



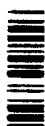
BRITISH STANDARD

BS EN  
10003-1 : 1995

*Incorporating  
Amendment No. 1*

# Metallic materials — Brinell hardness test

## Part 1. Test method



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CEN \*EN\*10\*003-1 94 ■ 3404589 0137894 178 ■

The European Standard EN 10003-1 : 1994 has the status of a  
British Standard

ICS 77.040.10

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The following table identifies the current issue of each page. Issue 1 indicates that a page has been introduced for the first time by amendment. Subsequent issue numbers indicate an updated page. Vertical sidelining on replacement pages indicates the most recent changes (amendment, addition, deletion).

| Page               | Issue    | Page              | Issue    |
|--------------------|----------|-------------------|----------|
| Front cover        | 2        | 9                 | 2        |
| Inside front cover | 2        | 10                | original |
| a                  | 1        | 11                | original |
| b                  | blank    | 12                | original |
| 1                  | original | 13                | original |
| 2                  | original | 14                | original |
| 3                  | original | 15                | original |
| 4                  | original | 16                | original |
| 5                  | original | 17                | original |
| 6                  | original | 18                | original |
| 7                  | original | Inside back cover | original |
| 8                  | original | Back cover        | original |

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## Contents

|                        | Page               |
|------------------------|--------------------|
| Committees responsible | Inside front cover |
| National foreword      | ii                 |
| Foreword               | 2                  |
| Text of EN 10003-1     | 3                  |

## National foreword

This British Standard has been prepared by Technical Committee ISE/NFE/4 and is the English language version of EN 10003-1 : 1994 *Metallic materials — Brinell hardness test — Part 1: Test method* published by ECISS (European Committee for Iron and Steel Standardization).

It supersedes BS 240 : 1986 which is withdrawn.

### Cross-references

| Publication referred to | Corresponding British Standard                                                                                                                                         |
|-------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| EN 10003-2              | BS EN 10003 <i>Metallic materials — Brinell hardness test Part 2 : 1995 Verification of Brinell hardness testing machines</i>                                          |
| EN 24498-1              | BS EN 24498 <i>Sintered metal materials, excluding hardmetals — Determination of apparent hardness Part 1 : 1993 Materials of essentially uniform section hardness</i> |

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EUROPEAN STANDARD  
NORME EUROPÉENNE  
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EN 10003-1

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English version

**Metallic materials — Brinell hardness test —  
Part 1: Test method**

Matériaux métalliques —  
Essai de dureté Brinell —  
Partie 1: Méthode d'essai

Metallische Werkstoffe —  
Härteprüfung nach Brinell —  
Teil 1: Prüfverfahren

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Ref No. EN 10003-1 : 1994 E

## Foreword

This European Standard has been prepared by the Technical Committee ECISS/TC 1A, Mechanical and physical tests, the secretariat of which is held by AFNOR.

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 1995, and conflicting national standards shall be withdrawn at the latest by April 1995.

During its preparation, the two following points have been discussed.

a) Rounding of the values of test force: it was decided to keep for this edition the values based on the old unit (kgf). However for the next revision of this European Standard it is necessary to think about the advantage of introducing rounded values of test force and the consequence on the Brinell scale.

b) Deletion of the steel ball indenter: it was agreed that :

- compared with the steel ball, the hardmetal ball will have a smaller residual deformation leading to a higher reliability of the hardness measurements,
- the hardmetal ball allows a higher number of tests to be carried out at an acceptable cost;
- steel balls complying with the requirement of EN 10003-2 are not readily available;
- the two types of ball give essentially identical results for hardness values up to 350;
- the steel ball is included in the corresponding ISO standard.

For these reasons it was decided to maintain the steel ball in this European Standard but at its next revision only the hard metal ball will be retained. Users of this European Standard shall take this decision into account.

According to the CEN/CENELEC Internal Regulations, 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, Sweden, Switzerland, United Kingdom.

## Contents

|                            | Page |
|----------------------------|------|
| Foreword                   | 2    |
| 0 Introduction             | 3    |
| 1 Scope                    | 3    |
| 2 Normative references     | 3    |
| 3 Principle                | 3    |
| 4 Symbols and designations | 3    |
| 5 Apparatus                | 3    |
| 6 Test piece               | 5    |
| 7 Procedure                | 5    |
| 8 Test report              | 7    |
| Annex                      |      |
| A (normative)              | 8    |

## 0 Introduction

The standard EN 10003 is valid for metallic materials and comprises the following parts:

- Part 1: *Metallic materials — Brinell hardness — Part 1: Test method*  
 Part 2: *Metallic materials — Brinell hardness — Part 2: Verification of Brinell hardness testing machines*  
 Part 3: *Metallic materials — Brinell hardness — Part 3: Calibration of standardized blocks to be used for Brinell hardness testing machines*

## 1 Scope

This European Standard specifies the method for the Brinell hardness test for metallic materials.

Special European Standards exist for particular materials and/or products (see clause 2).

## 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 10003-2 *Metallic materials — Brinell hardness test Part 2: Verification of Brinell hardness testing machines*  
 EN 24498-1 *Sintered metal materials excluding hardmetals — Determination of apparent hardness — Part 1: Materials of essentially uniform section hardness*

## 3 Principle

Forcing an indenter (hardened steel ball or hardmetal ball with diameter  $D$ ) into the surface of a test piece and measuring the diameter of the indentation  $d$  left in the surface after removal of the force  $F$ .

The steel ball is used for materials with a Brinell hardness not exceeding 350.

The hardmetal ball is used for materials with a Brinell hardness not exceeding 650.

The Brinell hardness is proportional to the quotient obtained by dividing the test force by the curved surface area of the indentation which is assumed to be spherical with a radius that corresponds to half of the diameter of the ball.

## 4 Symbols and designations

### 4.1 Symbols and designations (see figure 1 and table 1)

| Table 1    |                                                                                                                                                                                         |
|------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Symbol     | Designation                                                                                                                                                                             |
| $D$        | Diameter, in millimetres, of the ball                                                                                                                                                   |
| $F$        | Test force, in newtons                                                                                                                                                                  |
| $d$        | Mean diameter, in millimetres, of the indentation<br>$\left( d = \frac{d_1 + d_2}{2} \right)$                                                                                           |
| $h$        | Depth, in millimetres, of the indentation<br>$= \frac{D - \sqrt{D^2 - d^2}}{2}$                                                                                                         |
| HBS or HBW | Brinell hardness<br>= Constant $\times$<br>$\times \frac{\text{Test force}}{\text{Surface area of indentation}}$<br>= 0,102 $\times$<br>$\times \frac{2F}{\pi D(D - \sqrt{D^2 - d^2})}$ |

NOTE Constant =  $\frac{1}{\sigma_n} = \frac{1}{9,80665} = 0,102$

4.2 The Brinell hardness is denoted by the following symbols:

- HBS in cases where a steel ball is used;
- HBW in cases where a hard metal ball is used.

NOTE. In former standards, in case when a steel ball was used, the Brinell hardness was denoted by HB.

The symbol HBS or HBW is preceded by the hardness value and supplemented by an index indicating the test conditions in the order:

- a) diameter of the ball, in millimetres;
- b) a figure representing the test force (see table 2);
- c) duration of loading, in seconds, if different from the specified time (see 7.5).

EXAMPLE 1. 350 HBS 5/750 = Brinell hardness of 350 determined with a steel ball of 5 mm diameter and with a test force of 7,355 kN applied for 10 s to 15 s.

EXAMPLE 2. 600 HBW 1/30/20 = Brinell hardness of 600 determined with a hardmetal ball of 1 mm diameter and with a test force of 294,2 N applied for 20 s.

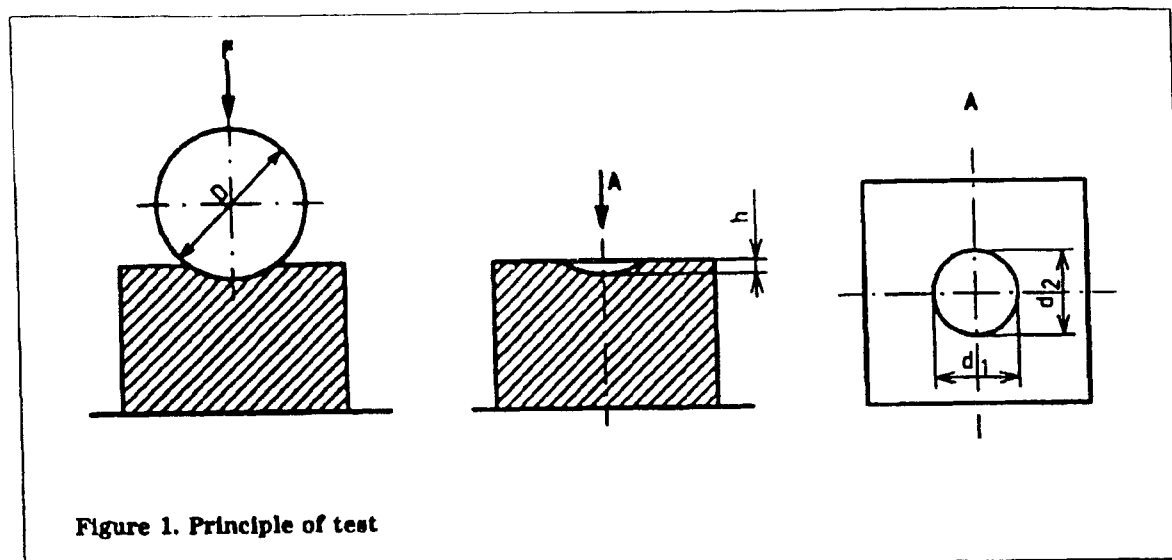


Figure 1. Principle of test

## 5 Apparatus

**5.1 Testing machine**, capable of applying a predetermined test force or forces within the range of 9,807 N to 29,42 kN, in accordance with EN 10003-2.

**5.2 Indenter**: a hardened and polished steel ball or polished hardmetal ball, as specified in EN 10003-2.

**5.3 Measuring device**, as specified in EN 10003-2.

## 6 Test piece

**6.1** The test shall be carried out on a surface which is smooth and even, free from oxide scale, foreign matter and, in particular, free from lubricants. The test piece shall have a surface finish that will allow an accurate measurement of the diameter of the indentation.

**6.2** Preparation shall be carried out in such a way that any alteration of the surface, for example due to heat or coldworking, is minimized.

**6.3** The thickness of the test piece shall be at least eight times the depth of indentation (see table A.1).

No deformation shall be visible at the back of the test piece after the test.

| Table 2              |                              |                               |                                      |
|----------------------|------------------------------|-------------------------------|--------------------------------------|
| Hardness symbol      | Ball diameter <i>D</i><br>mm | $\frac{0,102F}{D^2}$<br>ratio | Test force <i>F</i><br>Nominal value |
| HBS (HBW) 10/3000    | 10                           | 30                            | 29,42 kN                             |
| HBS (HBW) 10/1500    | 10                           | 15                            | 14,71 kN                             |
| HBS (HBW) 10/1000    | 10                           | 10                            | 9,807 kN                             |
| HBS (HBW) 10/500     | 10                           | 5                             | 4,903 kN                             |
| HBS (HBW) 10/250     | 10                           | 2,5                           | 2,452 kN                             |
| HBS (HBW) 10/100     | 10                           | 1                             | 980,7 N                              |
| HBS (HBW) 5/750      | 5                            | 30                            | 7,355 kN                             |
| HBS (HBW) 5/250      | 5                            | 10                            | 2,452 kN                             |
| HBS (HBW) 5/125      | 5                            | 5                             | 1,226 kN                             |
| HBS (HBW) 5/62,5     | 5                            | 2,5                           | 612,9 N                              |
| HBS (HBW) 5/25       | 5                            | 1                             | 245,2 N                              |
| HBS (HBW) 2,5/187,5  | 2,5                          | 30                            | 1,839 kN                             |
| HBS (HBW) 2,5/62,5   | 2,5                          | 10                            | 612,9 N                              |
| HBS (HBW) 2,5/31,25  | 2,5                          | 5                             | 306,5 N                              |
| HBS (HBW) 2,5/15,625 | 2,5                          | 2,5                           | 153,2 N                              |
| HBS (HBW) 2,5/6,25   | 2,5                          | 1                             | 61,29 N                              |
| HBS (HBW) 2/120      | 2                            | 30                            | 1,177 kN                             |
| HBS (HBW) 2/40       | 2                            | 10                            | 392,3 N                              |
| HBS (HBW) 2/20       | 2                            | 5                             | 196,1 N                              |
| HBS (HBW) 2/10       | 2                            | 2,5                           | 98,07 N                              |
| HBS (HBW) 2/4        | 2                            | 1                             | 39,23 N                              |
| HBS (HBW) 1/30       | 1                            | 30                            | 294,2 N                              |
| HBS (HBW) 1/10       | 1                            | 10                            | 98,07 N                              |
| HBS (HBW) 1/5        | 1                            | 5                             | 49,03 N                              |
| HBS (HBW) 1/2,5      | 1                            | 2,5                           | 24,52 N                              |
| HBS (HBW) 1/1        | 1                            | 1                             | 9,807 N                              |

## 7 Procedure

7.1 In general, the test is carried out at ambient temperature within the limits of 10 °C and 35 °C. Tests carried out under controlled conditions shall be made at a temperature of  $(23 \pm 5) ^\circ\text{C}$ .

