SLOVENSKI STANDARD

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Trdo spajkanje - Navodilo za uporabo trdo spajkanih spojev

Brazing - Guidance on the application of brazed joints

Hartlöten - Anleitung zur Anwendung hartgelöteter Verbindungen

Brasage fort - Guide d'application pour les assemblages réalisés par brasage fort

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ICS:

25.160.50 Trdo in mehko lotanje Brazing and soldering

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English Version

Brazing - Guidance on the application of brazed joints

Brasage fort - Guide d'application pour les assemblages réalisés par brasage fort

Hartlöten - Anleitung zur Anwendung hartgelöteter Verbindungen

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

CEN-CENELEC Management Centre: Avenue Marnix 17, B-1000 Brussels

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European foreword

This document (prEN 14324:2017) 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 14324:2004.

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

a) the normative references have been updated;

b) the document has been revised editorially.

Introduction

The purpose of this document is to provide information and guidance to users whose knowledge of brazing is limited, either regarding the whole process or in some specific areas. It is not intended to replace textbooks but to make readily available certain important information and to prevent some common errors.

Brazing techniques offer a wide field for joining, cladding, building up and comparable applications where brazing filler materials can be used. Structures similar to brazed joints can be achieved by arc brazing processes (MIG, TIG, plasma), infra-red brazing and electron beam brazing, which are better described as braze welding.

Where the word 'material' is used for components, they can be metallic or non-metallic, except when the component can only be metallic, when it is so described. The same usage applies to filler materials, although the use of non-metallic filler materials is very limited.

1 Scope

This European Standard gives guidance on the application of brazing and the manufacture of brazed joints. This standard gives an introduction to brazing and a basis for the understanding and use of brazing in different applications. Because of the wide range of applications of brazing, this standard does not give detailed guidance that might be product specific. For such information, reference should be made to the appropriate product standard or, for applications where this does not exist, the relevant criteria should be clearly established before any brazing is undertaken.

This standard covers joint design and assembly, material aspects for both parent material and filler materials, brazing process and process variables, pre- and post-braze treatment and inspection.

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 1045, *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*

EN 13134, *Brazing - Procedure approval*

EN ISO 13585, *Brazing - Qualification test of brazers and brazing operators (ISO 13585)*

EN ISO 17672:2016, *Brazing - Filler metals (ISO 17672:2016)*

EN ISO 18279, *Brazing - Imperfections in brazed joints (ISO 18279)*

3 Terms and definitions

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

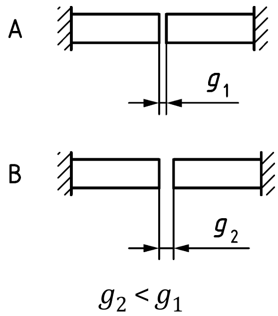
3.1
brazing
joining process in which a filler material is used which has a liquidus temperature above 450 °C, but below the solidus of the parent material, and which is mainly distributed in the brazing gap by capillary attraction

Note 1 to entry: Other joining methods exist (see E.6.3).

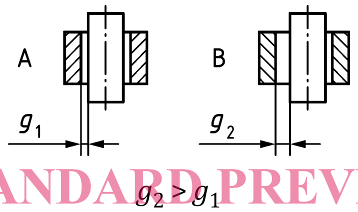
3.2
brazed joint
result of a joining process where the parent materials are not melted and the filling material and braze material have different chemical compositions compared to the parent materials

3.3
brazing gap
narrow, mainly parallel gap at the brazing temperature between the components to be brazed (see Figure 1 and 4.3.4)

3.4
assembly gap
fit up
narrow, mainly parallel gap at room temperature between the components to be brazed (see Figure 1 and 4.3.4)



a) Constrained butt joint



Shaded component has higher coefficient of expansion.

b) Tube joint (dissimilar materials)

Key

A assembly at ambient temperature
B assembly at brazing temperature
g_1 assembly gap
g_2 brazing gap

