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Brazing — Qualification test of brazers and brazing operators

Brasage fort — Essais de qualification des braseurs et des opérateurs braseurs en brasage fort

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Foreword

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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.

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

Introduction

The purpose of this International Standard is to provide a general set of rules for qualification, independent of product or application.

Brazing — Qualification test of brazers and brazing operators

1 Scope

This International Standard specifies basic requirements for the qualification testing of brazers and brazing operators providing conditions for brazing, testing, examination, acceptance criteria and range of qualification for certificates.

NOTE 1 Annex D gives guidelines on general quality requirements for brazing.

NOTE 2 This International Standard does not apply to brazing for aerospace applications covered by ISO 11745[2].

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 857-2, *Welding and allied processes — Vocabulary — Part 2: Soldering and brazing processes and related terms*

ISO 17672, *Brazing — Filler metals*

ISO 18279, *Brazing — Imperfections in brazed joints*

ISO/TR 25901, *Welding and related processes — Vocabulary*

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

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

EN 13134, *Brazing — Procedure approval*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 857-2, ISO/TR 25901 and the following apply.

3.1
brazer
person who holds and manipulates the device for heating the brazing area by hand

3.2
brazing operator
person who prepares the joint and sets up brazing equipment and thereby has direct influence on the brazed joint quality

NOTE Examples of brazing equipment are mechanized torch holders, furnaces, salt baths, and induction equipment.

3.3
brazing
joining process in which a molten filler material is used that has a liquidus temperature above 450 °C but lower than the solidus temperature of the parent material(s)

NOTE Adapted from ISO 857-2:2005, 3.1.2.

3.4
brazing procedure specification
BPS
document that has been qualified and provides the required variables of the brazing procedure to ensure repeatability during production brazing

3.5
preliminary brazing procedure specification
pBPS
document containing the required variables of the brazing procedure which is not yet qualified

3.6
manufacturer
workshop or site (or both) which is (are) under the same technical and quality management

3.7
examiner
person appointed to verify compliance with the applicable standard

NOTE In certain cases, an external independent examiner can be required.

[ISO/TR 25901:2007, 2.119]

3.8
examining body
organization appointed to verify compliance with the applicable standard

NOTE In certain cases, an external independent examining body can be required.

[ISO/TR 25901:2007, 2.120]

3.9
filler metal
filler metals
added metal required for soldered or brazed joints, which can be in the form of wire, inserts, powder, pastes, etc.

NOTE Adapted from ISO 857-2:2005, 3.2.1.

3.10
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

[ISO 857-2:2005, 3.2.2]

3.11
test piece
brazed assembly which is used for testing purposes

NOTE Adapted from ISO/TR 25901:2007, 2.373.

3.12
test specimen
part or portion cut from the test piece in order to perform a specified destructive test

[ISO/TR 25901:2007, 2.374]

4 Symbols, definitions and reference numbers

4.1 General

Where the full wording is not used, the symbols in 4.2 and reference numbers in 4.3 shall be used when completing the qualification test certificate (see Annexes A and B).

4.2 Symbols

t material thickness of the work piece

L overlap length

D outside pipe diameter

4.3 Reference numbers

For applicable brazing process reference numbers, see 5.2.

5 Essential variables and range of qualification

5.1 General

The qualification of brazers and brazing operators is based on essential variables. For each essential variable, a range of qualification is defined and brazing outside that range of qualification requires a new qualification test. The essential variables are:

— brazing process;

— product type;

— type of joint;

— parent material group(s);

— brazing filler metal type;

— brazing filler application;

— dimension (material thickness, outside pipe diameter and overlap length);

— filler metal flow direction;

— degree of mechanization.

NOTE There can be other variables that the manufacturer deems to be essential in certain applications, e.g. constraint on access for the torch, which need separate qualification (see Annex E).

The variables listed in the first paragraph are essential only to ISO 4063[1] processes 912 and 916, see 5.2. For the other processes in 5.2, the range of qualification is unlimited for the listed variables (except the brazing process).

5.2 Brazing process

Brazing processes are defined in ISO 857-2 and listed in the following, preceded by their ISO 4063[1] process numbers.

Each qualification test normally qualifies only one brazing process. A change of brazing process requires a new qualification test.

— 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

NOTE The principle of this International Standard can be applied to other brazing processes.

5.3 Product type

The brazing of one product type qualifies for other product types according to Table 1.

Table 1 — Range of qualification for product type

Product type for test piece	Range of qualification
Plate	Plate
Pipe	Pipe

5.4 Type of joint

Range of qualification for type of joint is given by Table 2.

Table 2 — Range of qualification for type of joint

Type of joint in test piece	Range of qualification
Butt joint	Butt joint
Overlap joint	Overlap joint

5.5 Parent material group(s)

To simplify the presentation of the range of qualification, the materials are indexed into A to F, according to Table 3, using the material grouping of ISO/TR 15608[3].

The parent material group used in the qualification test qualifies the brazer or brazing operator for the brazing of all other metals within the same material group as well as other material groups according to Table 3.

When brazing parent materials outside the grouping system, a separate qualification test is required and the qualification is limited to the materials used.

Table 3 — Range of qualification for parent material

ISO/TR 15608[3] material group	Index	Test piece	Range of qualification
1, 2, 3, 4, 5, 6, 9, 11	A	A – A	A – A
7, 8, 10	B	B – B	A – A, B – B, A – B
21, 22, 23	C	C – C	C – C
31-34, 37, 38	D	D – D	D – D
41-45	E	E – E	E – E
51-54	F	F – F	F – F
Dissimilar metal joints		A – B	A – A, A – B
		D – A	D – A
		D – B	D – A, D – B
		D – E	D – E
		E – A	E – A
		E – B	E – A, E – B

5.6 Filler metals and brazing filler application

The brazing filler metal type based on its class, as specified in ISO 17672, is a qualification criterion for other filler metal types within the same class.

The brazing filler metal application qualifies for other filler metal application according to Table 4.

Table 4 — Range of qualification for brazing filler application

Test piece brazing filler application	Range of qualification
Face fed	Face fed, Pre-placed
Pre-placed	Pre-placed
NOTE "Face fed" is also known as "applied to the mouth of the joint", which can be manually or mechanically fed.	

5.7 Dimensions

The brazer qualification test of brazed joints is based on the material thickness, outside pipe diameters and overlap length. The ranges of qualification are specified in Table 5.

For dissimilar material thicknesses of test pieces, the range of qualification is based on the thickness of each plate (or pipe).

It is not intended that material thicknesses or outside pipe diameters should be measured precisely, but rather the general philosophy behind the values given in Table 5 should be applied.

For test pieces of different outside pipe diameters and parent material thicknesses, the brazer is qualified for:

— the smallest to the largest diameter (see Table 5);

— the thinnest to the thickest parent material thickness (see Table 5).