7.2 The following test forces shall be used:

7.3 The test force shall be chosen so that the diameter of the indentation  $d$  lies between the values  $0,24D$  and  $0,6D$ .

The degree of loading ( $0,102F/D^2$  ratio) shall be chosen according to the material and the hardness test as indicated in table 3.

| Table 3                                  |                  |               |
|------------------------------------------|------------------|---------------|
| Material                                 | Brinell hardness | $0,102 F/D^2$ |
| Steel — Nickel alloys<br>Titanium alloys | —                | 30            |
| Cast iron <sup>1)</sup>                  | <140             | 10            |
|                                          | ≥140             | 30            |
| Copper and copper alloys                 | <35              | 5             |
|                                          | 35 to 200        | 10            |
|                                          | >200             | 30            |
| Light metals and their alloys            | <35              | 2,5           |
|                                          | 35 to 80         | 5             |
|                                          |                  | 10            |
|                                          |                  | 15            |
|                                          | >80              | 10            |
|                                          |                  | 15            |
| Lead, tin                                |                  | 1             |
| Sintered metal                           | See EN 24498-1   |               |

<sup>1)</sup> For the testing of cast iron the nominal diameter of the ball shall be 2,5 – 5 mm or 10 mm.

In order to test the largest representative area of the test piece, the diameter of the testing ball shall be chosen as large as possible.

When the thickness of the test piece permits, a 10 mm diameter ball is preferred.

7.4 The test piece shall be placed on a rigid support. The contact surfaces shall be clean and free from foreign matter (scale, oil, dirt, etc.). It is important that the test piece lies firmly on the support so that displacement cannot occur during the test.

7.5 Bring the indenter into contact with the test surface and apply the test force in a direction perpendicular to the surface, without shock, vibration or overrun, until the applied force attains the specified value. The time from the initial application of force until the full test force is reached shall not be less than 2 s nor greater than 8 s. Maintain the test force for 10 s to 15 s. For certain materials, a longer dwell time is provided; this time shall be applied with a tolerance of  $\pm 2$  s.

7.6 Throughout the test, the apparatus shall be protected from significant shock or vibration which can influence the test result.

7.7 The distance of the centre of each indentation from the edge of the test piece shall be at a minimum of two and a half times the mean indentation diameter for materials with a hardness of more than or equal to 150 HB and at a minimum of three times the mean indentation diameter for materials with a hardness of less than 150 HB.

The distance between the centre of two adjacent indentations shall be at least four times the mean diameter of the indentation in the case of materials with a hardness of more than or equal to 150 HB, and at least six times the mean diameter of the indentation in the case of materials with a hardness of less than 150 HB.

7.8 Measure the diameter of each indentation in two directions at right angles. The arithmetic mean of the two readings shall be taken for the calculation of the Brinell hardness.

NOTE. For some machines it may be necessary to utilize: the average of a greater number of symmetrically placed measurements; an assessment of the projected indentation area in the material surface.

7.9 Attention is drawn to table A.2 which contains calculation tables for use in tests made on flat surfaces.

## 8 Test report

The test report when requested shall include the following information:

- reference to this European Standard;
- all details necessary for identification of the test sample;
- the result obtained;
- additional requirements outside the scope of this European Standard;
- details of any occurrence which may have affected the result;
- the test temperature if it is not within the limits  $(23 \pm 5) ^\circ\text{C}$ .

NOTE 1. There is no general process of accurately converting Brinell hardness into other scales of hardness or into tensile strength. These conversions should therefore be avoided, unless a reliable basis for the conversion can be obtained by comparative tests.

NOTE 2. It should be noted that for anisotropic materials, for example those which have been heavily cold-worked, there may be a difference between the lengths of the two diameters of the indentation. The specification for the product may indicate limits for such differences.

## Annex A (normative)

| Table A.1. Minimum thickness in relation to the mean diameter of indentation |                                     |         |           |         |          |
|------------------------------------------------------------------------------|-------------------------------------|---------|-----------|---------|----------|
| Mean diameter of the indentation $d$                                         | Dimensions in millimetres           |         |           |         |          |
|                                                                              | Minimum thickness of the test piece |         |           |         |          |
|                                                                              | $D - 1$                             | $D - 2$ | $D - 2,5$ | $D - 5$ | $D - 10$ |
| 0,2                                                                          | 0,08                                |         |           |         |          |
| 0,3                                                                          | 0,18                                |         |           |         |          |
| 0,4                                                                          | 0,33                                |         |           |         |          |
| 0,5                                                                          | 0,54                                | 0,25    |           |         |          |
| 0,6                                                                          | 0,80                                | 0,37    | 0,29      |         |          |
| 0,7                                                                          |                                     | 0,51    | 0,40      |         |          |
| 0,8                                                                          |                                     | 0,67    | 0,53      |         |          |
| 0,9                                                                          |                                     | 0,86    | 0,67      |         |          |
| 1,0                                                                          |                                     | 1,07    | 0,83      |         |          |
| 1,1                                                                          |                                     | 1,32    | 1,02      |         |          |
| 1,2                                                                          |                                     | 1,60    | 1,23      | 0,58    |          |
| 1,3                                                                          |                                     |         | 1,46      | 0,69    |          |
| 1,4                                                                          |                                     |         | 1,72      | 0,80    |          |
| 1,5                                                                          |                                     |         | 2,00      | 0,92    |          |
| 1,6                                                                          |                                     |         |           | 1,05    |          |
| 1,7                                                                          |                                     |         |           | 1,19    |          |
| 1,8                                                                          |                                     |         |           | 1,34    |          |
| 1,9                                                                          |                                     |         |           | 1,50    |          |
| 2,0                                                                          |                                     |         |           | 1,67    |          |
| 2,2                                                                          |                                     |         |           | 2,04    |          |
| 2,4                                                                          |                                     |         |           | 2,46    | 1,17     |
| 2,6                                                                          |                                     |         |           | 2,92    | 1,38     |
| 2,8                                                                          |                                     |         |           | 3,43    | 1,60     |
| 3,0                                                                          |                                     |         |           | 4,00    | 1,84     |
| 3,2                                                                          |                                     |         |           |         | 2,10     |
| 3,4                                                                          |                                     |         |           |         | 2,38     |
| 3,6                                                                          |                                     |         |           |         | 2,68     |
| 3,8                                                                          |                                     |         |           |         | 3,00     |
| 4,0                                                                          |                                     |         |           |         | 3,34     |
| 4,2                                                                          |                                     |         |           |         | 3,70     |
| 4,4                                                                          |                                     |         |           |         | 4,08     |
| 4,6                                                                          |                                     |         |           |         | 4,48     |
| 4,8                                                                          |                                     |         |           |         | 4,91     |
| 5,0                                                                          |                                     |         |           |         | 5,36     |
| 5,2                                                                          |                                     |         |           |         | 5,83     |
| 5,4                                                                          |                                     |         |           |         | 6,33     |
| 5,6                                                                          |                                     |         |           |         | 6,86     |
| 5,8                                                                          |                                     |         |           |         | 7,42     |
| 6,0                                                                          |                                     |         |           |         | 8,00     |

| Table A.2. Tables for determination of the Brinell hardness for testing on flat surfaces |       |         |       |       |                                |          |          |          |          |         |
|------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------|----------|----------|----------|----------|---------|
| Ball diameter<br><i>D</i><br>mm                                                          |       |         |       |       | Ratio $0,102F/D^2$             |          |          |          |          |         |
|                                                                                          |       |         |       |       | 30                             | 15       | 10       | 5        | 2,5      | 1       |
|                                                                                          |       |         |       |       | Test force, <i>F</i>           |          |          |          |          |         |
| 10                                                                                       |       |         |       |       | 29,42 kN                       | 14,71 kN | 9,807 kN | 4,903 kN | 2,452 kN | 980,7 N |
|                                                                                          |       |         |       |       | 7,355 kN                       | —        | 2,452 kN | 1,226 kN | 612,9 N  | 245,2 N |
|                                                                                          |       |         |       |       | 1,839 kN                       | —        | 612,9 N  | 306,5 N  | 153,2 N  | 61,29 N |
|                                                                                          |       |         |       |       | 1,177 kN                       | —        | 392,3 N  | 196,1 N  | 98,07 N  | 39,23 N |
|                                                                                          |       |         |       |       | 294,2 N                        | —        | 98,07 N  | 49,03 N  | 24,52 N  | 9,807 N |
| Diameter of the indentation<br><i>d</i><br>mm                                            |       |         |       |       | Brinell hardness, HBS or HBW1) |          |          |          |          |         |
| 2,40                                                                                     | 1,200 | 0,600 0 | 0,480 | 0,240 | 653                            | 327      | 218      | 109      | 54,5     | 21,8    |
| 2,41                                                                                     | 1,205 | 0,602 4 | 0,482 | 0,241 | 648                            | 324      | 216      | 108      | 54,0     | 21,6    |
| 2,42                                                                                     | 1,210 | 0,605 0 | 0,484 | 0,242 | 643                            | 321      | 214      | 107      | 53,5     | 21,4    |
| 2,43                                                                                     | 1,215 | 0,607 5 | 0,486 | 0,243 | 637                            | 319      | 212      | 106      | 53,1     | 21,2    |
| 2,44                                                                                     | 1,220 | 0,610 0 | 0,488 | 0,244 | 632                            | 316      | 211      | 105      | 52,7     | 21,1    |
| 2,45                                                                                     | 1,225 | 0,612 5 | 0,490 | 0,245 | 627                            | 313      | 209      | 104      | 52,2     | 20,9    |
| 2,46                                                                                     | 1,230 | 0,615 0 | 0,492 | 0,246 | 621                            | 311      | 207      | 104      | 51,8     | 20,7    |
| 2,47                                                                                     | 1,235 | 0,617 5 | 0,494 | 0,247 | 616                            | 308      | 205      | 103      | 51,4     | 20,5    |
| 2,48                                                                                     | 1,240 | 0,620 0 | 0,496 | 0,248 | 611                            | 306      | 204      | 102      | 50,9     | 20,4    |
| 2,49                                                                                     | 1,245 | 0,622 5 | 0,498 | 0,249 | 606                            | 303      | 202      | 101      | 50,5     | 20,2    |
| 2,50                                                                                     | 1,250 | 0,625 0 | 0,500 | 0,250 | 601                            | 301      | 200      | 100      | 50,1     | 20,0    |
| 2,51                                                                                     | 1,255 | 0,627 5 | 0,502 | 0,251 | 597                            | 298      | 199      | 99,4     | 49,7     | 19,9    |
| 2,52                                                                                     | 1,260 | 0,630 0 | 0,504 | 0,252 | 592                            | 296      | 197      | 98,6     | 49,3     | 19,7    |
| 2,53                                                                                     | 1,265 | 0,632 5 | 0,506 | 0,253 | 587                            | 294      | 196      | 97,6     | 48,9     | 19,6    |
| 2,54                                                                                     | 1,270 | 0,635 0 | 0,508 | 0,254 | 582                            | 291      | 194      | 97,1     | 48,5     | 19,4    |
| 2,55                                                                                     | 1,275 | 0,637 5 | 0,510 | 0,255 | 578                            | 289      | 193      | 96,3     | 48,1     | 19,3    |
| 2,56                                                                                     | 1,280 | 0,640 0 | 0,512 | 0,256 | 573                            | 287      | 191      | 95,5     | 47,8     | 19,1    |
| 2,57                                                                                     | 1,285 | 0,642 5 | 0,514 | 0,257 | 569                            | 284      | 190      | 94,8     | 47,4     | 19,0    |
| 2,58                                                                                     | 1,290 | 0,645 0 | 0,516 | 0,258 | 564                            | 282      | 188      | 94,0     | 47,0     | 18,8    |
| 2,59                                                                                     | 1,295 | 0,647 5 | 0,518 | 0,259 | 560                            | 280      | 187      | 93,3     | 46,6     | 18,7    |
| 2,60                                                                                     | 1,300 | 0,650 0 | 0,520 | 0,260 | 555                            | 278      | 185      | 92,6     | 46,3     | 18,5    |
| 2,61                                                                                     | 1,305 | 0,652 5 | 0,522 | 0,261 | 551                            | 276      | 184      | 91,8     | 45,9     | 18,4    |
| 2,62                                                                                     | 1,310 | 0,655 0 | 0,524 | 0,262 | 547                            | 273      | 182      | 91,1     | 45,6     | 18,2    |
| 2,63                                                                                     | 1,315 | 0,657 5 | 0,526 | 0,263 | 543                            | 271      | 181      | 90,4     | 45,2     | 18,1    |
| 2,64                                                                                     | 1,320 | 0,660 0 | 0,528 | 0,264 | 538                            | 269      | 179      | 89,7     | 44,9     | 17,9    |
| 2,65                                                                                     | 1,325 | 0,662 5 | 0,530 | 0,265 | 534                            | 267      | 178      | 89,0     | 44,5     | 17,8    |
| 2,66                                                                                     | 1,330 | 0,665 0 | 0,532 | 0,266 | 530                            | 265      | 177      | 88,4     | 44,2     | 17,7    |
| 2,67                                                                                     | 1,335 | 0,667 5 | 0,534 | 0,267 | 526                            | 263      | 175      | 87,7     | 43,8     | 17,5    |
| 2,68                                                                                     | 1,340 | 0,670 0 | 0,536 | 0,268 | 522                            | 261      | 174      | 87,0     | 43,5     | 17,4    |
| 2,69                                                                                     | 1,345 | 0,672 5 | 0,538 | 0,269 | 518                            | 259      | 173      | 86,4     | 43,2     | 17,3    |

