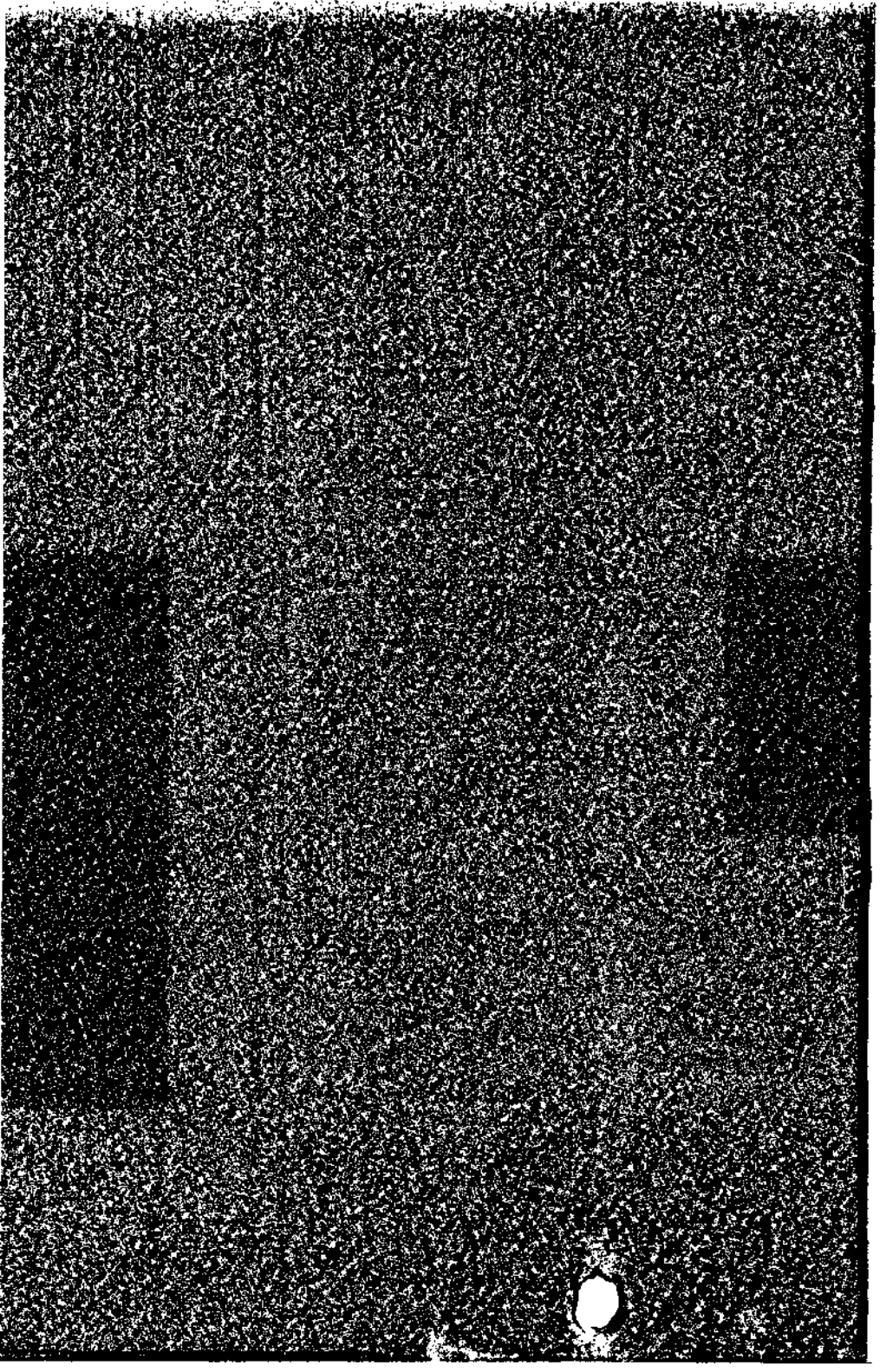

METHOD FOR

# BRINELL HARDNESS TEST

## Part 1. Testing of metals

**B.S. 240 : Part 1 : 1962**

Price 10/- net

BRITISH STANDARDS INSTITUTION

INCORPORATED BY ROYAL CHARTER

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The Institution desires to call attention to the fact that this British Standard does not purport to include all the necessary provisions of a contract.

