British Standard

BRITISH STANDARD

BS EN
1043-2 : 1997

Destructive tests on welds in metallic materials — Hardness test

Part 2. Micro hardness testing on welded joints

The European Standard EN 1043-2 : 1996 has the status of a British Standard

ICS 25.160.40

Committees responsible for this British Standard

The preparation of this British Standard was entrusted to Technical Committee WEE/2, upon which the following bodies were represented:

Aluminium Federation
Association of Consulting Scientists
British Constructional Steelwork Association Ltd.
British Iron and Steel Producers' Association
Electricity Association
Health and Safety Executive
Institution of Structural Engineers
Lloyd's Register of Shipping
Ministry of Defence
Power Generation Contractors' Association (PGCA) (BEAMA Ltd.)
Welding Institute
Welding Manufacturers' Association (BEAMA Ltd.)

This British Standard, having been prepared under the direction of the Engineering Sector Board, was published under the authority of the Standards Board and comes into effect on
15 April 1997

Amendments issued since publication

Amd. No.	Date	Text affected

The following BSI references relate to the work on this standard:
Committee reference WEE/2
Draft for comment 93/705235 DC

ISBN 0 580 27004 1

Contents

National foreword

This British Standard has been prepared by Technical Committee WEE/2 and is the English language version of EN 1043-2 *Destructive tests on welds in metallic materials — Hardness test — Part 2: Micro hardness testing on welded joints*, published by the European Committee for Standardization (CEN).

EN 1043-2 was produced as a result of international discussions in which the United Kingdom took an active part.

BS EN 1043-2 : 1996 supersedes tests detailed in BS 709 : 1983, which have been deleted by amendment.

Cross-reference

Publication referred to	Corresponding British Standard
EN 1043-1 : 1996	BS EN 1043 *Destructive tests on welds in metallic materials — Hardness testing* Part 1 : 1996 *Hardness tests on arc welded joints*

Compliance with a British Standard does not of itself confer immunity from legal obligations.

Summary of pages

This document comprises a front cover, an inside front cover, pages i and ii, the EN title page, pages 2 to 8, an inside back cover and a back cover.

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1043-2

October 1996

ICS 25.160.40

Descriptors: Welding, arc welding, welded joints, metals, destructive tests, hardness tests, microhardness tests

English version

Destructive tests on welds in metallic materials — Hardness test— Part 2: Micro hardness testing on welded joints

Essais destructifs des soudures sur matériaux métalliques — Essai de dureté — Partie 2: Essai de micro dureté des assemblages soudés

Zerstörende Prüfung an Schweißverbindungen an metallischen Werkstoffen — Härteprüfung — Teil 2: Mikrohärteprüfung an Schweißverbindungen

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Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

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CEN

European Committee for Standardization
Comité Européen de Normalisation
Europäisches Komitee für Normung

Central Secretariat: rue de Stassart 36, B-1050 Brussels

Foreword

This European Standard has been prepared by Technical Committee CEN/TC 121, Welding, of which the secretariat 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 April 1997, and conflicting national standards shall be withdrawn at the latest by April 1997.

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

Contents

1 Scope

This standard specifies micro hardness tests on transverse sections of welded joints of metallic materials with high hardness gradients. It covers Vickers hardness tests in accordance with ISO DIS 6507-1, normally with test loads of 0,98 N to less than 49 N (HV 0,1 to less than HV 5).

Testing should be carried out to ensure that the highest and/or the lowest level of hardness of both parent metal (in the case of dissimilar parent metals) and weld metal are determined.

The type and extent of testing shall be as specified by an application standard or by agreement between the contracting parties.

This standard does not cover the hardness test as described in EN 1043-1.

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.

EN 1043-1	*Destructive test on welds in metallic materials — Hardness testing* *Part 1: Hardness test on arc welded joints*
ISO/DIS 6507-1 : 1995	*Metallic materials — Vickers hardness test* *Part 1: Test method*

3 Principle

Micro hardness testing shall be carried out in accordance with ISO/DIS 6507-1.

The micro hardness tests may be carried out in the form of rows of indentations (R), or as individual indentations (E).

When types of weld are not shown in the examples, the test procedure shall be appropriate to the welded joint.

Unless otherwise specified, the test shall be carried out at ambient temperature (23 ± 5) °C.