| Table A.2. Tables for determination of the Brinell hardness for testing on flat surfaces<br>(continued) |       |         |       |       |                                            |          |          |          |          |         |
|---------------------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------------------|----------|----------|----------|----------|---------|
| Ball diameter<br><i>D</i><br>mm                                                                         |       |         |       |       | Ratio $0,102F/D^2$                         |          |          |          |          |         |
|                                                                                                         |       |         |       |       | 30                                         | 15       | 10       | 5        | 2,5      | 1       |
|                                                                                                         |       |         |       |       | Test force, <i>F</i>                       |          |          |          |          |         |
| 10                                                                                                      | 5     | 2,5     | 2     | 1     | 29,42 kN                                   | 14,71 kN | 9,807 kN | 4,903 kN | 2,452 kN | 980,7 N |
|                                                                                                         |       |         |       |       | 7,355 kN                                   | —        | 2,452 kN | 1,226 kN | 612,9 N  | 245,2 N |
|                                                                                                         |       |         |       |       | 1,839 kN                                   | —        | 612,9 N  | 306,5 N  | 153,2 N  | 61,29 N |
|                                                                                                         |       |         |       |       | 1,177 kN                                   | —        | 392,3 N  | 196,1 N  | 98,07 N  | 39,23 N |
|                                                                                                         |       |         |       |       | 294,2 N                                    | —        | 98,07 N  | 49,03 N  | 24,52 N  | 9,807 N |
| Diameter of the indentation<br><i>d</i><br>mm                                                           |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |          |          |          |          |         |
| 2,70                                                                                                    | 1,350 | 0,675 0 | 0,540 | 0,270 | 514                                        | 257      | 171      | 85,7     | 42,9     | 17,1    |
| 2,71                                                                                                    | 1,355 | 0,677 5 | 0,542 | 0,271 | 510                                        | 255      | 170      | 85,1     | 42,5     | 17,0    |
| 2,72                                                                                                    | 1,360 | 0,680 0 | 0,544 | 0,272 | 507                                        | 253      | 169      | 84,4     | 42,2     | 16,9    |
| 2,7                                                                                                     | 1,365 | 0,682 5 | 0,546 | 0,273 | 503                                        | 251      | 168      | 83,8     | 41,9     | 16,8    |
| 2,74                                                                                                    | 1,370 | 0,685 0 | 0,548 | 0,274 | 499                                        | 250      | 166      | 83,2     | 41,6     | 16,6    |
| 2,75                                                                                                    | 1,375 | 0,687 5 | 0,550 | 0,275 | 495                                        | 248      | 165      | 82,6     | 41,3     | 16,5    |
| 2,76                                                                                                    | 1,380 | 0,690 0 | 0,552 | 0,276 | 492                                        | 246      | 164      | 81,9     | 41,0     | 16,4    |
| 2,77                                                                                                    | 1,385 | 0,692 5 | 0,554 | 0,277 | 488                                        | 244      | 163      | 81,3     | 40,7     | 16,3    |
| 2,78                                                                                                    | 1,390 | 0,695 0 | 0,556 | 0,278 | 485                                        | 242      | 162      | 80,8     | 40,4     | 16,2    |
| 2,79                                                                                                    | 1,395 | 0,697 5 | 0,558 | 0,279 | 481                                        | 240      | 160      | 80,2     | 40,1     | 16,0    |
| 2,80                                                                                                    | 1,400 | 0,700 0 | 0,560 | 0,280 | 477                                        | 239      | 159      | 79,6     | 39,8     | 15,9    |
| 2,81                                                                                                    | 1,405 | 0,702 5 | 0,562 | 0,281 | 474                                        | 237      | 158      | 79,0     | 39,5     | 15,8    |
| 2,82                                                                                                    | 1,410 | 0,705 0 | 0,564 | 0,282 | 471                                        | 235      | 157      | 78,4     | 39,2     | 15,7    |
| 2,83                                                                                                    | 1,415 | 0,707 5 | 0,566 | 0,283 | 467                                        | 234      | 156      | 77,9     | 38,9     | 15,6    |
| 2,84                                                                                                    | 1,420 | 0,710 0 | 0,568 | 0,284 | 464                                        | 232      | 155      | 77,3     | 38,7     | 15,5    |

Table A.2 Tables for determination of the Brinell hardness for testing on flat surfaces (continued)

| Ball diameter<br><i>D</i><br>mm               |       |         |       |       | Ratio $0,102 F/D^2$                        |     |     |      |      |      |
|-----------------------------------------------|-------|---------|-------|-------|--------------------------------------------|-----|-----|------|------|------|
| 10                                            | 5     | 2,5     | 2     | 1     | 30                                         | 15  | 10  | 5    | 2,5  | 1    |
| Diameter of the indentation<br><i>d</i><br>mm |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |     |     |      |      |      |
| 2,85                                          | 1,425 | 0,712 5 | 0,570 | 0,285 | 461                                        | 230 | 154 | 76,8 | 38,4 | 15,4 |
| 2,86                                          | 1,430 | 0,715 0 | 0,572 | 0,286 | 457                                        | 229 | 152 | 76,2 | 38,1 | 15,2 |
| 2,87                                          | 1,435 | 0,717 5 | 0,574 | 0,287 | 454                                        | 227 | 151 | 75,7 | 37,8 | 15,1 |
| 2,88                                          | 1,440 | 0,720 0 | 0,576 | 0,288 | 451                                        | 225 | 150 | 75,1 | 37,6 | 15,0 |
| 2,89                                          | 1,445 | 0,722 5 | 0,578 | 0,289 | 448                                        | 224 | 149 | 74,6 | 37,3 | 14,9 |
| 2,90                                          | 1,450 | 0,725 0 | 0,580 | 0,290 | 444                                        | 222 | 148 | 74,1 | 37,0 | 14,8 |
| 2,91                                          | 1,455 | 0,727 5 | 0,582 | 0,291 | 441                                        | 221 | 147 | 73,6 | 36,8 | 14,7 |
| 2,92                                          | 1,460 | 0,730 0 | 0,584 | 0,292 | 438                                        | 219 | 146 | 73,0 | 36,5 | 14,6 |
| 2,93                                          | 1,465 | 0,732 5 | 0,586 | 0,293 | 435                                        | 218 | 145 | 72,5 | 36,3 | 14,5 |
| 2,94                                          | 1,470 | 0,735 0 | 0,588 | 0,294 | 432                                        | 216 | 144 | 72,0 | 36,0 | 14,4 |
| 2,95                                          | 1,475 | 0,737 5 | 0,590 | 0,295 | 429                                        | 215 | 143 | 71,5 | 35,8 | 14,3 |
| 2,96                                          | 1,480 | 0,740 0 | 0,592 | 0,296 | 426                                        | 213 | 142 | 71,0 | 35,5 | 14,2 |
| 2,97                                          | 1,485 | 0,742 5 | 0,594 | 0,297 | 423                                        | 212 | 141 | 70,5 | 35,3 | 14,1 |
| 2,98                                          | 1,490 | 0,745 0 | 0,596 | 0,298 | 420                                        | 210 | 140 | 70,1 | 35,0 | 14,0 |
| 2,99                                          | 1,495 | 0,747 5 | 0,598 | 0,299 | 417                                        | 209 | 139 | 69,6 | 34,8 | 13,9 |
| 3,00                                          | 1,500 | 0,750 0 | 0,600 | 0,300 | 415                                        | 207 | 138 | 69,1 | 34,6 | 13,8 |
| 3,01                                          | 1,505 | 0,752 5 | 0,602 | 0,301 | 412                                        | 206 | 137 | 68,6 | 34,3 | 13,7 |
| 3,02                                          | 1,510 | 0,755 0 | 0,604 | 0,302 | 409                                        | 205 | 136 | 68,2 | 34,1 | 13,6 |
| 3,03                                          | 1,515 | 0,757 5 | 0,606 | 0,303 | 406                                        | 203 | 135 | 67,7 | 33,9 | 13,5 |
| 3,04                                          | 1,520 | 0,760 0 | 0,608 | 0,304 | 404                                        | 202 | 135 | 67,3 | 33,6 | 13,5 |
| 3,05                                          | 1,525 | 0,762 5 | 0,610 | 0,305 | 401                                        | 200 | 134 | 66,8 | 33,4 | 13,4 |
| 3,06                                          | 1,530 | 0,765 0 | 0,612 | 0,306 | 398                                        | 199 | 133 | 66,4 | 33,2 | 13,3 |
| 3,07                                          | 1,535 | 0,767 5 | 0,614 | 0,307 | 395                                        | 198 | 132 | 65,9 | 33,0 | 13,2 |
| 3,08                                          | 1,540 | 0,770 0 | 0,616 | 0,308 | 393                                        | 196 | 131 | 65,5 | 32,7 | 13,1 |
| 3,09                                          | 1,545 | 0,772 5 | 0,618 | 0,309 | 390                                        | 195 | 130 | 65,0 | 32,5 | 13,0 |
| 3,10                                          | 1,550 | 0,775 0 | 0,620 | 0,310 | 388                                        | 194 | 129 | 64,6 | 32,3 | 12,9 |
| 3,11                                          | 1,555 | 0,777 5 | 0,622 | 0,311 | 385                                        | 193 | 128 | 64,2 | 32,1 | 12,8 |
| 3,12                                          | 1,560 | 0,780 0 | 0,624 | 0,312 | 383                                        | 191 | 128 | 63,8 | 31,9 | 12,8 |
| 3,13                                          | 1,565 | 0,782 5 | 0,626 | 0,313 | 380                                        | 190 | 127 | 63,3 | 31,7 | 12,7 |
| 3,14                                          | 1,570 | 0,787 0 | 0,628 | 0,314 | 378                                        | 189 | 126 | 62,9 | 31,5 | 12,6 |
| 3,15                                          | 1,575 | 0,787 5 | 0,630 | 0,315 | 375                                        | 188 | 125 | 62,5 | 31,3 | 12,5 |
| 3,16                                          | 1,580 | 0,790 0 | 0,632 | 0,316 | 373                                        | 186 | 124 | 62,1 | 31,1 | 12,4 |
| 3,17                                          | 1,585 | 0,792 5 | 0,634 | 0,317 | 370                                        | 185 | 123 | 61,7 | 30,9 | 12,3 |
| 3,18                                          | 1,590 | 0,795 0 | 0,636 | 0,318 | 368                                        | 184 | 123 | 61,3 | 30,7 | 12,3 |
| 3,19                                          | 1,595 | 0,797 5 | 0,638 | 0,319 | 366                                        | 183 | 122 | 60,9 | 30,5 | 12,2 |
| 3,20                                          | 1,600 | 0,800 0 | 0,640 | 0,320 | 363                                        | 182 | 121 | 60,5 | 30,3 | 12,1 |

