British Standard

BRITISH STANDARD

BS EN
13134:2000

Brazing — Procedure approval

The European Standard EN 13134:2000 has the status of a British Standard

ICS 25.160.50

National foreword

This British Standard is the official English language version of EN 13134:2000. Together with BS EN 13133:2000 it supersedes BS 1723-4:1988 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee WEE/19, Brazing and bronze welding, which has the responsibility to:

— aid enquirers to understand the text;

— present to the responsible European committee any enquiries on the interpretation, or proposals for change, and keep the UK interests informed;

— monitor related international and European developments and promulgate them in the UK.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Summary of pages

This document comprises a front cover, an inside front cover, the EN title page, pages 2 to 17 and a back cover.

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Brazing - Procedure approval

Brasage fort - Qualification de mode opératoire de brasage fort

Hartlöten - Hartlötverfahrensprüfung

This European Standard was approved by CEN on 27 July 2000.

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COMITÉ EUROPÉEN DE NORMALISATION
EUROPÄISCHES KOMITEE FÜR NORMUNG

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Ref. No. EN 13134:2000 E

Contents

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 121, Welding, the Secretariat of which is held by DS.

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of an identical text or by endorsement, at the latest by February 2001, and conflicting national standards shall be withdrawn at the latest by February 2001.

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this standard.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Czech Republic, Denmark, Finland, France, Germany, Greece, Iceland, Ireland, Italy, Luxembourg, Netherlands, Norway, Portugal, Spain, Sweden, Switzerland and the United Kingdom.

Introduction

Approved brazing procedure specifications will frequently, but not always, be needed in order to provide a well defined basis for the planning of brazing operations and for quality control during brazing. Brazing is considered a special process in the terminology of standards for quality systems; such standards usually require that special processes be carried out in accordance with written procedure specifications.

This standard defines the content for the brazing procedure specifications which is considered to fulfil the requirements in current standards for quality systems as regards procedure specifications.

Preparation of a brazing procedure specification records the necessary instructions for evaluation but does not in itself ensure that the resulting brazes fulfil the service requirements. Some deviations can be evaluated by non-destructive methods on the finished product but others, e.g. metallurgical deviations, cannot. This has resulted in the establishment of a set of rules for approval of the brazing procedure prior to the release of the specification to actual production.

Guidelines for the practical application of brazing procedure approval are given in annex A.

Furthermore, this standard allows for brazing procedure approval to be related to previous experience of similar applications. Many manufacturers have considerable experience in fabricating brazed structures. Brazed components and structures may have been supplied for a variety of applications and have performed satisfactorily over a period of time in service. If this experience is traceable and verifiable, this standard provides a route for brazing procedure approval based on this experience.

1 Scope

This European Standard specifies general rules (test procedures, test pieces) for the specification and approval of brazing procedures for all materials, metallic and non-metallic. It is anticipated that, where necessary, specific requirements for individual industries will be developed within this framework and detailed in the relevant application standard. The recommended format for the procedure approval certificate is given in annex B.

It assumes that the brazing procedure specifications are used in production and, in the case of manual flame brazing, by competent brazers approved in accordance with EN 13133, where relevant.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 13133	Brazing - Brazer approval.
EN 12797	Brazing - Destructive examination of brazed joints.
EN 12799	Brazing - Non-destructive testing of brazed joints.

3 Terms and definitions

For the purposes of this European Standard the following terms and definitions apply.

3.1
brazer
person who performs the brazing in a manual operation; he guides the heating means and ensures the introduction of the brazing filler metal

3.2
brazing procedure specification (BPS)
document providing the designations or values of the required variables necessary to achieve consistent brazing for the defined application

NOTE An example of the format to be used is given in annex C.

3.3
brazing procedure test
making and testing of a brazed joint in order to prove the feasibility of a brazing procedure

3.4
manufacturer
person or organization responsible for the manufacture of the brazed joints

3.5
examiner or examining body
person or organization appointed to verify compliance with the applicable standard

NOTE The examiner or examining body may be a notified body or recognized third-party, if required.