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This standard makes reference to the following British Standards:

B.S. 350. Conversion factors and tables. Part 1. Basis of tables Conversion factors.
B.S. 240. Brinell hardness test. Part 2. Verification of the testing machine.
B.S. 860. Table of approximate comparison of hardness scales.

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**The following B.S.I. references relate to the work on this standard:**
**Committee reference MEE/37, MEE/37/9.**
**Draft for comment AB(MEE) 5035.**





## CONTENTS

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The Mechanical Engineering Industry Standards Committee, under whose supervision this British Standard was prepared, consists of representatives from the following Government departments and scientific and industrial organizations:

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BRITISH STANDARD METHOD FOR

# BRINELL HARDNESS TEST

## Part 1. Testing of metals

### FOREWORD

The purpose of this British Standard is to define the test requirements and procedure for carrying out the Brinell hardness test at ordinary room temperature. During the revision of the standard full consideration has been given to the corresponding documents prepared by Technical Committees of the International Organization for Standardization (ISO), and the requirements laid down in the standard are not less exacting than the corresponding recommendations of the ISO.

Part 1 of this standard is intended to meet the general needs of industrial hardness measurement of ferrous and non-ferrous metals by the Brinell principle, including tests of thin metal sheet and strip which were formerly dealt with in B.S. 485 : 1934. Tables of hardness values for the commonly used loads and ball diameters and applicable to tests made on flat surfaces have been included, together with tables giving minimum recommended thicknesses of test pieces.

The accurate determination of hardness requires care and attention to detail. The recommendations included in the standard give guidance for achieving accuracy.

A new part of this standard deals with the verification of testing machines used for measuring Brinell hardness and with the calibration of standard Brinell hardness blocks. As this new Part 2 includes the requirements for steel balls, B.S. 240 : Part 2 : 1950 will be withdrawn.

## METHOD OF TEST

### THE BRINELL PRINCIPLE

1. An indenter comprising a hardened steel ball of diameter $D$ mounted in a suitable holder is forced into the material under test under a load $F$ (Fig. 1). The diameter of the indentation left in the surface of the material after removal of the load is measured in two directions at right angles. The area of the curved surface of the indentation is calculated from the mean diameter, $d$, the indentation being considered as a segment of a sphere of diameter $D$.

The Brinell hardness is the quotient obtained by dividing the load $F$, expressed in kilogrammes-force, by the surface area of the indentation expressed in square millimetres.

NOTE. The Brinell test, using a hardened steel ball, is not recommended for metals of hardness exceeding 450 HB. For such metals a ball of harder material, e.g. tungsten carbide, may be used, but the resulting values are not true Brinell hardness numbers and tests so made are regarded as ' modified ' Brinell tests.

### SYMBOLS

2. The symbols used are as follows:

$F$ = load in kilogrammes-force (kgf)

$D$ = diameter of ball in millimetres

$d$ = mean diameter of indentation in millimetres

$$\text{HB} = \text{Brinell Hardness} = \frac{2F}{\pi D(D-\sqrt{(D^2-d^2)})}$$

$$h = \text{depth of indentation in millimetres} = \frac{F}{\pi D \times \text{HB}}$$

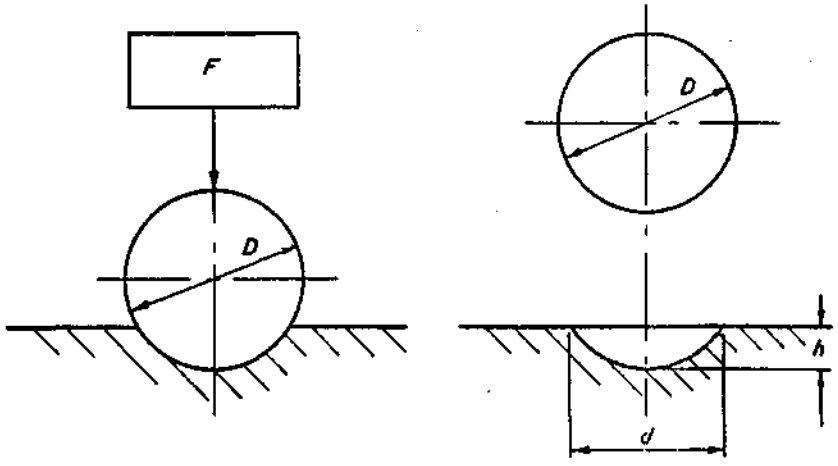


Fig. 1. Form of indentation.