| Table A.2 Tables for determination of the Brinell hardness for testing on flat surfaces (continued) |       |         |       |       |                                            |     |      |      |      |      |
|-----------------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------------------|-----|------|------|------|------|
| Ball diameter<br>D<br>mm                                                                            |       |         |       |       | Ratio $0,102 F/D^2$                        |     |      |      |      |      |
| 10                                                                                                  | 5     | 2,5     | 2     | 1     | 30                                         | 15  | 10   | 5    | 2,5  | 1    |
| Diameter of the indentation<br>d<br>mm                                                              |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |     |      |      |      |      |
| 3,21                                                                                                | 1,605 | 0,802 5 | 0,642 | 0,321 | 361                                        | 180 | 120  | 60,1 | 30,1 | 12,0 |
| 3,22                                                                                                | 1,610 | 0,805 0 | 0,644 | 0,322 | 359                                        | 179 | 120  | 59,8 | 29,9 | 12,0 |
| 3,23                                                                                                | 1,615 | 0,807 5 | 0,646 | 0,323 | 356                                        | 178 | 119  | 59,4 | 29,7 | 11,9 |
| 3,24                                                                                                | 1,620 | 0,810 0 | 0,648 | 0,324 | 354                                        | 177 | 118  | 59,0 | 29,5 | 11,8 |
| 3,25                                                                                                | 1,625 | 0,812 5 | 0,650 | 0,325 | 352                                        | 176 | 117  | 58,6 | 29,3 | 11,7 |
| 3,26                                                                                                | 1,630 | 0,815 0 | 0,652 | 0,326 | 350                                        | 175 | 117  | 58,3 | 29,1 | 11,7 |
| 3,27                                                                                                | 1,635 | 0,817 5 | 0,654 | 0,327 | 347                                        | 174 | 116  | 57,9 | 29,0 | 11,6 |
| 3,28                                                                                                | 1,640 | 0,820 0 | 0,656 | 0,328 | 345                                        | 173 | 115  | 57,5 | 28,8 | 11,5 |
| 3,29                                                                                                | 1,645 | 0,822 5 | 0,658 | 0,329 | 343                                        | 172 | 114  | 57,2 | 28,6 | 11,4 |
| 3,30                                                                                                | 1,650 | 0,825 0 | 0,660 | 0,330 | 341                                        | 170 | 114  | 56,8 | 28,4 | 11,4 |
| 3,31                                                                                                | 1,655 | 0,827 5 | 0,662 | 0,331 | 339                                        | 169 | 113  | 56,5 | 28,2 | 11,3 |
| 3,32                                                                                                | 1,660 | 0,830 0 | 0,664 | 0,332 | 337                                        | 168 | 112  | 56,1 | 28,1 | 11,2 |
| 3,33                                                                                                | 1,665 | 0,832 5 | 0,666 | 0,333 | 335                                        | 167 | 112  | 55,8 | 27,9 | 11,2 |
| 3,34                                                                                                | 1,670 | 0,835 0 | 0,668 | 0,334 | 333                                        | 166 | 111  | 55,4 | 27,7 | 11,1 |
| 3,35                                                                                                | 1,675 | 0,837 5 | 0,670 | 0,335 | 331                                        | 165 | 110  | 55,1 | 27,5 | 11,0 |
| 3,36                                                                                                | 1,680 | 0,840 0 | 0,672 | 0,336 | 329                                        | 164 | 110  | 54,8 | 27,4 | 11,0 |
| 3,37                                                                                                | 1,685 | 0,842 5 | 0,674 | 0,337 | 326                                        | 163 | 109  | 54,4 | 27,2 | 10,9 |
| 3,38                                                                                                | 1,690 | 0,845 0 | 0,676 | 0,338 | 325                                        | 162 | 108  | 54,1 | 27,0 | 10,8 |
| 3,39                                                                                                | 1,695 | 0,847 5 | 0,678 | 0,339 | 323                                        | 161 | 108  | 53,8 | 26,9 | 10,8 |
| 3,40                                                                                                | 1,700 | 0,850 0 | 0,680 | 0,340 | 321                                        | 160 | 107  | 53,4 | 26,7 | 10,7 |
| 3,41                                                                                                | 1,705 | 0,852 5 | 0,682 | 0,341 | 319                                        | 159 | 106  | 53,1 | 26,6 | 10,6 |
| 3,42                                                                                                | 1,710 | 0,855 0 | 0,684 | 0,342 | 317                                        | 158 | 106  | 52,8 | 26,4 | 10,6 |
| 3,43                                                                                                | 1,715 | 0,857 5 | 0,686 | 0,343 | 315                                        | 157 | 105  | 52,5 | 26,2 | 10,5 |
| 3,44                                                                                                | 1,720 | 0,860 0 | 0,688 | 0,344 | 313                                        | 156 | 104  | 52,2 | 26,1 | 10,4 |
| 3,45                                                                                                | 1,725 | 0,862 5 | 0,690 | 0,345 | 311                                        | 156 | 104  | 51,8 | 25,9 | 10,4 |
| 3,46                                                                                                | 1,730 | 0,865 0 | 0,692 | 0,346 | 309                                        | 155 | 103  | 51,5 | 25,8 | 10,3 |
| 3,47                                                                                                | 1,735 | 0,867 5 | 0,694 | 0,347 | 307                                        | 154 | 102  | 51,2 | 25,6 | 10,2 |
| 3,48                                                                                                | 1,740 | 0,870 0 | 0,696 | 0,348 | 306                                        | 153 | 102  | 50,9 | 25,5 | 10,2 |
| 3,49                                                                                                | 1,745 | 0,872 5 | 0,698 | 0,349 | 304                                        | 152 | 101  | 50,6 | 25,3 | 10,1 |
| 3,50                                                                                                | 1,750 | 0,875 0 | 0,700 | 0,350 | 302                                        | 151 | 101  | 50,3 | 25,2 | 10,1 |
| 3,51                                                                                                | 1,755 | 0,877 5 | 0,702 | 0,351 | 300                                        | 150 | 100  | 50,0 | 25,0 | 10,0 |
| 3,52                                                                                                | 1,760 | 0,880 0 | 0,704 | 0,352 | 298                                        | 149 | 99,5 | 49,7 | 24,9 | 9,95 |
| 3,53                                                                                                | 1,765 | 0,882 5 | 0,706 | 0,353 | 297                                        | 148 | 98,9 | 49,4 | 24,7 | 9,89 |
| 3,54                                                                                                | 1,770 | 0,885 0 | 0,708 | 0,354 | 295                                        | 147 | 98,3 | 49,2 | 24,6 | 9,83 |
| 3,55                                                                                                | 1,775 | 0,887 5 | 0,710 | 0,355 | 293                                        | 147 | 97,7 | 48,9 | 24,4 | 9,77 |
| 3,56                                                                                                | 1,780 | 0,890 0 | 0,712 | 0,356 | 292                                        | 146 | 97,2 | 48,6 | 24,3 | 9,72 |

| Table A.2 Tables for determination of the Brinell hardness for testing on flat surfaces (continued) |       |         |       |       |                                            |     |      |      |      |      |
|-----------------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------------------|-----|------|------|------|------|
| Ball diameter<br><i>D</i><br>mm                                                                     |       |         |       |       | Ratio 0,102 $F/D^2$                        |     |      |      |      |      |
| 10                                                                                                  | 5     | 2,5     | 2     | 1     | 30                                         | 15  | 10   | 5    | 2,5  | 1    |
| Diameter of the indentation<br><i>d</i><br>mm                                                       |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |     |      |      |      |      |
| 3,57                                                                                                | 1,785 | 0,892 5 | 0,714 | 0,357 | 290                                        | 145 | 96,6 | 48,3 | 24,2 | 9,66 |
| 3,58                                                                                                | 1,790 | 0,895 0 | 0,716 | 0,358 | 288                                        | 144 | 96,1 | 48,0 | 24,0 | 9,61 |
| 3,59                                                                                                | 1,795 | 0,897 5 | 0,718 | 0,359 | 286                                        | 143 | 95,5 | 47,7 | 23,9 | 9,55 |
| 3,60                                                                                                | 1,800 | 0,900 0 | 0,720 | 0,360 | 285                                        | 142 | 95,0 | 47,5 | 23,7 | 9,50 |
| 3,61                                                                                                | 1,805 | 0,902 5 | 0,722 | 0,361 | 283                                        | 142 | 94,4 | 47,2 | 23,6 | 9,44 |
| 3,62                                                                                                | 1,810 | 0,905 0 | 0,724 | 0,362 | 282                                        | 141 | 93,9 | 46,9 | 23,5 | 9,39 |
| 3,63                                                                                                | 1,815 | 0,907 5 | 0,726 | 0,363 | 280                                        | 140 | 93,3 | 46,7 | 23,3 | 9,33 |
| 3,64                                                                                                | 1,820 | 0,910 0 | 0,728 | 0,364 | 278                                        | 139 | 92,8 | 46,4 | 23,2 | 9,28 |
| 3,65                                                                                                | 1,825 | 0,912 5 | 0,730 | 0,365 | 277                                        | 138 | 92,3 | 46,1 | 23,1 | 9,23 |
| 3,66                                                                                                | 1,830 | 0,915 0 | 0,732 | 0,366 | 275                                        | 138 | 91,8 | 45,9 | 22,9 | 9,18 |
| 3,67                                                                                                | 1,835 | 0,917 5 | 0,734 | 0,367 | 274                                        | 137 | 91,2 | 45,6 | 22,8 | 9,12 |
| 3,68                                                                                                | 1,840 | 0,920 0 | 0,736 | 0,368 | 272                                        | 136 | 90,7 | 45,4 | 22,7 | 9,07 |
| 3,69                                                                                                | 1,845 | 0,922 5 | 0,738 | 0,369 | 271                                        | 135 | 90,2 | 45,1 | 22,6 | 9,02 |
| 3,70                                                                                                | 1,850 | 0,925 0 | 0,740 | 0,370 | 269                                        | 135 | 89,7 | 44,9 | 22,4 | 8,97 |
| 3,71                                                                                                | 1,855 | 0,927 5 | 0,742 | 0,371 | 268                                        | 134 | 89,2 | 44,6 | 22,3 | 8,92 |
| 3,72                                                                                                | 1,860 | 0,930 0 | 0,744 | 0,372 | 266                                        | 133 | 88,7 | 44,4 | 22,2 | 8,87 |
| 3,73                                                                                                | 1,865 | 0,932 5 | 0,746 | 0,373 | 265                                        | 132 | 88,2 | 44,1 | 22,1 | 8,82 |
| 3,74                                                                                                | 1,870 | 0,935 0 | 0,748 | 0,374 | 263                                        | 132 | 87,7 | 43,9 | 21,9 | 8,77 |
| 3,75                                                                                                | 1,875 | 0,937 5 | 0,750 | 0,375 | 262                                        | 131 | 87,2 | 43,6 | 21,8 | 8,72 |
| 3,76                                                                                                | 1,880 | 0,940 0 | 0,752 | 0,376 | 260                                        | 130 | 86,8 | 43,4 | 21,7 | 8,68 |
| 3,77                                                                                                | 1,885 | 0,942 5 | 0,754 | 0,377 | 259                                        | 129 | 86,3 | 43,1 | 21,6 | 8,63 |
| 3,78                                                                                                | 1,890 | 0,945 0 | 0,756 | 0,378 | 257                                        | 129 | 85,8 | 42,9 | 21,5 | 8,58 |
| 3,79                                                                                                | 1,895 | 0,947 5 | 0,758 | 0,379 | 256                                        | 128 | 85,3 | 42,7 | 21,3 | 8,53 |
| 3,80                                                                                                | 1,900 | 0,950 0 | 0,760 | 0,380 | 255                                        | 127 | 84,9 | 42,4 | 21,2 | 8,49 |
| 3,81                                                                                                | 1,905 | 0,952 5 | 0,762 | 0,381 | 253                                        | 127 | 84,4 | 42,2 | 21,1 | 8,44 |
| 3,82                                                                                                | 1,910 | 0,955 0 | 0,764 | 0,382 | 252                                        | 126 | 83,9 | 42,0 | 21,0 | 8,39 |
| 3,83                                                                                                | 1,915 | 0,957 5 | 0,766 | 0,383 | 250                                        | 125 | 83,5 | 41,7 | 20,9 | 8,35 |
| 3,84                                                                                                | 1,920 | 0,960 0 | 0,768 | 0,384 | 249                                        | 125 | 83,0 | 41,5 | 20,8 | 8,30 |
| 3,85                                                                                                | 1,925 | 0,962 5 | 0,770 | 0,385 | 248                                        | 124 | 82,6 | 41,3 | 20,6 | 8,26 |
| 3,86                                                                                                | 1,930 | 0,965 0 | 0,772 | 0,386 | 246                                        | 123 | 82,1 | 41,1 | 20,5 | 8,21 |
| 3,87                                                                                                | 1,935 | 0,967 5 | 0,774 | 0,387 | 245                                        | 123 | 81,7 | 40,9 | 20,4 | 8,17 |
| 3,88                                                                                                | 1,940 | 0,970 0 | 0,776 | 0,388 | 244                                        | 122 | 81,3 | 40,6 | 20,3 | 8,13 |
| 3,89                                                                                                | 1,945 | 0,972 5 | 0,778 | 0,389 | 242                                        | 121 | 80,8 | 40,4 | 20,2 | 8,08 |
| 3,90                                                                                                | 1,950 | 0,975 0 | 0,780 | 0,390 | 241                                        | 121 | 80,4 | 40,2 | 20,1 | 8,04 |
| 3,91                                                                                                | 1,955 | 0,977 5 | 0,782 | 0,391 | 240                                        | 120 | 80,0 | 40,0 | 20,0 | 8,00 |
| 3,92                                                                                                | 1,960 | 0,980 0 | 0,784 | 0,392 | 239                                        | 119 | 79,5 | 39,8 | 19,9 | 7,95 |