4 Denominations and symbols

The denominations and symbols to be used are specified in table 1 and represented in figures 1 to 3.

Table 1. Denominations and symbols

Symbol	Designation	Unit
E	Individual indentation	
R	Row of indentation	
HV	Vickers hardness	[1)]
L	Distance between the centrepoint of the indentations in heat affected zone	mm
H	Distance of rows of indentations from the reference line (surface or fusion line)	mm
t	Thickness of test specimen	mm

[1)] The unit of symbolization for Vickers hardness is given in ISO/DIS 6507-1.

5 Preparation of test specimens

The preparation of the test specimen shall be in accordance with ISO/DIS 6507-1.

A cross section of test piece shall be taken by mechanical cutting, usually transverse to the welded joint.

This operation and the subsequent preparation of the surface shall be carried out carefully so that the hardness of the surface to be tested is not affected metallurgically.

The surface to be tested shall be properly prepared and preferably etched, so that accurate measurements of the diagonal of the indentations can be achieved in the different zones of the welded joint.

6 Test procedure

6.1 Rows of indentations (R)

Figures 1 to 3 give examples of hardness indentations made in rows, including the distance from the surface, so that these rows, or parts of them, permit assessment of the welded joint. If required by the contracting parties, additional rows of indentations and/or different locations may be made. The location shall be stated in the test report.

In metals such as aluminium, copper and their alloys, the rows on the root-side of butt welds (see figure 1) are not necessary.

The number and spacing of indentations shall be sufficient to define hardened or softened regions due to welding. Recommended distances between the centrepoint of the indentations in the heat affected zone (HAZ) are given in table 2.

Sufficient indentations shall be made to ensure that unaffected parent metal is tested. In the weld metal, the distance between indentations shall be selected and checked so that the results obtained enable assessment of the welded joint to be made.

For metals that harden in the HAZ as a result of welding, two additional indentations in the HAZ shall be made at a distance not exceeding 0,5 mm between the centrepoint of the indentation and the fusion line (see figure 2).

For other joint configurations or metals (e.g. austenitic steels) special requirements may be given by an application standard or by agreement between the contracting parties.

Table 2. Recommended distance L between the centrepoint of the indentations in the heat affected zone (HAZ)

Vickers hardness symbol	Recommended distance between indentations L[1] mm	
	Ferrous metals[2]	Aluminium, copper and their alloys
HV 0,1	0,2	0,6 to 2
HV 1	0,5	1,5 to 4
HV 5	0,7	2,5 to 5

[1] The distance of any indentation from the previous indentation shall not be less than the value allowed for the previous indentation by ISO DIS 6507-2.

[2] Excluding austenitic steels.

6.2 Individual indentations E

Figure 4 shows typical areas for the location of individual indentations. The series 1-4 gives information about the unaffected parent metal; the series 5-8 refers to the HAZ and the series 9-11 to the weld metal. Otherwise, the location of the indentation can be determined on the basis of metallographic examination.

To prevent the influence of deformation caused by an indentation, the minimum distance between the centrepoint of individual indentations in any direction shall not be less than 2,5 times the mean diagonal of the nearest adjacent indentation.

For metals which harden in the HAZ as a result of welding, at least one indentation shall be made in the HAZ at a distance of ≤ 0,5 mm between the centrepoint of the indentation and the fusion line.

For testing with individual indentations, the areas shall be numbered as shown in figure 4.