NOTE 1. The kilogramme-force is that force which, acting alone on a mass of one kilogramme, will impart to it the international standard acceleration 980·665 cm/s². (See B.S. 350 : Part 1, Section One (2)a).

NOTE 2. The symbol HB is supplemented by numbers indicating the diameter of the ball used and the load applied. Thus 226 HB 10/3000 indicates that a Brinell hardness of 226 was obtained by using a 10 millimetre diameter ball with a load of 3000 kgf. If the time of duration of load differs from the standard as specified below, a further number is added to show the duration of the load in seconds.

### TABLES OF HARDNESS VALUES

3. When the mean diameter of the indentation has been determined, the Brinell hardness may be computed from the formula given in Clause 2. It is convenient, however, to use tables and such tables calculated from this formula are given in Appendix A. These tables have been prepared for balls of 1, 2, 5 and 10 mm diameter and loads giving a ratio of $F/D^2$ of 30, 10, 5 and 1 without regard to any limitations imposed by practical conditions.

The tables in Appendix A apply to hardness tests in which the indentations are made in flat surfaces.

### RELATION OF LOAD TO BALL DIAMETER

4. The choice of load and ball diameter to be used in a Brinell test is determined by two factors:

(i) the value of the ratio $F/D^2$

and (ii) the size of indentation which will provide optimum accuracy.

The same value of $F/D^2$ will, in principle, give the same hardness value for different loads and the value to be used will depend on the nature and hardness of the material to be tested. Four standard values of $F/D^2$ have been adopted, i.e. 30, 10, 5 and 1, and Table A gives correlated values of load and ball diameter corresponding to them.

Table A shall be used for choosing the load and ball diameter most suitable for the hardness measurement which is to be made.

TABLE A. CORRELATED VALUES OF LOAD AND BALL DIAMETER

| Diameter of ball | Load | | | |
|---|---|---|---|---|
| | $F/D^2 = 1$ | $F/D^2 = 5$ | $F/D^2 = 10$ | $F/D^2 = 30$ |
| mm | kgf | kgf | kgf | kgf |
| 1 | 1 | 5 | 10 | 30 |
| 2 | 4 | 20 | 40 | 120 |
| 5 | 25 | 125 | 250 | 750 |
| 10 | 100 | 500 | 1 000 | 3 000 |

The value of $F/D^2$ to be used should be stated in the specification for the material. For guidance, appropriate values for representative materials are given in Table B.

TABLE B. VALUES $F/D^2$ FOR REPRESENTATIVE MATERIALS

| Representative materials | Approximate Brinell hardness | $F/D^2$ ratio |
|---|---|---|
| Steels and cast iron | Above 100 | 30 |
| Copper, copper alloys and aluminium alloys | 30 to 200 | 10 |
| Aluminium | 15 to 100 | 5 |
| Lead, tin and their alloys | 3 to 20 | 1 |

For materials of coarse structure, the indentation should be sufficiently large to ensure that the average hardness of the material is obtained, and wherever possible several indentations should be made and an average taken.

LOAD

5. *a.* The load shall be accurate within ± 0·5 per cent.

*b.* The load shall be applied along the axis of the indenter and normal to the surface of the test piece.

*c.* The load shall be applied in such a manner that the indenter is forced into the test piece without shock or vibration.

*d.* The full load shall be maintained for 10 to 15 seconds.

NOTE. For some materials it may be necessary to use a different duration of loading. If the duration of loading differs from the standard it shall be reported when declaring the hardness. (See Clause 2.)

INDENTER

6. *a.* The indenter shall comprise a hardened steel ball mounted in a suitable holder.

*b.* The ball shall be polished and free from surface defects.