| Table A.2 Tables for determination of the Brinell hardness for testing on flat surfaces (continued) |       |         |       |       |                                            |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------------------|------|------|------|------|------|
| Ball diameter<br><i>D</i><br>mm                                                                     |       |         |       |       | Ratio 0,102 $F/D^2$                        |      |      |      |      |      |
| 10                                                                                                  | 5     | 2,5     | 2     | 1     | 30                                         | 15   | 10   | 5    | 2,5  | 1    |
| Diameter of the indentation<br><i>d</i><br>mm                                                       |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |      |      |      |      |      |
| 3,93                                                                                                | 1,965 | 0,982 5 | 0,786 | 0,393 | 237                                        | 119  | 79,1 | 39,6 | 19,8 | 7,91 |
| 3,94                                                                                                | 1,970 | 0,985 0 | 0,788 | 0,394 | 236                                        | 118  | 78,7 | 39,4 | 19,7 | 7,87 |
| 3,95                                                                                                | 1,975 | 0,987 5 | 0,790 | 0,395 | 235                                        | 117  | 78,3 | 39,1 | 19,6 | 7,83 |
| 3,96                                                                                                | 1,980 | 0,990 0 | 0,792 | 0,396 | 234                                        | 117  | 77,9 | 38,9 | 19,5 | 7,79 |
| 3,97                                                                                                | 1,985 | 0,992 5 | 0,794 | 0,397 | 232                                        | 116  | 77,5 | 38,7 | 19,4 | 7,75 |
| 3,98                                                                                                | 1,990 | 0,995 0 | 0,796 | 0,398 | 231                                        | 116  | 77,1 | 38,5 | 19,3 | 7,71 |
| 3,99                                                                                                | 1,995 | 0,997 5 | 0,798 | 0,399 | 230                                        | 115  | 76,7 | 38,3 | 19,2 | 7,67 |
| 4,00                                                                                                | 2,000 | 1,000 0 | 0,800 | 0,400 | 229                                        | 114  | 76,3 | 38,1 | 19,1 | 7,63 |
| 4,01                                                                                                | 2,005 | 1,002 5 | 0,802 | 0,401 | 228                                        | 114  | 75,9 | 37,9 | 19,0 | 7,59 |
| 4,02                                                                                                | 2,010 | 1,005 0 | 0,804 | 0,402 | 226                                        | 113  | 75,5 | 37,7 | 18,9 | 7,55 |
| 4,03                                                                                                | 2,015 | 1,007 5 | 0,806 | 0,403 | 225                                        | 113  | 75,1 | 37,5 | 18,8 | 7,51 |
| 4,04                                                                                                | 2,020 | 1,010 0 | 0,808 | 0,404 | 224                                        | 112  | 74,7 | 37,3 | 18,7 | 7,47 |
| 4,05                                                                                                | 2,025 | 1,012 5 | 0,810 | 0,405 | 223                                        | 111  | 74,3 | 37,1 | 18,6 | 7,43 |
| 4,06                                                                                                | 2,030 | 1,015 0 | 0,812 | 0,406 | 222                                        | 111  | 73,9 | 37,0 | 18,5 | 7,39 |
| 4,07                                                                                                | 2,035 | 1,017 5 | 0,814 | 0,407 | 221                                        | 111  | 73,5 | 36,8 | 18,4 | 7,35 |
| 4,08                                                                                                | 2,040 | 1,020 0 | 0,816 | 0,408 | 219                                        | 110  | 73,2 | 36,6 | 18,3 | 7,32 |
| 4,09                                                                                                | 2,045 | 1,022 5 | 0,818 | 0,409 | 218                                        | 109  | 72,8 | 36,4 | 18,2 | 7,28 |
| 4,10                                                                                                | 2,050 | 1,025 0 | 0,820 | 0,410 | 217                                        | 109  | 72,4 | 36,2 | 18,1 | 7,24 |
| 4,11                                                                                                | 2,055 | 1,027 5 | 0,822 | 0,411 | 216                                        | 108  | 72,0 | 36,0 | 18,0 | 7,20 |
| 4,12                                                                                                | 2,060 | 1,030 0 | 0,824 | 0,412 | 215                                        | 108  | 71,7 | 35,8 | 17,9 | 7,17 |
| 4,13                                                                                                | 2,065 | 1,032 5 | 0,826 | 0,413 | 214                                        | 107  | 71,3 | 35,7 | 17,8 | 7,13 |
| 4,14                                                                                                | 2,070 | 1,035 0 | 0,828 | 0,414 | 213                                        | 106  | 71,0 | 35,5 | 17,7 | 7,10 |
| 4,15                                                                                                | 2,075 | 1,037 5 | 0,830 | 0,415 | 212                                        | 106  | 70,6 | 35,3 | 17,6 | 7,06 |
| 4,16                                                                                                | 2,080 | 1,040 0 | 0,832 | 0,416 | 211                                        | 105  | 70,2 | 35,1 | 17,6 | 7,02 |
| 4,17                                                                                                | 2,085 | 1,042 5 | 0,834 | 0,417 | 210                                        | 105  | 69,9 | 34,9 | 17,5 | 6,99 |
| 4,18                                                                                                | 2,090 | 1,045 0 | 0,836 | 0,418 | 209                                        | 104  | 69,5 | 34,8 | 17,4 | 6,95 |
| 4,19                                                                                                | 2,095 | 1,047 5 | 0,838 | 0,419 | 208                                        | 104  | 69,2 | 34,6 | 17,3 | 6,92 |
| 4,20                                                                                                | 2,100 | 1,050 0 | 0,840 | 0,420 | 207                                        | 103  | 68,8 | 34,4 | 17,2 | 6,88 |
| 4,21                                                                                                | 2,105 | 1,052 5 | 0,842 | 0,421 | 205                                        | 103  | 68,5 | 34,2 | 17,1 | 6,85 |
| 4,22                                                                                                | 2,110 | 1,055 0 | 0,844 | 0,422 | 204                                        | 102  | 68,2 | 34,1 | 17,0 | 6,82 |
| 4,23                                                                                                | 2,115 | 1,057 5 | 0,846 | 0,423 | 203                                        | 102  | 67,8 | 33,9 | 17,0 | 6,78 |
| 4,24                                                                                                | 2,120 | 1,060 0 | 0,848 | 0,424 | 202                                        | 101  | 67,5 | 33,7 | 16,9 | 6,75 |
| 4,25                                                                                                | 2,125 | 1,062 5 | 0,850 | 0,425 | 201                                        | 101  | 67,1 | 33,6 | 16,8 | 6,71 |
| 4,26                                                                                                | 2,130 | 1,065 0 | 0,852 | 0,426 | 200                                        | 100  | 66,8 | 33,4 | 16,7 | 6,68 |
| 4,27                                                                                                | 2,135 | 1,067 5 | 0,854 | 0,427 | 199                                        | 99,7 | 66,5 | 33,2 | 16,6 | 6,65 |
| 4,28                                                                                                | 2,140 | 1,070 0 | 0,856 | 0,428 | 198                                        | 99,2 | 66,2 | 33,1 | 16,5 | 6,62 |

| Table A.2 Tables for determination of the Brinell hardness for testing on flat surfaces (continued) |       |         |       |       |                                            |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------------------|------|------|------|------|------|
| Ball diameter<br><i>D</i><br>mm                                                                     |       |         |       |       | Ratio $0,102 F/D^2$                        |      |      |      |      |      |
| 10                                                                                                  | 5     | 2,5     | 2     | 1     | 30                                         | 15   | 10   | 5    | 2,5  | 1    |
| Diameter of the indentation<br><i>d</i><br>mm                                                       |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |      |      |      |      |      |
| 4,29                                                                                                | 2,145 | 1,072 5 | 0,858 | 0,429 | 198                                        | 98,8 | 65,8 | 32,9 | 16,5 | 6,58 |
| 4,30                                                                                                | 2,150 | 1,075 0 | 0,860 | 0,430 | 197                                        | 98,3 | 65,5 | 32,8 | 16,4 | 6,55 |
| 4,31                                                                                                | 2,155 | 1,077 5 | 0,862 | 0,431 | 196                                        | 97,8 | 65,2 | 32,6 | 16,3 | 6,52 |
| 4,32                                                                                                | 2,160 | 1,080 0 | 0,864 | 0,432 | 195                                        | 97,3 | 64,9 | 32,4 | 16,2 | 6,49 |
| 4,33                                                                                                | 2,165 | 1,082 5 | 0,866 | 0,433 | 194                                        | 96,8 | 64,6 | 32,3 | 16,1 | 6,46 |
| 4,34                                                                                                | 2,170 | 1,085 0 | 0,868 | 0,434 | 193                                        | 96,4 | 64,2 | 32,1 | 16,1 | 6,42 |
| 4,35                                                                                                | 2,175 | 1,087 5 | 0,870 | 0,435 | 192                                        | 95,9 | 63,9 | 32,0 | 16,0 | 6,39 |
| 4,36                                                                                                | 2,180 | 1,090 0 | 0,872 | 0,436 | 191                                        | 95,4 | 63,6 | 31,8 | 15,9 | 6,36 |
| 4,37                                                                                                | 2,185 | 1,092 5 | 0,874 | 0,437 | 190                                        | 95,0 | 63,3 | 31,7 | 15,8 | 6,33 |
| 4,38                                                                                                | 2,190 | 1,095 0 | 0,876 | 0,438 | 189                                        | 94,5 | 63,0 | 31,5 | 15,8 | 6,30 |
| 4,39                                                                                                | 2,195 | 1,097 5 | 0,878 | 0,439 | 188                                        | 94,1 | 62,7 | 31,4 | 15,7 | 6,27 |
| 4,40                                                                                                | 2,200 | 1,100 0 | 0,880 | 0,440 | 187                                        | 93,6 | 62,4 | 31,2 | 15,6 | 6,24 |
| 4,41                                                                                                | 2,205 | 1,102 5 | 0,882 | 0,441 | 186                                        | 93,2 | 62,1 | 31,1 | 15,5 | 6,21 |
| 4,42                                                                                                | 2,210 | 1,105 0 | 0,884 | 0,442 | 185                                        | 92,7 | 61,8 | 30,9 | 15,5 | 6,18 |
| 4,43                                                                                                | 2,215 | 1,107 5 | 0,886 | 0,443 | 185                                        | 92,3 | 61,5 | 30,8 | 15,4 | 6,15 |
| 4,44                                                                                                | 2,220 | 1,110 0 | 0,888 | 0,444 | 184                                        | 91,8 | 61,2 | 30,6 | 15,3 | 6,12 |
| 4,45                                                                                                | 2,225 | 1,112 5 | 0,890 | 0,445 | 183                                        | 91,4 | 60,9 | 30,5 | 15,2 | 6,09 |
| 4,46                                                                                                | 2,230 | 1,115 0 | 0,892 | 0,446 | 182                                        | 91,0 | 60,6 | 30,3 | 15,2 | 6,06 |
| 4,47                                                                                                | 2,235 | 1,117 5 | 0,894 | 0,447 | 181                                        | 90,6 | 60,4 | 30,2 | 15,1 | 6,04 |
| 4,48                                                                                                | 2,240 | 1,120 0 | 0,896 | 0,448 | 180                                        | 90,1 | 60,1 | 30,0 | 15,0 | 6,01 |
| 4,49                                                                                                | 2,245 | 1,122 5 | 0,898 | 0,449 | 179                                        | 89,7 | 59,8 | 29,9 | 14,9 | 5,98 |
| 4,50                                                                                                | 2,250 | 1,125 0 | 0,900 | 0,450 | 179                                        | 89,3 | 59,5 | 29,8 | 14,9 | 5,95 |
| 4,51                                                                                                | 2,255 | 1,127 5 | 0,902 | 0,451 | 178                                        | 88,9 | 59,2 | 29,6 | 14,8 | 5,92 |
| 4,52                                                                                                | 2,260 | 1,130 0 | 0,904 | 0,452 | 177                                        | 88,4 | 59,0 | 29,5 | 14,7 | 5,90 |
| 4,53                                                                                                | 2,265 | 1,132 5 | 0,906 | 0,453 | 176                                        | 88,0 | 58,7 | 29,3 | 14,7 | 5,87 |
| 4,54                                                                                                | 2,270 | 1,135 0 | 0,908 | 0,454 | 175                                        | 87,6 | 58,4 | 29,2 | 14,6 | 5,84 |
| 4,55                                                                                                | 2,275 | 1,137 5 | 0,910 | 0,455 | 174                                        | 87,2 | 58,1 | 29,1 | 14,5 | 5,81 |
| 4,56                                                                                                | 2,280 | 1,140 0 | 0,912 | 0,456 | 174                                        | 86,8 | 57,9 | 28,9 | 14,5 | 5,79 |
| 4,57                                                                                                | 2,285 | 1,142 5 | 0,914 | 0,457 | 173                                        | 86,4 | 57,6 | 28,8 | 14,4 | 5,76 |
| 4,58                                                                                                | 2,290 | 1,145 0 | 0,916 | 0,458 | 172                                        | 86,0 | 57,3 | 28,7 | 14,3 | 5,73 |
| 4,59                                                                                                | 2,295 | 1,147 5 | 0,918 | 0,459 | 171                                        | 85,6 | 57,1 | 28,5 | 14,3 | 5,71 |
| 4,60                                                                                                | 2,300 | 1,150 0 | 0,920 | 0,460 | 170                                        | 85,2 | 56,8 | 28,4 | 14,2 | 5,68 |
| 4,61                                                                                                | 2,305 | 1,152 5 | 0,922 | 0,461 | 170                                        | 84,8 | 56,5 | 28,3 | 14,1 | 5,65 |
| 4,62                                                                                                | 2,310 | 1,155 0 | 0,924 | 0,462 | 169                                        | 84,4 | 56,3 | 28,1 | 14,1 | 5,63 |
| 4,63                                                                                                | 2,315 | 1,157 5 | 0,926 | 0,463 | 168                                        | 84,0 | 56,0 | 28,0 | 14,0 | 5,60 |
| 4,64                                                                                                | 2,320 | 1,160 0 | 0,928 | 0,464 | 167                                        | 83,6 | 55,8 | 27,9 | 13,9 | 5,58 |

