SLOVENSKI STANDARD
oSIST prEN 12799:2017

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Trdo spajkanje - Neporušitveno preskušanje trdo spajkanih spojev

Brazing - Non-destructive examination of brazed joints

Hartlöten - Zerstörungsfreie Prüfung von Hartlötverbindungen

Brasage fort - Contrôles non destructifs des assemblages réalisés par brasage fort

Ta slovenski standard je istoveten z: **prEN 12799**

ICS:

25.160.50 Trdo in mehko lotanje Brazing and soldering

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EUROPEAN STANDARD

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English Version

Brazing - Non-destructive examination of brazed joints

Brasage fort - Contrôles nob destructifs des assemblages réalisés par brasage fort

Hartlöten - Zerstörungsfreie Prüfung von Hartlötverbindungen

This draft European Standard is submitted to CEN members for enquiry. It has been drawn up by the Technical Committee CEN/TC 121.

If this draft becomes a European Standard, 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.

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Recipients of this draft are invited to submit, with their comments, notification of any relevant patent rights of which they are aware and to provide supporting documentation.

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

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European foreword

This document (prEN 12799:2017) has been prepared by Technical Committee CEN/TC 121 “Welding and allied processes”, the secretariat of which is held by DIN.

This document is currently submitted to the CEN Enquiry.

This document will supersede EN 12799:2000.

In comparison with the previous edition, the main changes are:

a) the normative references have been updated;

b) the document has been revised editorially.

1 Scope

This European Standard describes non-destructive examination procedures and test piece types necessary to perform the tests on brazed joints.

The non-destructive examination methods described are as follows:

a) visual examination (see Clause 4);

b) ultrasonic examination (see Clause 5);

c) radiographic examination (see Clause 6);

d) penetrant examination (see Clause 7);

e) leak testing (see Clause 8);

f) proof testing (see Clause 9);

g) thermography (see Clause 10).

The brazed joints to which these tests are applied can either be test samples manufactured to obtain brazed joint design data, or manufactured as part of the approval testing of a brazing procedure, or parts of a brazed assembly. The type of test piece described for each test can be quoted or incorporated in engineering application standards that deal with brazed assemblies.

This European Standard does not recommend the number of samples to be tested or the repeat tests allowed. Neither does it specify methods of sampling brazed joints, except to give guidance regarding the precautions necessary, nor does it comment on the acceptance criteria applicable to any of the tests. No attempt is made to define which test or tests, if any, should be applied in any situation. This is a matter to be established before any particular method of test is selected.

The methods of non-destructive examination are not associated with any particular type of brazed assembly but lay down the general principles of the types of testing described. It is emphasized that a satisfactory examination method can only be developed and used after taking into account all the relevant factors regarding the equipment to be used and the characteristics of the test piece being examined.

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.

EN 1593, *Non-destructive testing - Leak testing - Bubble emission techniques*

EN 12668-1, *Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 1: Instruments*

EN 12668-2, *Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 2: Probes*

EN 12668-3, *Non-destructive testing - Characterization and verification of ultrasonic examination equipment - Part 3: Combined equipment*

EN 13184, *Non-destructive testing - Leak testing - Pressure change method*

EN 13185, *Non-destructive testing - Leak testing - Tracer gas method*

EN ISO 3452-1, *Non-destructive testing - Penetrant testing - Part 1: General principles (ISO 3452-1)*

EN ISO 5579, *Non-destructive testing - Radiographic testing of metallic materials using film and X- or gamma rays - Basic rules (ISO 5579)*

EN ISO 9712:2012, *Non-destructive testing - Qualification and certification of NDT personnel (ISO 9712:2012)*

EN ISO 16810:2014, *Non-destructive testing - Ultrasonic testing - General principles (ISO 16810:2012)*

EN ISO 16811, *Non-destructive testing - Ultrasonic testing - Sensitivity and range setting (ISO 16811)*

EN ISO 16823, *Non-destructive testing - Ultrasonic testing - Transmission technique (ISO 16823)*

3 General principles

Imperfections may be observed when brazed joints are examined non-destructively. They may reduce the quality and performance characteristics of the joint or the brazed assembly.

This European Standard does not give guidance regarding the cause of the imperfection or its effect upon the joint quality or the effects of single or multiple imperfections upon the performance characteristics of the brazed assembly. This will depend upon the life-limiting processes to which the joint is subjected and the life requirements and performance specific to the brazed assembly.