Figure 1 — Assembly gap and brazing gap

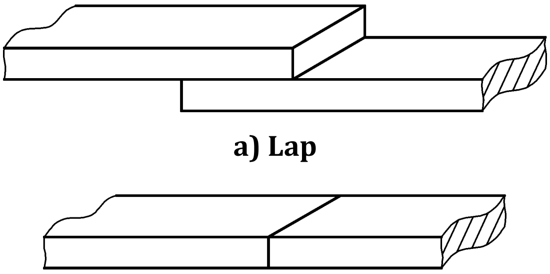
4 Joint design

4.1 Principle

The brazing process depends upon capillary flow of a molten brazing filler material between parts separated by a narrow gap. The filler material has a different composition from the components to be brazed. This compositional difference may affect the properties of the assembly in service, e.g. at elevated temperature, in corrosive media or under fatigue loading. In addition the properties of the parent material of the components to be brazed can be affected by the brazing cycle.

4.2 Types of joint

There are basically two types of joint as shown in Figure 2. In practice very few assemblies are as simple as the basic types shown in Figure 2 (see Annex A).



a) Lap

b) Butt

Figure 2 — Basic joint types

Lap joints are generally used because they are easier to fabricate and offer increased strength. Butt joints are used where adequate strength is readily obtained, e.g. where the mechanical properties of the parent materials are lower than those of the brazed joint, or where the thickness and/or length of a lap joint is undesirable.

It should be noted that the useful overlap for a lap joint in shear is related to the thickness of the thinner component; beyond the optimum overlap there is little to be gained in joint strength by increasing the overlap length.

4.3 Assembly gap and brazing gap

4.3.1 General

The areas of a brazed assembly are defined as shown schematically in Figure 3.

Perhaps the most critical feature in brazing is the control of the brazing gap, i.e. the gap at the **brazing temperature**, between the components to be brazed and through which the filler material has to flow by capillary action. There are several factors that influence the choice of the brazing gap and which have to be taken into consideration. It is essential to recognise that where joints are to be made between different parent materials, the assembly gap (fit up) will usually have to be different from the brazing gap (see 4.3.4).

NOTE The assembly gap may need to be larger or smaller than the brazing gap, depending on the thermal expansion coefficients of the materials, the configuration and the brazing process.

Different filler materials require different gaps even within the same group, as can be seen from the typical ranges given in Table 1, but the optimum gap may also be affected by a number of other joint parameters (see example in Figure 4), e.g.:

— parent material(s);

— geometry of the joint;

— surface finish of the faying surfaces;

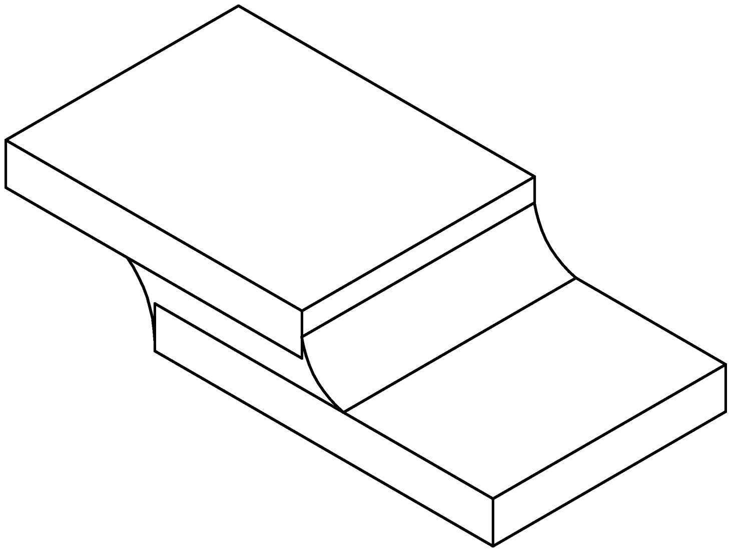
— use of a flux or protective atmosphere;

— careful control of brazing temperature and heating rate;

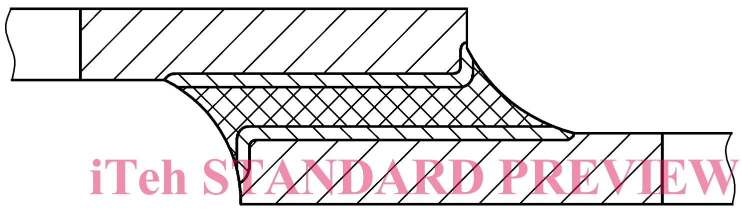
— brazing process.