| Table A.2 Tables for determination of the Brinell hardness for testing on flat surfaces (continued) |       |         |       |       |                                            |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------------------|------|------|------|------|------|
| Ball diameter<br><i>D</i><br>mm                                                                     |       |         |       |       | Ratio $0,102 F/D^2$                        |      |      |      |      |      |
| 10                                                                                                  | 5     | 2,5     | 2     | 1     | 30                                         | 15   | 10   | 5    | 2,5  | 1    |
| Diameter of the indentation<br><i>d</i><br>mm                                                       |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |      |      |      |      |      |
| 4,65                                                                                                | 2,325 | 1,162 5 | 0,930 | 0,465 | 167                                        | 83,3 | 55,5 | 27,8 | 13,9 | 5,55 |
| 4,66                                                                                                | 2,330 | 1,165 0 | 0,932 | 0,466 | 166                                        | 82,9 | 55,3 | 27,6 | 13,8 | 5,53 |
| 4,67                                                                                                | 2,335 | 1,167 5 | 0,934 | 0,467 | 165                                        | 82,5 | 55,0 | 27,5 | 13,8 | 5,50 |
| 4,68                                                                                                | 2,340 | 1,170 0 | 0,936 | 0,468 | 164                                        | 82,1 | 54,8 | 27,4 | 13,7 | 5,48 |
| 4,69                                                                                                | 2,345 | 1,172 5 | 0,938 | 0,469 | 164                                        | 81,8 | 54,5 | 27,3 | 13,6 | 5,45 |
| 4,70                                                                                                | 2,350 | 1,175 0 | 0,940 | 0,470 | 163                                        | 81,4 | 54,3 | 27,1 | 13,6 | 5,43 |
| 4,71                                                                                                | 2,355 | 1,177 5 | 0,942 | 0,471 | 162                                        | 81,0 | 54,0 | 27,0 | 13,5 | 5,40 |
| 4,72                                                                                                | 2,360 | 1,180 0 | 0,944 | 0,472 | 161                                        | 80,7 | 53,8 | 26,9 | 13,4 | 5,38 |
| 4,73                                                                                                | 2,365 | 1,182 5 | 0,946 | 0,473 | 161                                        | 80,3 | 53,5 | 26,8 | 13,4 | 5,35 |
| 4,74                                                                                                | 2,370 | 1,185 0 | 0,948 | 0,474 | 160                                        | 79,9 | 53,3 | 26,6 | 13,3 | 5,33 |
| 4,75                                                                                                | 2,375 | 1,187 5 | 0,950 | 0,475 | 159                                        | 79,6 | 53,0 | 26,5 | 13,3 | 5,30 |
| 4,76                                                                                                | 2,380 | 1,190 0 | 0,952 | 0,476 | 158                                        | 79,2 | 52,8 | 26,4 | 13,2 | 5,28 |
| 4,77                                                                                                | 2,385 | 1,192 5 | 0,954 | 0,477 | 158                                        | 78,9 | 52,6 | 26,3 | 13,1 | 5,26 |
| 4,78                                                                                                | 2,390 | 1,195 0 | 0,956 | 0,478 | 157                                        | 78,5 | 52,3 | 26,2 | 13,1 | 5,23 |
| 4,79                                                                                                | 2,395 | 1,197 5 | 0,958 | 0,479 | 156                                        | 78,2 | 52,1 | 26,1 | 13,0 | 5,21 |
| 4,80                                                                                                | 2,400 | 1,200 0 | 0,960 | 0,480 | 156                                        | 77,8 | 51,9 | 25,9 | 13,0 | 5,19 |
| 4,81                                                                                                | 2,405 | 1,202 5 | 0,962 | 0,481 | 155                                        | 77,5 | 51,6 | 25,8 | 12,9 | 5,16 |
| 4,82                                                                                                | 2,410 | 1,205 0 | 0,964 | 0,482 | 154                                        | 77,1 | 51,4 | 25,7 | 12,9 | 5,14 |
| 4,83                                                                                                | 2,415 | 1,207 5 | 0,966 | 0,483 | 154                                        | 76,8 | 51,2 | 25,6 | 12,8 | 5,12 |
| 4,84                                                                                                | 2,420 | 1,210 0 | 0,968 | 0,484 | 153                                        | 76,4 | 51,0 | 25,5 | 12,7 | 5,10 |
| 4,85                                                                                                | 2,425 | 1,212 5 | 0,970 | 0,485 | 152                                        | 76,1 | 50,7 | 25,4 | 12,7 | 5,07 |
| 4,86                                                                                                | 2,430 | 1,215 0 | 0,972 | 0,486 | 152                                        | 75,8 | 50,5 | 25,3 | 12,6 | 5,05 |
| 4,87                                                                                                | 2,435 | 1,217 5 | 0,974 | 0,487 | 151                                        | 75,4 | 50,3 | 25,1 | 12,6 | 5,03 |
| 4,88                                                                                                | 2,440 | 1,220 0 | 0,976 | 0,488 | 150                                        | 75,1 | 50,1 | 25,0 | 12,5 | 5,01 |
| 4,89                                                                                                | 2,445 | 1,222 5 | 0,978 | 0,489 | 150                                        | 74,8 | 49,8 | 24,9 | 12,5 | 4,98 |
| 4,90                                                                                                | 2,450 | 1,225 0 | 0,980 | 0,490 | 149                                        | 74,4 | 49,6 | 24,8 | 12,4 | 4,96 |
| 4,91                                                                                                | 2,455 | 1,227 5 | 0,982 | 0,491 | 148                                        | 74,1 | 49,4 | 24,7 | 12,4 | 4,94 |
| 4,92                                                                                                | 2,460 | 1,230 0 | 0,984 | 0,492 | 148                                        | 73,8 | 49,2 | 24,6 | 12,3 | 4,92 |
| 4,93                                                                                                | 2,465 | 1,232 5 | 0,986 | 0,493 | 147                                        | 73,5 | 49,0 | 24,5 | 12,2 | 4,90 |
| 4,94                                                                                                | 2,470 | 1,235 0 | 0,988 | 0,494 | 146                                        | 73,2 | 48,8 | 24,4 | 12,2 | 4,88 |
| 4,95                                                                                                | 2,475 | 1,237 5 | 0,990 | 0,495 | 146                                        | 72,8 | 48,6 | 24,3 | 12,1 | 4,86 |
| 4,96                                                                                                | 2,480 | 1,240 0 | 0,992 | 0,496 | 145                                        | 72,5 | 48,3 | 24,2 | 12,1 | 4,83 |
| 4,97                                                                                                | 2,485 | 1,242 5 | 0,994 | 0,497 | 144                                        | 72,2 | 48,1 | 24,1 | 12,0 | 4,81 |
| 4,98                                                                                                | 2,490 | 1,245 0 | 0,996 | 0,498 | 144                                        | 71,9 | 47,9 | 24,0 | 12,0 | 4,79 |
| 4,99                                                                                                | 2,495 | 1,247 5 | 0,998 | 0,499 | 143                                        | 71,6 | 47,7 | 23,9 | 11,9 | 4,77 |
| 5,00                                                                                                | 2,500 | 1,250 0 | 1,000 | 0,500 | 143                                        | 71,3 | 47,5 | 23,8 | 11,9 | 4,75 |

| Table A.2 Tables for determination of the Brinell hardness for testing on flat surfaces (continued) |       |         |       |       |                                            |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------------------|------|------|------|------|------|
| Ball diameter<br><i>D</i><br>mm                                                                     |       |         |       |       | Ratio $0,102 F/D^2$                        |      |      |      |      |      |
| 10                                                                                                  | 5     | 2,5     | 2     | 1     | 30                                         | 15   | 10   | 5    | 2,5  | 1    |
| Diameter of the indentation<br><i>d</i><br>mm                                                       |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |      |      |      |      |      |
| 5,01                                                                                                | 2,505 | 1,252 5 | 1,002 | 0,501 | 142                                        | 71,0 | 47,3 | 23,7 | 11,8 | 4,73 |
| 5,02                                                                                                | 2,510 | 1,255 0 | 1,004 | 0,502 | 141                                        | 70,7 | 47,1 | 23,6 | 11,8 | 4,71 |
| 5,03                                                                                                | 2,515 | 1,257 5 | 1,006 | 0,503 | 141                                        | 70,4 | 46,9 | 23,5 | 11,7 | 4,69 |
| 5,04                                                                                                | 2,520 | 1,260 0 | 1,008 | 0,504 | 140                                        | 70,1 | 46,7 | 23,4 | 11,7 | 4,67 |
| 5,05                                                                                                | 2,525 | 1,262 5 | 1,010 | 0,505 | 140                                        | 69,8 | 46,5 | 23,3 | 11,6 | 4,65 |
| 5,06                                                                                                | 2,530 | 1,265 0 | 1,012 | 0,506 | 139                                        | 69,5 | 46,3 | 23,2 | 11,6 | 4,63 |
| 5,07                                                                                                | 2,535 | 1,267 5 | 1,014 | 0,507 | 139                                        | 69,2 | 46,1 | 23,1 | 11,5 | 4,61 |
| 5,08                                                                                                | 2,540 | 1,270 0 | 1,016 | 0,508 | 138                                        | 68,9 | 45,9 | 23,0 | 11,5 | 4,59 |
| 5,09                                                                                                | 2,545 | 1,272 5 | 1,018 | 0,509 | 137                                        | 68,6 | 45,7 | 22,9 | 11,4 | 4,57 |
| 5,10                                                                                                | 2,550 | 1,275 0 | 1,020 | 0,510 | 137                                        | 68,3 | 45,5 | 22,8 | 11,4 | 4,55 |
| 5,11                                                                                                | 2,555 | 1,277 5 | 1,022 | 0,511 | 136                                        | 68,0 | 45,3 | 22,7 | 11,3 | 4,53 |
| 5,12                                                                                                | 2,560 | 1,280 0 | 1,024 | 0,512 | 135                                        | 67,7 | 45,1 | 22,6 | 11,3 | 4,51 |
| 5,13                                                                                                | 2,565 | 1,282 5 | 1,026 | 0,513 | 135                                        | 67,4 | 45,0 | 22,5 | 11,2 | 4,50 |
| 5,14                                                                                                | 2,570 | 1,285 0 | 1,028 | 0,514 | 134                                        | 67,1 | 44,8 | 22,4 | 11,2 | 4,48 |
| 5,15                                                                                                | 2,575 | 1,287 5 | 1,030 | 0,515 | 134                                        | 66,9 | 44,6 | 22,3 | 11,1 | 4,46 |
| 5,16                                                                                                | 2,580 | 1,290 0 | 1,032 | 0,516 | 133                                        | 66,6 | 44,4 | 22,2 | 11,1 | 4,44 |
| 5,17                                                                                                | 2,585 | 1,292 5 | 1,034 | 0,517 | 133                                        | 66,3 | 44,2 | 22,1 | 11,1 | 4,42 |
| 5,18                                                                                                | 2,590 | 1,295 0 | 1,036 | 0,518 | 132                                        | 66,0 | 44,0 | 22,0 | 11,0 | 4,40 |
| 5,19                                                                                                | 2,595 | 1,297 5 | 1,038 | 0,519 | 132                                        | 65,8 | 43,8 | 21,9 | 11,0 | 4,38 |
| 5,20                                                                                                | 2,600 | 1,300 0 | 1,040 | 0,520 | 131                                        | 65,5 | 43,7 | 21,8 | 10,9 | 4,37 |
| 5,21                                                                                                | 2,605 | 1,302 5 | 1,042 | 0,521 | 130                                        | 65,2 | 43,5 | 21,7 | 10,9 | 4,35 |
| 5,22                                                                                                | 2,610 | 1,305 0 | 1,044 | 0,522 | 130                                        | 64,9 | 43,3 | 21,6 | 10,8 | 4,33 |
| 5,23                                                                                                | 2,615 | 1,307 5 | 1,046 | 0,523 | 129                                        | 64,7 | 43,1 | 21,6 | 10,8 | 4,31 |
| 5,24                                                                                                | 2,620 | 1,310 0 | 1,048 | 0,524 | 129                                        | 64,4 | 42,9 | 21,5 | 10,7 | 4,29 |
| 5,25                                                                                                | 2,625 | 1,312 5 | 1,050 | 0,525 | 128                                        | 64,1 | 42,8 | 21,4 | 10,7 | 4,28 |
| 5,26                                                                                                | 2,630 | 1,315 0 | 1,052 | 0,526 | 128                                        | 63,9 | 42,6 | 21,3 | 10,6 | 4,26 |
| 5,27                                                                                                | 2,635 | 1,317 5 | 1,054 | 0,527 | 127                                        | 63,6 | 42,4 | 21,2 | 10,6 | 4,24 |
| 5,28                                                                                                | 2,640 | 1,320 0 | 1,056 | 0,528 | 127                                        | 63,6 | 42,2 | 21,1 | 10,6 | 4,22 |
| 5,29                                                                                                | 2,645 | 1,322 5 | 1,058 | 0,529 | 126                                        | 63,1 | 42,1 | 21,0 | 10,5 | 4,21 |
| 5,30                                                                                                | 2,650 | 1,325 0 | 1,060 | 0,530 | 126                                        | 62,8 | 41,9 | 20,9 | 10,5 | 4,19 |
| 5,31                                                                                                | 2,655 | 1,327 5 | 1,062 | 0,531 | 125                                        | 62,6 | 41,7 | 20,9 | 10,4 | 4,17 |
| 5,32                                                                                                | 2,660 | 1,330 0 | 1,064 | 0,532 | 125                                        | 62,3 | 41,5 | 20,8 | 10,4 | 4,15 |
| 5,33                                                                                                | 2,665 | 1,332 5 | 1,066 | 0,533 | 124                                        | 62,1 | 41,4 | 20,7 | 10,3 | 4,14 |
| 5,34                                                                                                | 2,670 | 1,335 0 | 1,068 | 0,534 | 124                                        | 61,8 | 41,2 | 20,6 | 10,3 | 4,12 |