*c.* The diameter of the ball shall not differ from nominal by more than ± 0·002 5 mm.

*d.* The hardness of the ball shall be not less than 850 HV. (See B.S. 240 : Part 2, ' Verification of testing machine ').





MEASUREMENT OF INDENTATION

7. *a.* The mean diameter of the indentation shall be determined from measurements taken in two directions at right angles.

*b.* The measuring microscope or other measuring device used shall be capable of measuring the diameter of indentations to an accuracy of ± 0·25 per cent of the diameter of the ball.

NOTE 1. A microscope or measuring device complying with the requirements of Clause 7*b* may introduce a maximum inaccuracy of ± 1 per cent in the measurement of indentation diameters, resulting in a maximum inaccuracy of ± 2 per cent in hardness values within the range of the tables in Appendix A.

NOTE 2. Brinell measuring microscopes having a scale which can be read to no better than ½ division are in use in industry. When used for measuring indentations covering 50 divisions or more, such microscopes will meet the requirements of Clause 7*b*.

If a lower accuracy is acceptable, such microscopes may be used for measuring indentations of less than 50 divisions, but it should be noted that for indentations of 25 divisions errors in hardness of approximately 4 per cent may be incurred.

TEST PIECE

8. *a.* The surface finish of the test piece shall be such as to permit accurate measurement of the diameter of the indentation. A high degree of surface finish is required when the test is made with a ball of small diameter.

NOTE 1. Precautions should be taken to ensure that the surface tested is representative and that its hardness is not affected by any unsuitable machining, grinding or polishing process applied to it.

NOTE 2. Hardness measurements made on test pieces with curved surfaces should be regarded as being of comparative value only.

*b.* The thickness of the test piece shall be not less than 8 times the depth, *h*, of the indentation. (See Clause 9*d* and Appendix B.)

*c.* The test piece shall be located rigidly in relation to the indenter so that the surface to be indented is at right angles to the axis of the indenter.

*d.* The distance of the centre of an indentation from the edge of the test piece shall be at least 3 times the diameter of the indentation. The distance between the centres of two adjacent indentations shall be at least 4 times the diameter of the indentation.

RECOMMENDATIONS

9. *a.* The testing machine should not be sited in gritty or unduly dusty conditions, nor in a position subject to vibration or excessive temperature changes.

*b.* The testing machine should be frequently checked by means of standardized hardness blocks (See B.S. 240 : Part 2*).

* B.S. 240 : Part 2, ' Verification of testing machine '.

*c.* The indenter should be examined regularly for signs of damage and replaced whenever these are found. The results of any test inadvertently made with a damaged or distorted ball should be discarded.

*d.* For some materials the requirement that the thickness of the test piece shall be not less than 8 times the depth of the impression may be unduly restrictive. If, in particular circumstances, it becomes necessary to accept a lower ratio of thickness to depth, the hardness value may be influenced by the size and hardness of the anvil, and a special investigation may be needed to establish what influence these factors exert on the true hardness as obtained from thicker test pieces.

*e.* As there is no general procedure for accurately converting Brinell hardness into other scales of hardness, it is recommended that such conversions should be avoided, except for special cases where a reliable basis for the conversion has been established beforehand by direct test on the material concerned. (See B.S. 860, ' Table of approximate comparison of hardness scales '.)





## APPENDIX A

## TABLES OF BRINELL HARDNESS VALUES (HB) FOR USE IN TESTS MADE ON FLAT SURFACES

The following tables have been calculated from the formula

$$HB = \frac{2F}{\pi D(D-\sqrt{(D^2-d^2)})}$$

without regard to the limitations imposed by practical conditions.

The tables cover a range of indentation diameter, $d$, between 0·25 $D$ and 0·6 $D$.

In industrial tests carried out in accordance with this standard, using testing machines in good order, the principal limitation will arise in the measurement of the diameter of the indentation, and it is unlikely that the accuracy of determination of the mean diameter will be better than $\pm$ 1 per cent. This will lead to an error of approximately $\pm$ 2 per cent in the hardness value obtained.

NOTE. The values above 450 HB, appearing in italic type, are for use only when a ' modified ' Brinell test is made, e.g. employing a tungsten carbide ball.