7 Test results

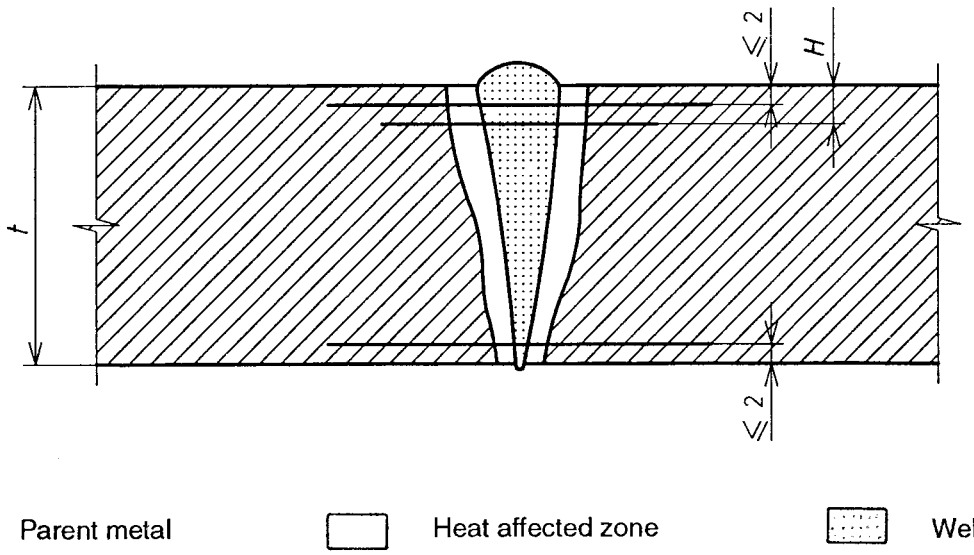
The hardness values shall be recorded in relation to the position of the indentation.

8 Test report

A test report is required. The information to be recorded is listed in annexes A and B.

Use of the format given in annexes A and B is recommended.

Other formats may be used provided that they contain all the required information. Additional information may be required by an application standard or by agreement between the contracting parties.



NOTE. For thickness ≤ 4 mm, rows of indentations shall be at the mid thickness position.

Figure 1. Example of rows of indentation (R) in butt welds in ferrous metals

(Dimensions in millimetres)

