7.5 Acceptance levels.....	6
7.6 Re-testing.....	6
8 Essential variables and range of qualification	6
8.1 General.....	6
8.2 Brazing process.....	6
8.3 Product type.....	6
8.4 Type of joint.....	7
8.5 Branch connection.....	7
8.6 Parent material group(s).....	7
8.7 Filler metals, flux and brazing filler application.....	8
8.8 Dimensions.....	8
8.9 Filler metal flow direction.....	8
8.10 Post braze heat treatment.....	9
8.11 Related to the manufacturer.....	9
9 Brazing procedure qualification record (BPQR)	9
10 Brazing procedure specification (BPS)	9
Annex A (informative) Quality requirements for brazing	11
Annex B (informative) Brazing procedure specification (BPS)	12
Annex C (informative) Examples of test pieces	13
Annex D (informative) Brazing procedure qualification record (BPQR)	15
Annex E (normative) Material grouping system	16
Bibliography	18

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.

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 documents 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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For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT) see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 44, *Welding and allied processes* Subcommittee SC 11, *Qualification requirements for welding and allied processes personnel*.

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>.

Introduction

The purpose of this document is to provide a general set of rules for brazing procedure qualification independent of product or application.

All new brazing procedure tests are to be carried out in accordance with this document from the date of its issue. However, this document does not invalidate previous brazing procedure tests made to former standards or specifications.

Where additional tests need to be carried out to make the qualification technically equivalent, it is only necessary to perform the additional tests on a test piece which should be made in accordance with this document.

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Brazing — Specification and qualification of brazing procedures for metallic materials

1 Scope

This document specifies requirements for the specification and qualification of brazing procedures for brazing of metallic materials.

This document specifies requirements for brazing of the test piece, testing of the test specimen, essential variables and their range of qualification, acceptance criteria, brazing procedure qualification record (BPQR) and brazing procedure specification (BPS).

This document gives provisions on general quality requirements for brazing (see [Annex A](#)).

This document does not cover testing of residual stresses, corrosion resistance and impact properties.

This document applies to the following brazing processes in accordance with ISO 857-2 and ISO 4063 with local and global heating:

- 911 Infrared brazing;
- 912 Flame brazing, torch brazing;
- 913 Laser beam brazing;
- 914 Electron beam brazing;
- 916 Induction brazing;
- 918 Resistance brazing;
- 919 Diffusion brazing;
- 921 Furnace brazing;
- 922 Vacuum brazing;
- 923 Dip-bath brazing;
- 924 Salt-bath brazing;
- 925 Flux bath brazing;
- 926 Immersion brazing;
- 972 Arc weld brazing.

The principles of this document can be applied to brazing of other materials.

This document does not apply to brazing for aerospace applications covered by ISO 11745.

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 4063, *Welding and allied processes — Nomenclature of processes and reference numbers*

ISO/FDIS 17779:2021(E)

ISO 13585, *Brazing – Qualification test of brazers and brazing operators*

ISO 17672, *Brazing — Filler metals*

ISO 18279, *Brazing — Imperfections in brazed joints*

ISO 18496, *Brazing — Fluxes for brazing — Classification and technical delivery conditions*

EN 12797, *Brazing – Destructive tests of brazed joints*

EN 12799, *Brazing – Non-destructive examination of brazed joints*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

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

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <http://www.electropedia.org/>

3.1

brazing

joining process using filler metal with a liquidus temperature above 450 °C

[SOURCE: ISO 857-2:2005, 3.1.12]

3.2

brazing procedure specification

BPS

document that has been qualified and provides the required variables of the brazing procedure to ensure repeatability during production brazing

3.3

preliminary brazing procedure specification

pBPS

document containing the required variables of the brazing procedure which is not yet qualified

3.4

brazing procedure qualification record

BPQR

record comprising all necessary data from qualification of a *preliminary brazing procedure specification* (3.3).

3.5

manufacturer

workshop or site or both which is (are) under the same technical and quality management

3.6

examiner

person who has been appointed to verify compliance with the applicable standard

Note 1 to entry: In certain cases, an external independent examiner can be required.

[SOURCE: ISO/TR 25901-1:2016, 2.5.29]

3.7

examining body

organization that has been appointed to verify compliance with the applicable standard

Note 1 to entry: In certain cases, an external independent examining body can be required.

[SOURCE: ISO/TR 25901-1:2016, 2.5.30]

3.8

filler metal

added metal applied to brazed joints

Note 1 to entry: Filler metal can be in the form of wire, inserts, powder, pastes, foil, etc.

3.9

flux

non-metallic material which, when molten, promotes wetting by removing existing oxide or other detrimental films from the surfaces to be joined and prevents their re-formation during the joining operation

[SOURCE: ISO 857-2:2005, 3.2.2]

3.10

test piece

brazed assembly which is used for testing purposes

3.11

test specimen

part or portion cut from the test piece in order to perform specified destructive testing

[SOURCE: ISO/TR 25901-1:2016, 2.2.1.6]

4 Preliminary brazing procedure specification (pBPS)

A preliminary brazing procedure specification shall be prepared. An example pBPS form is shown in [Annex B](#).