## TABLE 1

DIAMETER OF BALL = 10 mm LOAD = 3 000 kgf $F/D^2 = 30$

| Diameter of impression | 0·00 | 0·01 | 0·02 | 0·03 | 0·04 | 0·05 | 0·06 | 0·07 | 0·08 | 0·09 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 2·50 | *601* | *597* | *592* | *587* | *582* | *578* | *573* | *569* | *564* | *560* |
| 2·60 | *555* | *551* | *547* | *543* | *538* | *534* | *530* | *526* | *522* | *518* |
| 2·70 | *514* | *510* | *507* | *503* | *499* | *495* | *492* | *488* | *485* | *481* |
| 2·80 | *477* | *474* | *471* | *467* | *464* | *461* | *457* | *454* | *451* | 448 |
| 2·90 | 444 | 441 | 438 | 435 | 432 | 429 | 426 | 423 | 420 | 417 |
| 3·00 | 415 | 412 | 409 | 406 | 404 | 401 | 398 | 395 | 393 | 390 |
| 3·10 | 388 | 385 | 383 | 380 | 378 | 375 | 373 | 370 | 368 | 366 |
| 3·20 | 363 | 361 | 359 | 356 | 354 | 352 | 350 | 347 | 345 | 343 |
| 3·30 | 341 | 339 | 337 | 335 | 333 | 331 | 329 | 326 | 325 | 323 |
| 3·40 | 321 | 319 | 317 | 315 | 313 | 311 | 309 | 307 | 306 | 304 |
| 3·50 | 302 | 300 | 298 | 297 | 295 | 293 | 292 | 290 | 288 | 286 |
| 3·60 | 285 | 283 | 282 | 280 | 278 | 277 | 275 | 274 | 272 | 271 |
| 3·70 | 269 | 268 | 266 | 265 | 263 | 262 | 260 | 259 | 257 | 256 |
| 3·80 | 255 | 253 | 252 | 250 | 249 | 248 | 246 | 245 | 244 | 242 |
| 3·90 | 241 | 240 | 239 | 237 | 236 | 235 | 234 | 232 | 231 | 230 |
| 4·00 | 229 | 228 | 226 | 225 | 224 | 223 | 222 | 221 | 219 | 218 |
| 4·10 | 217 | 216 | 215 | 214 | 213 | 212 | 211 | 210 | 209 | 208 |
| 4·20 | 207 | 205 | 204 | 203 | 202 | 201 | 200 | 199 | 198 | 198 |
| 4·30 | 197 | 196 | 195 | 194 | 193 | 192 | 191 | 190 | 189 | 188 |
| 4·40 | 187 | 186 | 185 | 185 | 184 | 183 | 182 | 181 | 180 | 179 |
| 4·50 | 179 | 178 | 177 | 176 | 175 | 174 | 174 | 173 | 172 | 171 |
| 4·60 | 170 | 170 | 169 | 168 | 167 | 167 | 166 | 165 | 164 | 164 |
| 4·70 | 163 | 162 | 161 | 161 | 160 | 159 | 158 | 158 | 157 | 156 |
| 4·80 | 156 | 155 | 154 | 154 | 153 | 152 | 152 | 151 | 150 | 150 |
| 4·90 | 149 | 148 | 148 | 147 | 146 | 146 | 145 | 144 | 144 | 143 |
| 5·00 | 143 | 142 | 141 | 141 | 140 | 140 | 139 | 138 | 138 | 137 |
| 5·10 | 137 | 136 | 136 | 135 | 134 | 134 | 133 | 133 | 132 | 132 |
| 5·20 | 131 | 130 | 130 | 129 | 129 | 128 | 128 | 127 | 127 | 126 |
| 5·30 | 126 | 125 | 125 | 124 | 124 | 123 | 123 | 122 | 122 | 121 |
| 5·40 | 121 | 120 | 120 | 119 | 119 | 118 | 118 | 117 | 117 | 116 |
| 5·50 | 116 | 115 | 115 | 114 | 114 | 114 | 113 | 113 | 112 | 112 |
| 5·60 | 111 | 111 | 110 | 110 | 110 | 109 | 109 | 108 | 108 | 107 |
| 5·70 | 107 | 107 | 106 | 106 | 105 | 105 | 105 | 104 | 104 | 103 |
| 5·80 | 103 | 103 | 102 | 102 | 101 | 101 | 101 | 100 | 99·9 | 99·5 |
| 5·90 | 99·2 | 98·8 | 98·4 | 98·0 | 97·7 | 97·3 | 96·9 | 96·6 | 96·2 | 95·9 |
| 6·00 | 95·5 | — | — | — | — | — | — | — | — | — |