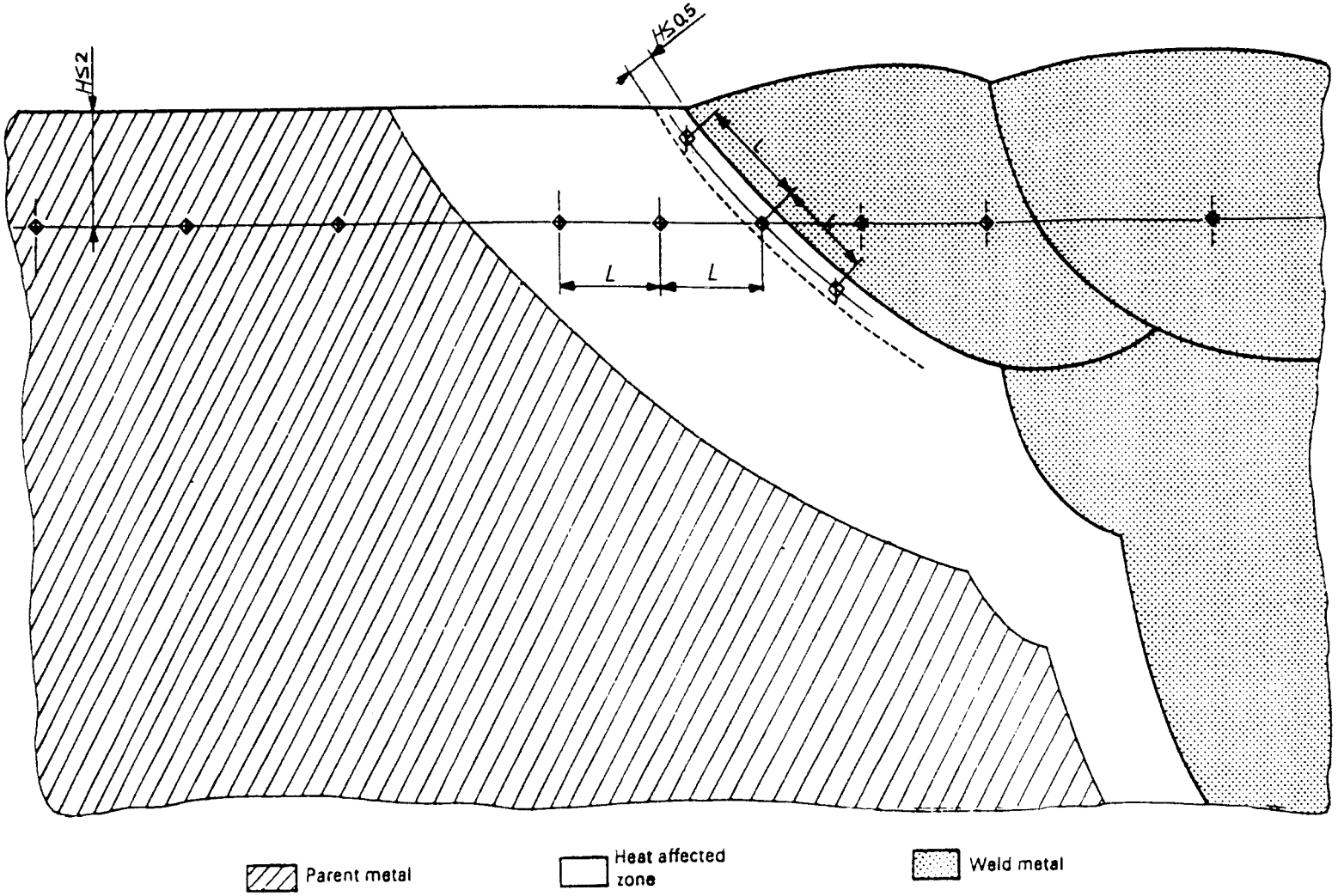


Figure 2. Location of the indentations in butt welds in ferrous metals (excluding austenitic steels) (Dimensions in millimetres)

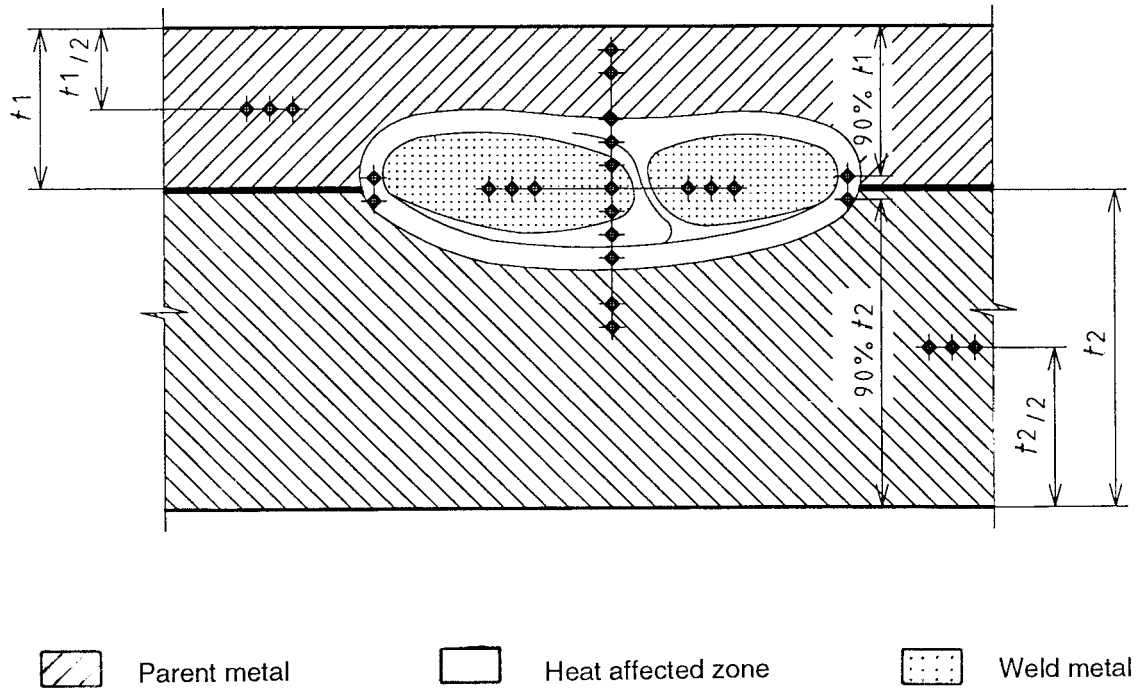
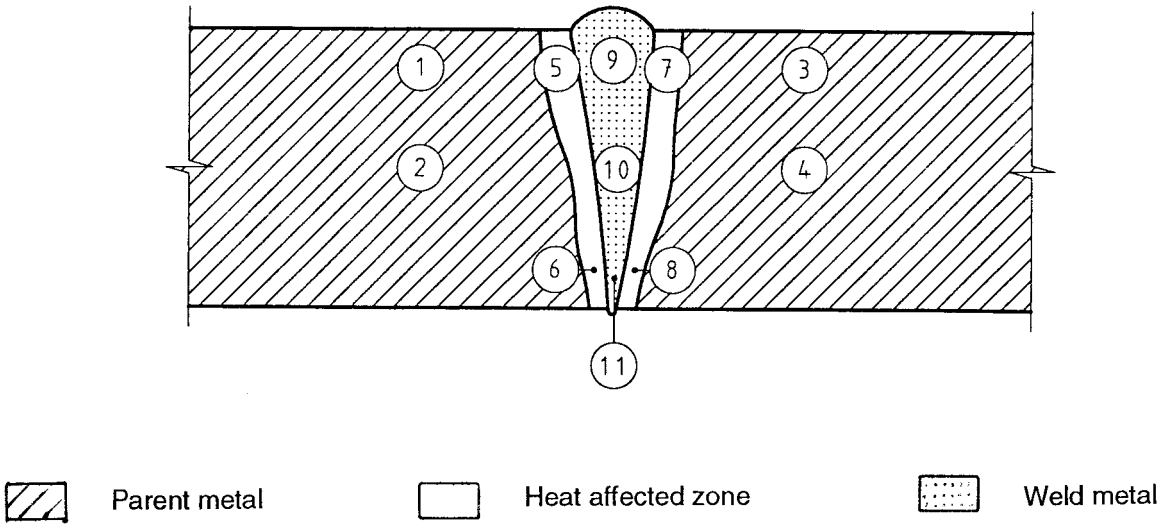