The majority of brazed joints are designed with the component parts in a lap configuration. Because of the capillary nature of a brazed joint, most imperfections will be contained within the joint region, with the principal axes parallel to the plane of the joint. Any other imperfections are caused by stresses in the brazing metal or the parent materials, or were already present before brazing. Guidance is given regarding the types of imperfections that are observed when non-destructive tests are applied; these are defined diagrammatically in Annex A.

NOTE The importance of tolerances to typical imperfections, the cause for rejection, the method of imperfection interpretation and the method of presentation of observations have to be established before a specific method of test is selected.

The use of any method should always be considered in relation to testing as a whole. The benefits of using any particular method can only be obtained by consideration of the results in conjunction with results obtained by using other test methods. The most appropriate method or methods of examination should be selected.

4 Visual examination

4.1 General

Simple visual examination is the most fundamental and commonly used method of non-destructive examination. The examination described in this Clause relates to the quality of the joint and does not include dimensional inspection.

Consideration shall be given at the design stage to the provision of adequate access to permit visual examination.

Before any visual examination is undertaken it shall be established which joints (and fillets of joints) are accessible for inspection; a suggested criterion for accessibility for satisfactory inspection, either directly by eye or viewed in a mirror, is shown in Figure 1.

4.2 Principle

The brazed joint and adjacent parent material are visually examined (unaided and aided) to check the appearance, soundness and contour.

4.3 Qualification of personnel

Personnel who carry out visual examination shall:

a) be informed about the braze process used and the possible imperfections;

b) have vision tested in accordance with EN ISO 9712:2012, 7.4;

c) have received instruction in the specific requirements in accordance with 4.4;

d) have received instruction in the general application standard.

When training records are kept, they shall verify compliance with items a) to d) and contain a supervisor's statement that an acceptable level of attainment has been achieved. Visual examination does not require personnel with qualifications in addition to that detailed in items a) to d).

4.4 Requirements specific to the examination

The following shall be established before any examination is undertaken.

a) Manufacturing stage at which visual examination is to be carried out; this should include consideration as to whether inspection is carried out on-line;

b) Requirements for surface preparation for inspection;

NOTE There is usually no such preparation after fluxless brazing processes. After brazing, flux and flux residues are normally removed (see 4.8).

c) Minimum relevant imperfection size;

The recommended minimum relevant imperfection size for visual examination is 0,5 mm as defined in 4.8 b), unless otherwise specified.

d) Extent of visual examination as defined in 4.7;

e) Acceptance criteria (see 4.8);

f) Any requirements for a written inspection procedure;

g) Reporting requirements;

h) Any aids to visual inspection additional to those listed in 4.6.

4.5 Information to be supplied for visual inspection

Before commencing examination, the following shall be available to the operator.

a) All the information required in 4.4;

b) A written inspection procedure, if applicable.

4.6 Inspection aids and equipment

The following are likely to be required.

a) Suitable illumination;

b) A wide-angle low-magnification (x5) viewer, e.g. a standard universal bench-mounted device that leaves both hands free and may also incorporate illumination;

c) A comparison gauge for the minimum relevant imperfection size, e.g. either:

   1) a mounted wire of this diameter to hold alongside the imperfection, the end of which may be bent for easy alignment with the major axes of the imperfection; or

   2) an x8 loupe with graticule;

d) A plain small mirror, e.g. a dental mirror, for partially accessible joints;

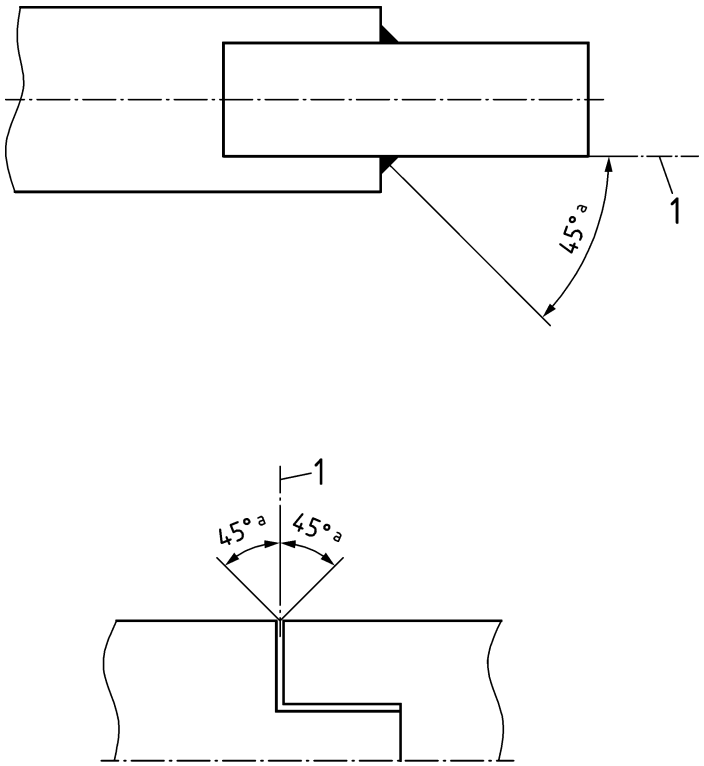
e) Means of locally illuminating areas in shadow, e.g. optic fibre light guides;