3.6
preliminary brazing procedure specification (pBPS)
tentative BPS, which is assumed to be adequate by the manufacturer, but which has not been approved. Brazing of test pieces needed for the approval of a BPS has to be carried out on the basis of a pBPS

3.7
test piece
assembly which is brazed together during the approval test

3.8
test specimen
sample taken from a test piece

4 Information and requirements to be agreed and to be documented

The following information and requirements shall be agreed and documented prior to the contract.

a) The application standards to be used, if any, together with any supplementary requirements (see clause 1).

b) The specification of the parent materials.

c) The types of test, if any, to be carried out on brazing consumables.

d) The brazing process to be used.

e) The brazing filler metal and flux (if any) to be used, if not specified elsewhere.

f) The relevant brazing variables (see clause 5 and annex A).

g) The pBPS, based on the information detailed in this clause (see clause 6).

h) The joint/assembly design if it is not specified in the relevant application standard (see 8.1).

i) The number of test pieces, the number of test specimens and the number of further test specimens for re-testing (see 8.2, 8.3 and 9.5).

j) The extent of visual testing, the details of metallographic examination and additional testing requirements for non-destructive and destructive tests (see clause 9).

k) The acceptance/non-acceptance criteria, including (where appropriate) the level of confidence (see 9.5 and annex A).

l) The range of approval, where this is possible (see clause 10).

m) Records and documentation.

NOTE Examples of the formats to be used are given in annexes B, C and D.

5 Brazing variables

The relevant brazing variables shall be selected [see 4 f) and annex A].

6 pBPS

A pBPS shall be prepared which it is believed will meet the requirements for the brazed assemblies [see 4 g)]. This shall be approved by one of the methods given in clause 7 to become an approved BPS (see 3.2).

7 Approval of BPS

A BPS can be suitably approved in one of three ways:

a) by submitting documentary evidence to verify that a relevant procedure that has been proven by experience is available for approval by an examiner or examining body;

b) by submitting a relevant procedure previously accepted by another examiner or examining body;

c) by carrying out appropriate brazing procedure tests for approval by an examiner or examining body.

In the case of manual hand torch (flame) brazing, the brazer who undertakes the brazing procedure test satisfactorily in accordance with this standard is thereby approved by EN 13133.

8 Test pieces and test specimens

8.1 General

The pBPS shall be used to braze assemblies from which the test specimens required for non-destructive and/or destructive tests can be taken. In a few cases, it may be possible to braze standard test pieces for this purpose but it will be more usual to braze a production assembly or to devise an assembly which simulates fairly closely the relevant part of the production assembly which will ultimately be required [see 4 h)]. It will be necessary to simulate such items as the heat sink, restraint (particularly if the production assembly is to be jigged), and positioning of inserts.

8.2 Number of test pieces

The number of test pieces shall be sufficient to allow the test specimens required for the non-destructive and/or destructive tests to be taken [see 4 i) and clause 9].

8.3 Number of test specimens

For a brazing procedure to be approved, the test pieces representing the brazing procedure test shall comply with the requirements necessary to produce test specimens for the non-destructive and destructive tests [see c4 i) and clause 9]. For the destructive tests detailed in 9.4 items 1), 2), 4) and 5), a minimum of three test specimens is recommended.

9 Examination and testing

9.1 Extent of testing

Tests which may be suitable are described in EN 12797 and EN 12799 but in many cases it will be found that very few, if any, of them are suitable for the assemblies in question. For example, if a component is required to maintain a very low internal pressure, then a vacuum leak test is the meaningful test, destructive tests giving no useful information. When none of the tests given in EN 12797 and EN 12799 are relevant, suitable tests shall be devised [see 4 j)]. For example, if an assembly is exposed to high stress at elevated temperature, then some type of stress rupture test may be required.

9.2 Visual examination

All joints shall be visually examined [see 4 j)] in accordance with EN 12799; the brazed assembly may need to be cut open to offer an internal examination and the test may therefore be destructive.

9.3 Metallographic examination

All joints shall be metallographically examined [see 4 j)] in accordance with EN 12797.

9.4 Additional examination and testing

The basic requirement is to examine the soundness of the brazed assembly.

When any of the following additional non-destructive tests are specified [see 4 j)] they shall be carried out as described in EN 12799:

a) ultrasonic examination;

b) radiographic examination;

c) penetrant testing;

d) leak testing;

e) proof testing;

f) thermographic examination.

When any of the following additional destructive tests are specified [see 4 j)] they shall be carried out as described in EN 12797:

1) shear tests;

2) tensile tests;

3) hardness tests;

4) peel tests;

5) bend tests.

No modification shall be made to the test specimens that will affect the quality of the results obtained from destructive and non-destructive test, and no repair or modification to the procedures shall be carried out on a test specimen at any stage in its manufacture. Procedures such as surface dressing shall be allowed for non-destructive tests where non-critical surface imperfections affect the result of the test.