Figure 3. Location of the indentations in spot and projection seam welds in ferrous metals

Dimensions in millimetres



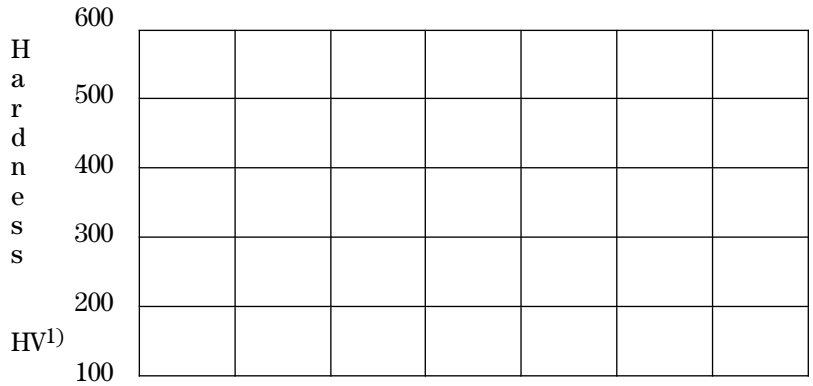
NOTE. Other areas are possible, by agreement.

Figure 4. Examples showing areas for hardness testing with individual indentations (E)

Annex A (informative)
Hardness testing (R) on welded joints

Type of hardness test:
Identification of the test machine:
Parent metal:
Thickness of materials
Type of weld:
Welding process:
Consumable:
Postweld heat treatment and/or ageing:
Notes:

Picture or drawing with numbered areas



[1)] Indication of load in accordance with ISO/DIS 6507-1.

Annex B (informative)
Hardness testing (E) on welded joints

Type of hardness test:
Identification of the test machine:
Parent metal:
Thickness of materials
Type of weld:
Welding process:
Consumable:
Postweld heat treatment and/or ageing:
Notes:

Picture or drawing with numbered areas

		Area	Position of indentations	Individual hardness values HV[1)]
Parent metal	Unaffected metal	1	Parent metal, unaffected, surface	
		2	Parent metal, unaffected, centre	
		3	Parent metal, unaffected, surface	
		4	Parent metal, unaffected, centre	
	H A Z	5	Parent metal, heat affected zone, top of weld	
		6	Parent metal, heat affected zone, bottom of weld	
		7	Parent metal, heat affected zone, top of weld	
		8	Parent metal, heat affected zone, bottom of weld	
Weld metal		9	Weld metal, top	
		10	Weld metal, centre	
		11	Weld metal, bottom	

[1)] Indication of load in accordance with ISO/DIS 6507-1.

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