| Table A.2 Tables for determination of the Brinell hardness for testing on flat surfaces (continued) |       |         |       |       |                                            |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------------------|------|------|------|------|------|
| Ball diameter<br><i>D</i><br>mm                                                                     |       |         |       |       | Ratio $0,102 F/D^2$                        |      |      |      |      |      |
| 10                                                                                                  | 5     | 2,5     | 2     | 1     | 30                                         | 15   | 10   | 5    | 2,5  | 1    |
| Diameter of the indentation<br><i>d</i><br>mm                                                       |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |      |      |      |      |      |
| 5,35                                                                                                | 2,675 | 1,337 5 | 1,070 | 0,535 | 123                                        | 61,5 | 41,0 | 20,5 | 10,3 | 4,10 |
| 5,36                                                                                                | 2,680 | 1,340 0 | 1,072 | 0,536 | 123                                        | 61,3 | 40,9 | 20,4 | 10,2 | 4,09 |
| 5,37                                                                                                | 2,685 | 1,342 5 | 1,074 | 0,537 | 122                                        | 61,0 | 40,7 | 20,3 | 10,2 | 4,07 |
| 5,38                                                                                                | 2,690 | 1,345 0 | 1,076 | 0,538 | 122                                        | 60,8 | 40,5 | 20,3 | 10,1 | 4,05 |
| 5,39                                                                                                | 2,695 | 1,347 5 | 1,078 | 0,539 | 121                                        | 60,6 | 40,4 | 20,2 | 10,1 | 4,04 |
| 5,40                                                                                                | 2,700 | 1,350 0 | 1,080 | 0,540 | 121                                        | 60,3 | 40,2 | 20,1 | 10,1 | 4,02 |
| 5,41                                                                                                | 2,705 | 1,352 5 | 1,082 | 0,541 | 120                                        | 60,1 | 40,0 | 20,0 | 10,0 | 4,00 |
| 5,42                                                                                                | 2,710 | 1,355 0 | 1,084 | 0,542 | 120                                        | 59,8 | 39,9 | 19,9 | 9,97 | 3,99 |
| 5,43                                                                                                | 2,715 | 1,357 5 | 1,086 | 0,543 | 119                                        | 59,6 | 39,7 | 19,9 | 9,93 | 3,97 |
| 5,44                                                                                                | 2,720 | 1,360 0 | 1,088 | 0,544 | 119                                        | 59,3 | 39,6 | 19,8 | 9,89 | 3,96 |
| 5,45                                                                                                | 2,725 | 1,362 5 | 1,090 | 0,545 | 118                                        | 59,1 | 39,4 | 19,7 | 9,85 | 3,94 |
| 5,46                                                                                                | 2,730 | 1,365 0 | 1,092 | 0,546 | 118                                        | 58,9 | 39,2 | 19,6 | 9,81 | 3,92 |
| 5,47                                                                                                | 2,735 | 1,367 5 | 1,094 | 0,547 | 117                                        | 58,6 | 39,1 | 19,5 | 9,77 | 3,91 |
| 5,48                                                                                                | 2,740 | 1,370 0 | 1,096 | 0,548 | 117                                        | 58,4 | 38,9 | 19,5 | 9,73 | 3,89 |
| 5,49                                                                                                | 2,745 | 1,372 5 | 1,098 | 0,549 | 116                                        | 58,2 | 38,8 | 19,4 | 9,69 | 3,88 |
| 5,50                                                                                                | 2,750 | 1,375 0 | 1,100 | 0,550 | 116                                        | 57,9 | 38,6 | 19,3 | 9,66 | 3,86 |
| 5,51                                                                                                | 2,755 | 1,377 5 | 1,102 | 0,551 | 115                                        | 57,7 | 38,5 | 19,2 | 9,62 | 3,85 |
| 5,52                                                                                                | 2,760 | 1,380 0 | 1,104 | 0,552 | 115                                        | 57,5 | 38,3 | 19,2 | 9,58 | 3,83 |
| 5,53                                                                                                | 2,765 | 1,382 5 | 1,106 | 0,553 | 114                                        | 57,2 | 38,2 | 19,1 | 9,54 | 3,82 |
| 5,54                                                                                                | 2,770 | 1,385 0 | 1,108 | 0,554 | 114                                        | 57,0 | 38,0 | 19,0 | 9,50 | 3,80 |
| 5,55                                                                                                | 2,775 | 1,387 5 | 1,110 | 0,555 | 114                                        | 56,8 | 37,9 | 18,9 | 9,47 | 3,79 |
| 5,56                                                                                                | 2,780 | 1,390 0 | 1,112 | 0,556 | 113                                        | 56,6 | 37,7 | 18,9 | 9,43 | 3,77 |
| 5,57                                                                                                | 2,785 | 1,392 5 | 1,114 | 0,557 | 113                                        | 56,3 | 37,6 | 18,8 | 9,39 | 3,76 |
| 5,58                                                                                                | 2,790 | 1,395 0 | 1,116 | 0,558 | 112                                        | 56,1 | 37,4 | 18,7 | 9,35 | 3,74 |
| 5,59                                                                                                | 2,795 | 1,397 5 | 1,118 | 0,559 | 112                                        | 55,9 | 37,3 | 18,6 | 9,32 | 3,73 |
| 5,60                                                                                                | 2,800 | 1,400 0 | 1,120 | 0,560 | 111                                        | 55,7 | 37,1 | 18,6 | 9,28 | 3,71 |
| 5,61                                                                                                | 2,805 | 1,402 5 | 1,122 | 0,561 | 111                                        | 55,5 | 37,0 | 18,5 | 9,24 | 3,70 |
| 5,62                                                                                                | 2,810 | 1,405 0 | 1,124 | 0,562 | 110                                        | 55,2 | 36,8 | 18,4 | 9,21 | 3,68 |
| 5,63                                                                                                | 2,815 | 1,407 5 | 1,126 | 0,563 | 110                                        | 55,0 | 36,7 | 18,3 | 9,17 | 3,67 |
| 5,64                                                                                                | 2,820 | 1,410 0 | 1,128 | 0,564 | 110                                        | 54,8 | 36,5 | 18,3 | 9,14 | 3,65 |
| 5,65                                                                                                | 2,825 | 1,412 5 | 1,130 | 0,565 | 109                                        | 54,6 | 36,4 | 18,2 | 9,10 | 3,64 |
| 5,66                                                                                                | 2,830 | 1,415 0 | 1,132 | 0,566 | 109                                        | 54,4 | 36,3 | 18,1 | 9,06 | 3,63 |
| 5,67                                                                                                | 2,835 | 1,417 5 | 1,134 | 0,567 | 108                                        | 54,2 | 36,1 | 18,1 | 9,03 | 3,61 |
| 5,68                                                                                                | 2,840 | 1,420 0 | 1,136 | 0,568 | 108                                        | 54,0 | 36,0 | 18,0 | 8,99 | 3,60 |
| 5,69                                                                                                | 2,845 | 1,422 5 | 1,138 | 0,569 | 107                                        | 53,7 | 35,8 | 17,9 | 8,96 | 3,58 |
| 5,70                                                                                                | 2,850 | 1,425 0 | 1,140 | 0,570 | 107                                        | 53,5 | 35,7 | 17,8 | 8,92 | 3,57 |

| Table A.2 Tables for determination of the Brinell hardness for testing on flat surfaces (concluded) |       |         |       |       |                                            |      |      |      |      |      |
|-----------------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------------------|------|------|------|------|------|
| Ball diameter<br><i>D</i><br>mm                                                                     |       |         |       |       | Ratio $0,102 F/D^2$                        |      |      |      |      |      |
| 10                                                                                                  | 5     | 2,5     | 2     | 1     | 30                                         | 15   | 10   | 5    | 2,5  | 1    |
| Diameter of the indentation<br><i>d</i><br>mm                                                       |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |      |      |      |      |      |
| 5,71                                                                                                | 2,855 | 1,427 5 | 1,142 | 0,571 | 107                                        | 53,3 | 35,6 | 17,8 | 8,89 | 3,56 |
| 5,72                                                                                                | 2,860 | 1,430 0 | 1,144 | 0,572 | 106                                        | 53,1 | 35,4 | 17,7 | 8,85 | 3,54 |
| 5,73                                                                                                | 2,865 | 1,432 5 | 1,146 | 0,573 | 106                                        | 52,9 | 35,3 | 17,6 | 8,82 | 3,53 |
| 5,74                                                                                                | 2,870 | 1,435 0 | 1,148 | 0,574 | 105                                        | 52,7 | 35,1 | 17,6 | 8,79 | 3,51 |
| 5,75                                                                                                | 2,875 | 1,437 5 | 1,150 | 0,575 | 105                                        | 52,5 | 35,0 | 17,5 | 8,75 | 3,50 |
| 5,76                                                                                                | 2,880 | 1,440 0 | 1,152 | 0,576 | 105                                        | 52,3 | 34,9 | 17,4 | 8,72 | 3,49 |
| 5,77                                                                                                | 2,885 | 1,442 5 | 1,154 | 0,577 | 104                                        | 52,1 | 34,7 | 17,4 | 8,68 | 3,47 |
| 5,78                                                                                                | 2,890 | 1,445 0 | 1,156 | 0,578 | 104                                        | 51,9 | 34,6 | 17,3 | 8,65 | 3,46 |
| 5,79                                                                                                | 2,895 | 1,447 5 | 1,158 | 0,579 | 103                                        | 51,7 | 34,5 | 17,2 | 8,62 | 3,45 |
| 5,80                                                                                                | 2,900 | 1,450 0 | 1,160 | 0,580 | 103                                        | 51,5 | 34,3 | 17,2 | 8,59 | 3,43 |
| 5,81                                                                                                | 2,905 | 1,452 5 | 1,162 | 0,581 | 103                                        | 51,3 | 34,2 | 17,1 | 8,55 | 3,42 |
| 5,82                                                                                                | 2,910 | 1,455 0 | 1,164 | 0,582 | 102                                        | 51,1 | 34,1 | 17,0 | 8,52 | 3,41 |
| 5,83                                                                                                | 2,915 | 1,457 5 | 1,166 | 0,583 | 102                                        | 50,9 | 33,9 | 17,0 | 8,49 | 3,39 |
| 5,84                                                                                                | 2,920 | 1,460 0 | 1,168 | 0,584 | 101                                        | 50,7 | 33,8 | 16,9 | 8,45 | 3,38 |
| 5,85                                                                                                | 2,925 | 1,462 5 | 1,170 | 0,585 | 101                                        | 50,5 | 33,7 | 16,8 | 8,42 | 3,37 |
| 5,86                                                                                                | 2,930 | 1,465 0 | 1,172 | 0,586 | 101                                        | 50,3 | 33,6 | 16,8 | 8,39 | 3,36 |
| 5,87                                                                                                | 2,935 | 1,467 5 | 1,174 | 0,587 | 100                                        | 50,2 | 33,4 | 16,7 | 8,36 | 3,34 |
| 5,88                                                                                                | 2,940 | 1,470 0 | 1,176 | 0,588 | 99,9                                       | 50,0 | 33,3 | 16,7 | 8,33 | 3,33 |
| 5,89                                                                                                | 2,945 | 1,472 5 | 1,178 | 0,589 | 99,5                                       | 49,8 | 33,2 | 16,6 | 8,30 | 3,32 |
| 5,90                                                                                                | 2,950 | 1,475 0 | 1,180 | 0,590 | 99,2                                       | 49,6 | 33,1 | 16,5 | 8,26 | 3,31 |
| 5,91                                                                                                | 2,955 | 1,477 5 | 1,182 | 0,591 | 98,8                                       | 49,4 | 32,9 | 16,5 | 8,23 | 3,29 |
| 5,92                                                                                                | 2,960 | 1,480 0 | 1,184 | 0,592 | 98,4                                       | 49,2 | 32,8 | 16,4 | 8,20 | 3,28 |
| 5,93                                                                                                | 2,965 | 1,482 5 | 1,186 | 0,593 | 98,0                                       | 49,0 | 32,7 | 16,3 | 8,17 | 3,27 |
| 5,94                                                                                                | 2,970 | 1,485 0 | 1,188 | 0,594 | 97,7                                       | 48,8 | 32,5 | 16,3 | 8,14 | 3,26 |
| 5,95                                                                                                | 2,975 | 1,487 5 | 1,190 | 0,595 | 97,3                                       | 48,7 | 32,4 | 16,2 | 8,11 | 3,24 |
| 5,96                                                                                                | 2,980 | 1,490 0 | 1,192 | 0,596 | 96,9                                       | 48,5 | 32,3 | 16,2 | 8,08 | 3,23 |
| 5,97                                                                                                | 2,985 | 1,492 5 | 1,194 | 0,597 | 96,6                                       | 48,3 | 32,2 | 16,1 | 8,05 | 3,22 |
| 5,98                                                                                                | 2,990 | 1,495 0 | 1,196 | 0,598 | 96,2                                       | 48,1 | 32,1 | 16,0 | 8,02 | 3,21 |
| 5,99                                                                                                | 2,995 | 1,497 5 | 1,198 | 0,599 | 95,9                                       | 47,9 | 32,0 | 16,0 | 7,99 | 3,20 |
| 6,00                                                                                                | 3,000 | 1,500 0 | 1,200 | 0,600 | 95,5                                       | 47,7 | 31,8 | 15,9 | 7,96 | 3,18 |

<sup>1)</sup> Steel ball (HBS) used for materials whose hardness does not exceed 350.