## TABLE 2

DIAMETER OF BALL = 10 mm LOAD = 1 000 kgf $F/D^2 = 10$

| Diameter of impression | 0·00 | 0·01 | 0·02 | 0·03 | 0·04 | 0·05 | 0·06 | 0·07 | 0·08 | 0·09 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 2·50 | 200 | 199 | 197 | 196 | 194 | 193 | 191 | 190 | 188 | 187 |
| 2·60 | 185 | 184 | 182 | 181 | 179 | 178 | 177 | 175 | 174 | 173 |
| 2·70 | 171 | 170 | 169 | 168 | 166 | 165 | 164 | 163 | 162 | 160 |
| 2·80 | 159 | 158 | 157 | 156 | 155 | 154 | 152 | 151 | 150 | 149 |
| 2·90 | 148 | 147 | 146 | 146 | 144 | 143 | 142 | 141 | 140 | 139 |
| 3·00 | 138 | 137 | 136 | 135 | 135 | 134 | 133 | 132 | 131 | 130 |
| 3·10 | 129 | 128 | 128 | 127 | 126 | 125 | 124 | 123 | 123 | 122 |
| 3·20 | 121 | 120 | 120 | 119 | 118 | 117 | 117 | 116 | 115 | 114 |
| 3·30 | 114 | 113 | 112 | 112 | 111 | 110 | 110 | 109 | 108 | 108 |
| 3·40 | 107 | 106 | 106 | 105 | 104 | 104 | 103 | 102 | 102 | 101 |
| 3·50 | 101 | 100 | 99·5 | 98·9 | 98·3 | 97·7 | 97·2 | 96·6 | 96·1 | 95·5 |
| 3·60 | 95·0 | 94·4 | 93·9 | 93·3 | 92·8 | 92·3 | 91·8 | 91·2 | 90·7 | 90·2 |
| 3·70 | 89·7 | 89·2 | 88·7 | 88·2 | 87·7 | 87·2 | 86·8 | 86·3 | 85·8 | 85·3 |
| 3·80 | 84·9 | 84·4 | 83·9 | 83·5 | 83·0 | 82·6 | 82·1 | 81·7 | 81·3 | 80·8 |
| 3·90 | 80·4 | 80·0 | 79·5 | 79·1 | 78·7 | 78·3 | 77·9 | 77·5 | 77·1 | 76·7 |
| 4·00 | 76·3 | 75·9 | 75·5 | 75·1 | 74·7 | 74·3 | 73·9 | 73·5 | 73·2 | 72·8 |
| 4·10 | 72·4 | 72·0 | 71·7 | 71·3 | 71·0 | 70·6 | 70·2 | 69·9 | 69·5 | 69·2 |
| 4·20 | 68·8 | 68·5 | 68·2 | 67·8 | 67·5 | 67·1 | 66·8 | 66·5 | 66·2 | 65·8 |
| 4·30 | 65·5 | 65·2 | 64·9 | 64·6 | 64·2 | 63·9 | 63·6 | 63·3 | 63·0 | 62·7 |
| 4·40 | 62·4 | 62·1 | 61·8 | 61·5 | 61·2 | 60·9 | 60·6 | 60·4 | 60·1 | 59·8 |
| 4·50 | 59·5 | 59·2 | 59·0 | 58·7 | 58·4 | 58·1 | 57·9 | 57·6 | 57·3 | 57·1 |
| 4·60 | 56·8 | 56·5 | 56·3 | 56·0 | 55·8 | 55·5 | 55·3 | 55·0 | 54·8 | 54·5 |
| 4·70 | 54·3 | 54·0 | 53·8 | 53·5 | 53·3 | 53·0 | 52·8 | 52·6 | 52·3 | 52·1 |
| 4·80 | 51·9 | 51·6 | 51·4 | 51·2 | 51·0 | 50·7 | 50·5 | 50·3 | 50·1 | 49·8 |
| 4·90 | 49·6 | 49·4 | 49·2 | 49·0 | 48·8 | 48·6 | 48·3 | 48·1 | 47·9 | 47·7 |
| 5·00 | 47·5 | 47·3 | 47·1 | 46·9 | 46·7 | 46·5 | 46·3 | 46·1 | 45·9 | 45·7 |
| 5·10 | 45·6 | 45·3 | 45·1 | 45·0 | 44·8 | 44·6 | 44·4 | 44·2 | 44·0 | 43·8 |
| 5·20 | 43·7 | 43·5 | 43·3 | 43·1 | 42·9 | 42·8 | 42·6 | 42·4 | 42·2 | 42·1 |
| 5·30 | 41·9 | 41·7 | 41·5 | 41·4 | 41·2 | 41·0 | 40·9 | 40·7 | 40·5 | 40·4 |
| 5·40 | 40·2 | 40·0 | 39·9 | 39·7 | 39·6 | 39·4 | 39·2 | 39·1 | 38·9 | 38·8 |
| 5·50 | 38·6 | 38·5 | 38·3 | 38·2 | 38·0 | 37·9 | 37·7 | 37·6 | 37·4 | 37·3 |
| 5·60 | 37·1 | 37·0 | 36·8 | 36·7 | 36·5 | 36·4 | 36·3 | 36·1 | 36·0 | 35·8 |
| 5·70 | 35·7 | 35·6 | 35·4 | 35·3 | 35·1 | 35·0 | 34·9 | 34·7 | 34·6 | 34·5 |
| 5·80 | 34·3 | 34·2 | 34·1 | 33·9 | 33·8 | 33·7 | 33·6 | 33·4 | 33·3 | 33·2 |
| 5·90 | 33·1 | 32·9 | 32·8 | 32·7 | 32·6 | 32·4 | 32·3 | 32·2 | 32·1 | 32·0 |
| 6·00 | 31·8 | — | — | — | — | — | — | — | — | — |