9.5 Re-testing

If the test specimen fails to comply with the specified acceptance criteria [see 4 k)] for the agreed tests, the specified number of further tests specimens [see 4 i)] shall be prepared for each one that failed, either from the same brazed assembly or from a newly brazed assembly. These shall be subjected to the same test. If any of these additional test specimens do not comply with the specified acceptance criteria, the brazing procedure shall be regarded as not capable of complying with the requirements of this standard without modification.

10 Range of approval

An approval of a BPS is valid for brazing in workshops or sites under the same technical and quality control of that manufacturer. To avoid duplication of nearly technically identical procedure tests (see annex A), it may be possible to establish ranges for approval of, for example, parent materials, filler materials, thicknesses, diameters or lap lengths, based on previous documentary evidence [see 4 l)].

11 Brazing procedure approval record (BPAR)

The BPAR is a statement of the results of assessing each test piece including retests. The record shall include details of any test failures. If no non-compliant features or test results are found, a statement that the test samples made by the brazing procedure satisfy the agreed criteria in respect of that type of sample and the tests conducted shall be signed by the examiner or examining body's representative.

It is recommended that the form given in annex C is used to record or refer to details of the approval test of brazing procedure and the form given in annex D is used to record details of the results of such a test.

Annex A
(informative)

Guidelines for practical application of brazing procedure approval

Before any brazing procedure approval is undertaken, there is a crucial need to examine all the relevant factors, if only to avoid subsequent unnecessary expense. Although not specifically within the scope of this standard, this examination should also cover the requirements for inspection of production assemblies, including the acceptance criteria. It is important to recognize that the procedure approval test is not intended to be a guide to production reproducibility.

Table A.1 lists the relevant brazing variables for the common brazing processes. It is not exhaustive and for some specific applications it may be necessary to include others but it does address the majority of cases.

It is essential to recognize the importance of carrying out realistic tests for brazing procedure approval. In such cases it is unnecessarily expensive to carry out unsuitable tests and possibly dangerously misleading. This applies equally to the choice of tests with which to prove the procedure and the types of test piece used. The tests to prove the procedure have to be selected to take into account the requirements in service, e.g. if the brazed assembly needs to hold a high internal vacuum, then the approval testing has to include a vacuum leak test at the appropriate level. Other types of test may be deemed relevant, depending on the service conditions, but the primary requirements have always to be borne in mind and given priority. The choice of test piece, e.g. form and size, has an importance in brazing that it seldom has in welding. As an example of this, in general terms, welded specimens beyond a certain minimum size have similar properties and for this reason a given welding procedure can be used for a range of different joints. In general this is not true of brazed components. The extreme example of this is where dissimilar materials with significantly different coefficients of thermal expansion are being joined; small pieces can be brazed without much difficulty but the differential expansion/contraction prevents big ones from being joined. Even with similar materials, a change in heat sink can cause problems, particularly if the thermal conductivity is low. As a consequence of factors such as these, in certain instances it will be necessary to carry out procedure approval on actual-sized brazed assemblies. A consequence of this is that testing small pieces may at best be merely a waste of money and at worst dangerously misleading.

Table A.1 - Relevant brazing variables

Variables	Brazing process								
	Column headings: A: Hand torch B: Mechanized flame C: Induction D: Resistance E: Protective atmosphere furnace F: Vacuum furnace G: Open furnace H: Flux bath; dip bath and salt bath I: Infra-red								
	A	B	C	D	E	F	G	H	I
Parent materials (types and thickness)	x	x	x	x	x	x	x	x	x
Brazing filler metal,									
Type	x	x	x	x	x	x	x	x	x
Form	x	x	x	x	x	x	x	x	x
method of filler metal supply	x	x	x	x	x	x	x	x	x
point of application	x	x	x	x	x	x	x	x	x
Flux,									
type	x	x	x	x	x		x	x	x
Form	x	x	x	x	x		x	x	x
method of filler metal supply	x	x	x	x	x		x	x	x
point of application	x	x	x	x	x		x	x	x
Stop off	x	x	x		x	x	x		x
Assembly design and configuration (including room temperature, fit-up and joint gap at brazing temperature)	x	x	x	x	x	x	x	x	x
Jig and fixture details	x	x	x	x	x	x	x	x	x
Method of pre-braze cleaning	x	x	x	x	x	x	x	x	x
Method of post-braze cleaning	x	x	x	x	x		x	x	x
Post-braze heat treatment (temperature-time cycle)	x	x	x	x	x	x	x	x	x
Time-temperature cycle		x	x		x	x	x	x	x
Temperature measurement (control and position of sensors)		x	x		x	x	x	x	x
Heating gases (types and pressures)	x	x							
Nozzle/burner size and number	x	x							
Power source (type, frequency and setting)			x						
Induction coil, design and position (relative to joint)			x						
Electrode design and material				x					
Machine settings (electrode pressure, current, time)				x					