## List of references

See national foreword.

BS EN  
10003-1 : 1995

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**Amendment No. 1**  
**published and effective from 15 August 1996**  
**to BS EN 10003 : Part 1 : 1995**

**Metallic materials — Brinell hardness test**

**Part 1. Test method**

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# **Metallic materials — Brinell hardness test**

## **Part 1. Test method**

The European Standard EN 10003-1 : 1994 has the status of a  
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ICS 77.040.10

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| Table A.2. Tables for determination of the Brinell hardness for testing on flat surfaces<br>(continued) |       |         |       |       |                                            |          |          |          |          |         |
|---------------------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------------------|----------|----------|----------|----------|---------|
| Ball diameter<br><i>D</i><br>mm                                                                         |       |         |       |       | Ratio $0,102F/D^2$                         |          |          |          |          |         |
|                                                                                                         |       |         |       |       | 30                                         | 15       | 10       | 5        | 2,5      | 1       |
|                                                                                                         |       |         |       |       | Test force, <i>F</i>                       |          |          |          |          |         |
| 10                                                                                                      |       |         |       |       | 29,42 kN                                   | 14,71 kN | 9,807 kN | 4,903 kN | 2,452 kN | 980,7 N |
|                                                                                                         | 5     |         |       |       | 7,355 kN                                   | —        | 2,452 kN | 1,226 kN | 612,9 N  | 245,2 N |
|                                                                                                         |       | 2,5     |       |       | 1,839 kN                                   | —        | 612,9 N  | 306,5 N  | 153,2 N  | 61,29 N |
|                                                                                                         |       |         | 2     |       | 1,177 kN                                   | —        | 392,3 N  | 196,1 N  | 98,07 N  | 39,23 N |
|                                                                                                         |       |         |       | 1     | 294,2 N                                    | —        | 98,07 N  | 49,03 N  | 24,52 N  | 9,807 N |
| Diameter of the indentation<br><i>d</i><br>mm                                                           |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |          |          |          |          |         |
| 2,70                                                                                                    | 1,350 | 0,675 0 | 0,540 | 0,270 | 514                                        | 257      | 171      | 85,7     | 42,9     | 17,1    |
| 2,71                                                                                                    | 1,355 | 0,677 5 | 0,542 | 0,271 | 510                                        | 255      | 170      | 85,1     | 42,5     | 17,0    |
| 2,72                                                                                                    | 1,360 | 0,680 0 | 0,544 | 0,272 | 507                                        | 253      | 169      | 84,4     | 42,2     | 16,9    |
| 2,73                                                                                                    | 1,365 | 0,682 5 | 0,546 | 0,273 | 503                                        | 251      | 168      | 83,8     | 41,9     | 16,8    |
| 2,74                                                                                                    | 1,370 | 0,685 0 | 0,548 | 0,274 | 499                                        | 250      | 166      | 83,2     | 41,6     | 16,6    |
| 2,75                                                                                                    | 1,375 | 0,687 5 | 0,550 | 0,275 | 495                                        | 248      | 165      | 82,6     | 41,3     | 16,5    |
| 2,76                                                                                                    | 1,380 | 0,690 0 | 0,552 | 0,276 | 492                                        | 246      | 164      | 81,9     | 41,0     | 16,4    |
| 2,77                                                                                                    | 1,385 | 0,692 5 | 0,554 | 0,277 | 488                                        | 244      | 163      | 81,3     | 40,7     | 16,3    |
| 2,78                                                                                                    | 1,390 | 0,695 0 | 0,556 | 0,278 | 485                                        | 242      | 162      | 80,8     | 40,4     | 16,2    |
| 2,79                                                                                                    | 1,395 | 0,697 5 | 0,558 | 0,279 | 481                                        | 240      | 160      | 80,2     | 40,1     | 16,0    |
| 2,80                                                                                                    | 1,400 | 0,700 0 | 0,560 | 0,280 | 477                                        | 239      | 159      | 79,6     | 39,8     | 15,9    |
| 2,81                                                                                                    | 1,405 | 0,702 5 | 0,562 | 0,281 | 474                                        | 237      | 158      | 79,0     | 39,5     | 15,8    |
| 2,82                                                                                                    | 1,410 | 0,705 0 | 0,564 | 0,282 | 471                                        | 235      | 157      | 78,4     | 39,2     | 15,7    |
| 2,83                                                                                                    | 1,415 | 0,707 5 | 0,566 | 0,283 | 467                                        | 234      | 156      | 77,9     | 38,9     | 15,6    |
| 2,84                                                                                                    | 1,420 | 0,710 0 | 0,568 | 0,284 | 464                                        | 232      | 155      | 77,3     | 38,7     | 15,5    |

## Summary of pages

The following table identifies the current issue of each page. Issue 1 indicates that a page has been introduced for the first time by amendment. Subsequent issue numbers indicate an updated page. Vertical sidelining on replacement pages indicates the most recent changes (amendment, addition, deletion).

| Page               | Issue    | Page              | Issue    |
|--------------------|----------|-------------------|----------|
| Front cover        | 2        | 9                 | 2        |
| Inside front cover | 2        | 10                | original |
| a                  | 1        | 11                | original |
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| Amd. No. | Date        | Text affected                         |
|----------|-------------|---------------------------------------|
| 9147     | August 1996 | Indicated by a sideline in the margin |
|          |             |                                       |
|          |             |                                       |
|          |             |                                       |

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| Table A.2 Tables for determination of the Brinell hardness for testing on flat surfaces (continued) |       |         |       |       |                                            |     |     |      |      |      |
|-----------------------------------------------------------------------------------------------------|-------|---------|-------|-------|--------------------------------------------|-----|-----|------|------|------|
| Ball diameter<br><i>D</i><br>mm                                                                     |       |         |       |       | Ratio $0,102 F/D^2$                        |     |     |      |      |      |
| 10                                                                                                  | 5     | 2,5     | 2     | 1     | 30                                         | 15  | 10  | 5    | 2,5  | 1    |
| Diameter of the indentation<br><i>d</i><br>mm                                                       |       |         |       |       | Brinell hardness, HBS or HBW <sup>1)</sup> |     |     |      |      |      |
| 2,85                                                                                                | 1,425 | 0,712 5 | 0,570 | 0,285 | 461                                        | 230 | 154 | 76,8 | 38,4 | 15,4 |
| 2,86                                                                                                | 1,430 | 0,715 0 | 0,572 | 0,286 | 457                                        | 229 | 152 | 76,2 | 38,1 | 15,2 |
| 2,87                                                                                                | 1,435 | 0,717 5 | 0,574 | 0,287 | 454                                        | 227 | 151 | 75,7 | 37,8 | 15,1 |
| 2,88                                                                                                | 1,440 | 0,720 0 | 0,576 | 0,288 | 451                                        | 225 | 150 | 75,1 | 37,6 | 15,0 |
| 2,89                                                                                                | 1,445 | 0,722 5 | 0,578 | 0,289 | 448                                        | 224 | 149 | 74,6 | 37,3 | 14,9 |
| 2,90                                                                                                | 1,450 | 0,725 0 | 0,580 | 0,290 | 444                                        | 222 | 148 | 74,1 | 37,0 | 14,8 |
| 2,91                                                                                                | 1,455 | 0,727 5 | 0,582 | 0,291 | 441                                        | 221 | 147 | 73,6 | 36,8 | 14,7 |
| 2,92                                                                                                | 1,460 | 0,730 0 | 0,584 | 0,292 | 438                                        | 219 | 146 | 73,0 | 36,5 | 14,6 |
| 2,93                                                                                                | 1,465 | 0,732 5 | 0,586 | 0,293 | 435                                        | 218 | 145 | 72,5 | 36,3 | 14,5 |
| 2,94                                                                                                | 1,470 | 0,735 0 | 0,588 | 0,294 | 432                                        | 216 | 144 | 72,0 | 36,0 | 14,4 |
| 2,95                                                                                                | 1,475 | 0,737 5 | 0,590 | 0,295 | 429                                        | 215 | 143 | 71,5 | 35,8 | 14,3 |
| 2,96                                                                                                | 1,480 | 0,740 0 | 0,592 | 0,296 | 426                                        | 213 | 142 | 71,0 | 35,5 | 14,2 |
| 2,97                                                                                                | 1,485 | 0,742 5 | 0,594 | 0,297 | 423                                        | 212 | 141 | 70,5 | 35,3 | 14,1 |
| 2,98                                                                                                | 1,490 | 0,745 0 | 0,596 | 0,298 | 420                                        | 210 | 140 | 70,1 | 35,0 | 14,0 |
| 2,99                                                                                                | 1,495 | 0,747 5 | 0,598 | 0,299 | 417                                        | 209 | 139 | 69,6 | 34,8 | 13,9 |
| 3,00                                                                                                | 1,500 | 0,750 0 | 0,600 | 0,300 | 415                                        | 207 | 138 | 69,1 | 34,6 | 13,8 |
| 3,01                                                                                                | 1,505 | 0,752 5 | 0,602 | 0,301 | 412                                        | 206 | 137 | 68,6 | 34,3 | 13,7 |
| 3,02                                                                                                | 1,510 | 0,755 0 | 0,604 | 0,302 | 409                                        | 205 | 136 | 68,2 | 34,1 | 13,6 |
| 3,03                                                                                                | 1,515 | 0,757 5 | 0,606 | 0,303 | 406                                        | 203 | 135 | 67,7 | 33,9 | 13,5 |
| 3,04                                                                                                | 1,520 | 0,760 0 | 0,608 | 0,304 | 404                                        | 202 | 135 | 67,3 | 33,6 | 13,5 |
| 3,05                                                                                                | 1,525 | 0,762 5 | 0,610 | 0,305 | 401                                        | 200 | 134 | 66,8 | 33,4 | 13,4 |
| 3,06                                                                                                | 1,530 | 0,765 0 | 0,612 | 0,306 | 398                                        | 199 | 133 | 66,4 | 33,2 | 13,3 |
| 3,07                                                                                                | 1,535 | 0,767 5 | 0,614 | 0,307 | 395                                        | 198 | 132 | 65,9 | 33,0 | 13,2 |
| 3,08                                                                                                | 1,540 | 0,770 0 | 0,616 | 0,308 | 393                                        | 196 | 131 | 65,5 | 32,7 | 13,1 |
| 3,09                                                                                                | 1,545 | 0,772 5 | 0,618 | 0,309 | 390                                        | 195 | 130 | 65,0 | 32,5 | 13,0 |
| 3,10                                                                                                | 1,550 | 0,775 0 | 0,620 | 0,310 | 388                                        | 194 | 129 | 64,6 | 32,3 | 12,9 |
| 3,11                                                                                                | 1,555 | 0,777 5 | 0,622 | 0,311 | 385                                        | 193 | 128 | 64,2 | 32,1 | 12,8 |
| 3,12                                                                                                | 1,560 | 0,780 0 | 0,624 | 0,312 | 383                                        | 191 | 128 | 63,8 | 31,9 | 12,8 |
| 3,13                                                                                                | 1,565 | 0,782 5 | 0,626 | 0,313 | 380                                        | 190 | 127 | 63,3 | 31,7 | 12,7 |
| 3,14                                                                                                | 1,570 | 0,787 0 | 0,628 | 0,314 | 378                                        | 189 | 126 | 62,9 | 31,5 | 12,6 |
| 3,15                                                                                                | 1,575 | 0,787 5 | 0,630 | 0,315 | 375                                        | 188 | 125 | 62,5 | 31,3 | 12,5 |
| 3,16                                                                                                | 1,580 | 0,790 0 | 0,632 | 0,316 | 373                                        | 186 | 124 | 62,1 | 31,1 | 12,4 |
| 3,17                                                                                                | 1,585 | 0,792 5 | 0,634 | 0,317 | 370                                        | 185 | 123 | 61,7 | 30,9 | 12,3 |
| 3,18                                                                                                | 1,590 | 0,795 0 | 0,636 | 0,318 | 368                                        | 184 | 123 | 61,3 | 30,7 | 12,3 |
| 3,19                                                                                                | 1,595 | 0,797 5 | 0,638 | 0,319 | 366                                        | 183 | 122 | 60,9 | 30,5 | 12,2 |
| 3,20                                                                                                | 1,600 | 0,800 0 | 0,640 | 0,320 | 363                                        | 182 | 121 | 60,5 | 30,3 | 12,1 |