Table 1 — Typical brazing gaps

Filler metal class according to EN ISO 17672	Brazing gap[a] mm
Al	0,05 to 0,25
Ag	0,05 to 0,30
CuP	0,05 to 0,30
Cu	Up to 0,15 0,05 to 0,20
Ni	Up to 0,15
Au	Up to 0,10
[a] Brazing gap will depend on the selected filler materials, the brazing process and the brazing conditions.	



a) Simple brazed assembly



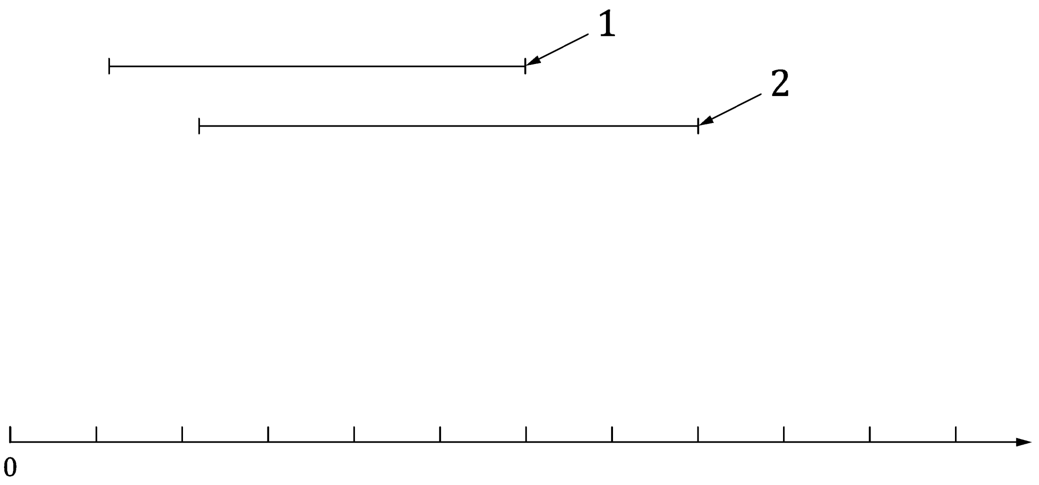
b) Section through assembly in a)

Key

- parent material
- parent material affected by brazing (heat affected zone (HAZ))
- diffusion-transition zone
- braze material

NOTE Extent of HAZ will vary with materials and brazing process.

Figure 3 — Schematic of brazed assembly



Key

1 mechanized flame brazing with flux

2 hand flame brazing with flux

Figure 4 — Schematic of differences in brazing gap ranges with different brazing processes (in this example for mild steel brazed with an Ag filler materials)

4.3.2 Influence of brazing filler materials

Those types with the shortest melting range, often containing significant additions of temperature depressant elements (e.g. Si, B, P and Zn) exhibit enhanced fluidity and excellent capillary penetration. This also applies to most eutectic compositions and many pure metals. Conversely, those filler materials having wide melting ranges will generally have better wide gap filling characteristics and are more suitable for brazing when gaps are at the upper end of the stated range.

4.3.3 Influence of parent material

For those parent materials that are not readily soluble in the brazing filler material, or do not undergo mutual interaction to form alloy layers, gaps may, in general, be tighter than with those combinations where significant alloying occurs. Extensive inter-alloying will impair the fluidity of the brazing filler material and necessitate the use of wider brazing gaps to ensure complete penetration of the joint by the brazing filler material.

4.3.4 Influence of dissimilar parent materials

When dissimilar parent materials, of different coefficients of thermal expansion, are to be joined, care has to be exercised in designing the joint in order to obtain the correct brazing gap (see Figure 5). In extreme cases, joint gaps may close completely or open excessively at brazing temperature resulting in non-penetration or non-retention of the brazing filler material, respectively. Given that the brazing gap is the essential parameter, the assembly gap (to which the components will be machined) has to be calculated from the expansion coefficients of the parent materials, the sizes of the components and the brazing temperature.

This problem becomes greater:

— as the size of the brazed assembly increases;

— as the brazing temperature becomes higher;

— as the thermal expansion differential widens.