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5 Brazing procedure test

The brazing and testing of test pieces shall be in accordance with [Clause 6](#) and [Clause 7](#).

A brazer or brazing operator who undertakes the brazing procedure test satisfactorily in accordance with this document shall be considered qualified for the appropriate range of qualification in accordance with ISO 13585, provided that the relevant testing requirements are met.

6 Test piece

6.1 General

The test piece or pieces shall be brazed using a type of joint design proposed in the pBPS and be representative for the intended production.

6.2 Shape and dimensions of test pieces

If not specified in application standard, the shape and dimension of the test piece shall be agreed by the contracting parties.

The test piece is typically a basic lap or butt joint in sheet material or a sleeve joint in tube (for examples of applicable joint configurations, see [Annex C](#)).

The size of the test piece shall be sufficient to allow all required tests to be carried out. Additional test pieces may be prepared in order to allow for extra and/or for re-testing specimens.

6.3 Brazing of test pieces

Preparation and brazing of test pieces shall be carried out in accordance with the pBPS, and under the general conditions of brazing in production, which they shall represent.

Brazing and testing of the test pieces shall be witnessed by an examiner or an examining body.

7 Examination and testing

7.1 Extent of testing

As a minimum, testing shall be carried out in accordance with [Table 1](#), EN 12797 and EN 12799.

Table 1 — Examination and testing of the test pieces

Test piece	Type of test	Extent of testing
T-joint	Visual, and Metallographic, or Bend	100 % 2 sections ^a 2 specimens ^b
Lap joint	Visual, and Metallographic, and Shear, or Peel	100 % 2 sections ^a 2 specimens 2 specimens
Butt joint	Visual, and Metallographic, and Tensile, or Bend	100 % 2 sections ^a 2 specimens 2 specimens ^b
^a Normally, macro sections are sufficient. However, micro sections can be required. ^b One first surface and one second surface test.		

Application standards can specify additional tests, e.g.:

- longitudinal tensile test;
- volumetric testing (RT or UT);
- corrosion tests;
- chemical analysis;
- cruciform test.

NOTE Specific service, material or manufacturing conditions can require more comprehensive testing than is specified by this document in order to gain more information and to avoid repeating the brazing procedure test at a later date just to obtain additional test data.

7.2 Test specimens

The shape and dimensions of test specimens shall be in accordance with EN 12797, EN 12799, an application standard or technically equivalent standards. For other test specimens where the shape and dimensions are not specified, they shall be agreed by the contracting parties.

7.3 Non-destructive testing

The extent of non-destructive testing shall be in accordance with 7.1 and Table 1 and be carried out on the test pieces prior to cutting of the test specimens. Visual testing shall be performed in accordance with EN 12799 or technically equivalent standards. Radiographic testing, where specified, shall also be carried out in accordance with EN 12799 or technically equivalent standards.

7.4 Destructive testing

7.4.1 General

The extent of destructive testing shall be in accordance with 7.1 and Table 1.

7.4.2 Bend testing

The testing and test specimens shall be in accordance with EN 12797 or technically equivalent standards and Table 1.

One first surface bend test specimen and one second surface bend test specimens shall be tested. The first surface is defined as the surface from which the filler metal is applied. The second surface is defined as the opposite surface from which the filler metal is applied.

For testing of T-joints, the configuration of the test piece shall be in accordance with Figure 1.

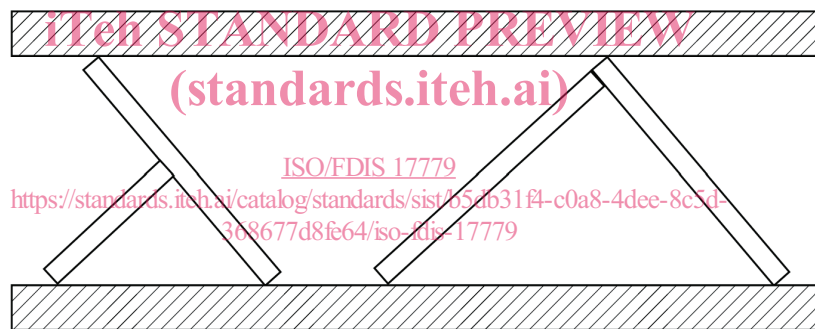


Figure 1 — Types of configuration of transverse bend testing of T-joint

7.4.3 Peel testing

The test specimens and the testing shall be performed in accordance with EN 12797 or technically equivalent standards.

7.4.4 Shear testing

The test specimens shall be in accordance with one of the types defined in EN 12797 or technically equivalent standards. The test specimen shall fracture in the weakest parent material, unless otherwise specified.

If the specimen fractures in the braze metal although the requirements in 7.5 are met, the overlap length is considered to be too small and the joint should be re-designed.

7.4.5 Transverse tensile testing

The test specimens shall be in accordance with one of the types defined in EN 12797 or technically equivalent standards. The details of testing procedure and test specimen shall be established before any testing is undertaken. The tensile strength shall not be less than the specified minimum tensile