Table A.1 - Relevant brazing variables (concluded)

Variables	Brazing process								
	A	B	C	D	E	F	G	H	I
Furnace type					x	x	x		
Atmosphere (type, purity and flow rate)			x		x				x
Internal purge	x	x							
Vacuum pressure			x			x			x
Backfill gas (type and pressure)						x			
Bath composition								x	
Preheat before brazing								x	

Note: For infra-red brazing (and for any other specialized processes), the contracting parties should agree on the relevant variables additional to those listed above.

Annex B
(informative)

Brazing procedure approval record (BPAR) form - Part 1: Procedure approval certificate

Manufacturer
name and address:

Examiner or examining body
name and address:

Manufacturer's brazing procedure
reference No.:

Examiner or examining body
reference No.:

Method of approval:

a) Submission of documentary evidence that a relevant procedure proven by experience is already in existence.

b) Submission of a relevant procedure previously accepted by another examiner or examining body.

c) Carrying out of appropriate brazing procedure tests for the present examiner or examining body.

(Delete as appropriate)

In the case of a) or b), reference numbers
of the documents submitted:

Range of approval, if any:

Reference numbers of documents
submitted to justify range of approval:

Certified that this brazing procedure complies with the requirements of the following standards or any equivalent documents:

Name of examiner or examining body's representative, signature and date:

Name of manufacturer's representative, signature and date:

Annex C
(informative)

Brazing procedure approval record (BPAR) form - Part 2: Approved brazing procedure

Manufacturer's brazing procedure reference No.:

Examiner or examining body reference No.:

Details of approved brazing procedure:

Brazing process:

Joint type(s):

Joint design
(Dimensional sketches or drawing reference, including position of joint in relation to the vertical, room temperature fit up and joint gap at brazing temperature and restrictions on access)

Parent material(s) and specification(s)

Brazing filler metal:
- Type and specification:
- Form:
- Method of filler metal supply:

Flux:
- Type and specification:
- Form:
- Method of flux metal supply:

Jig/fixture details:

Method of pre-braze cleaning:

Method of post-braze cleaning:

Post-braze heat treatment (temperature-time cycle)

Brazing procedure details relevant to the process involved (see Table A.1):

Name of manufacturer's representative, signature and date:

Name of examiner or examining body's representative, signature and date:

Annex D
(informative)

Brazing procedure approval record (BPAR) form - Part 3: Test results

Manufacturer's brazing procedure reference No.:

Examiner or examining body reference No.:

Results of non-destructive tests agreed by the contracting parties

Test	Results
(to be filled as appropriate)	(statement of compliance or non-compliance with reasons for any non-compliance)

Results of destructive tests agreed by the contracting parties

Test	Results
(to be filled as appropriate)	(statement of compliance or non-compliance with reasons for any non-compliance)

Tests carried out in accordance with the following standards or other agreed documents:

Laboratory report reference numbers:

Name of manufacturer's representative, signature and date:

Name of examiner or examining body's representative, signature and date:

Annex ZA
(informative)

Clauses of this European Standard addressing essential requirements or other provisions of EU Directives

This European Standard has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association and supports essential requirements of Directive 97/23/EEC of the European Parliament and of the Council of 29 May 1997 on the approximation of the laws of the Member States concerning pressure equipment.

> WARNING Other requirements and other EU Directives may be applicable to the product(s) falling within the scope of this standard.

The following clauses of this standard as detailed in Table ZA.1, are likely to support requirements of the Directive 97/23/EEC.

Compliance with these clauses of this standard provides one means of conforming with the specific essential requirements of the Directive concerned and associated EFTA regulations.

Table ZA.1 - Correspondence between this European Standard and Directive 97/23/EEC

Clauses/sub-clauses of this European Standard	Essential requirements of Directive 97/23/EEC	Qualifying remarks/Notes
ALL CLAUSES	Annex 1, section 3.1.2	Permanent joining - Brazing procedure approval

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