f) Approved methods of marking individual joints if detailed in 4.9, e.g. certain types of waterproof felt marker pens.

4.7 Extent of visual inspection on each workpiece

As many work pieces have a proportion of fillets that either have difficult access or can be examined only by special techniques, the extent of inspection shall be defined for each workpiece and shall be established before the examination is undertaken and not left to the discretion of the inspector.

The specified inspection sites shall be shown on the assembly drawing or, in complex cases, on a drawing prepared for this purpose. The drawing shall also state, or reference, the acceptance criteria.

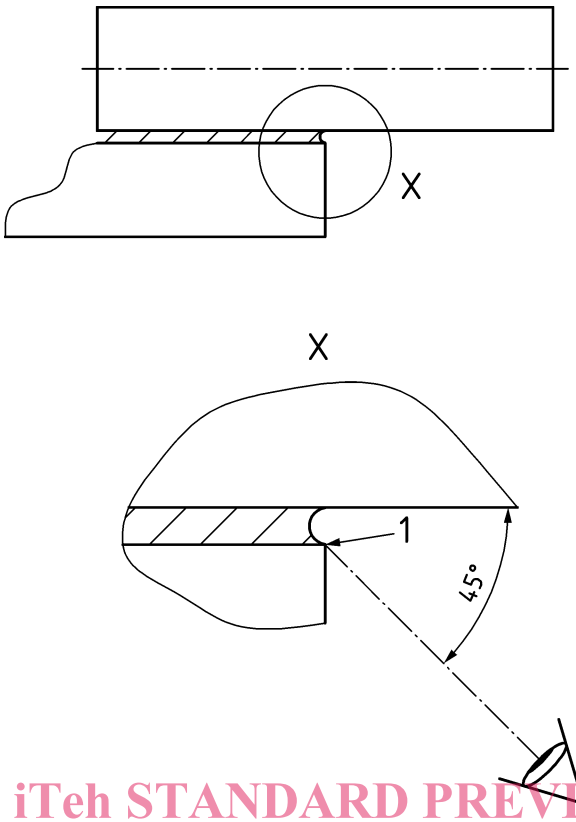


Key

1 axis

[a] viewing angle

Figure 1 — Access for visual inspection: joints to be viewable within a stated angle of joint axis or exit plane



Key

1 bottom of recess to be visible at 45° to the joint axis

Figure 2 — Access for visual inspection: recessed fillet, when recessed fillets are permitted

4.8 Acceptance guidelines

The following points should be considered.

a) *Flux and flux residues (when appropriate to the brazing process used)*. The extent of removal of flux and flux residues to permit inspection should be detailed;

b) *Minimum relevant imperfection size*. Imperfections having a maximum dimension smaller than an agreed minimum size are to be disregarded. It is recommended that the minimum relevant imperfection size is 0,5 mm;

The acceptability for service of brazed assemblies which may require greater integrity should be determined by additional tests, e.g. leak tightness.

c) *Continuity of fillets*. It should be stated whether complete or incomplete fillets are acceptable. Where incomplete fillets are acceptable, the description should be as direct as possible and avoid possible errors. For example, 'incomplete fillets with *x* gaps maximum each not exceeding *y* mm' is preferable to 'incomplete fillets with gaps not exceeding 20 % of total length';

d) *Recessed fillets*. Recessed fillets may be due to brazing gaps at the upper limit for the braze process employed or insufficient filler metal. It is difficult to estimate the depth of recess and if the condition is acceptable it is suggested the criterion shown in Figure 2 is adopted;

e) *Excess filler metal*. When it is a requirement that filler metal does not encroach on a surface adjacent to a brazed joint, that area has to be accurately indicated on the assembly drawing. This is necessary firstly as a guide to the application of stop-off agents during preparation before brazing and secondly for inspection purposes;