## TABLE 3

DIAMETER OF BALL = 10 mm LOAD = 500 kgf $F/D^2 = 5$

| Diameter of impression | 0·00 | 0·01 | 0·02 | 0·03 | 0·04 | 0·05 | 0·06 | 0·07 | 0·08 | 0·09 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 2·50 | 100 | 99·4 | 98·6 | 97·8 | 97·1 | 96·3 | 95·5 | 94·8 | 94·0 | 93·3 |
| 2·60 | 92·6 | 91·8 | 91·1 | 90·4 | 89·7 | 89·0 | 88·4 | 87·7 | 87·0 | 86·4 |
| 2·70 | 85·7 | 85·1 | 84·4 | 83·8 | 83·2 | 82·6 | 81·9 | 81·3 | 80·8 | 80·2 |
| 2·80 | 79·6 | 79·0 | 78·4 | 77·9 | 77·3 | 76·8 | 76·2 | 75·7 | 75·1 | 74·6 |
| 2·90 | 74·1 | 73·6 | 73·0 | 72·5 | 72·0 | 71·5 | 71·0 | 70·5 | 70·1 | 69·6 |
| 3·00 | 69·1 | 68·6 | 68·2 | 67·7 | 67·3 | 66·8 | 66·4 | 65·9 | 65·5 | 65·0 |
| 3·10 | 64·6 | 64·2 | 63·8 | 63·3 | 62·9 | 62·5 | 62·1 | 61·7 | 61·3 | 60·9 |
| 3·20 | 60·5 | 60·1 | 59·8 | 59·4 | 59·0 | 58·6 | 58·3 | 57·9 | 57·5 | 57·2 |
| 3·30 | 56·8 | 56·5 | 56·1 | 55·8 | 55·4 | 55·1 | 54·8 | 54·4 | 54·1 | 53·8 |
| 3·40 | 53·4 | 53·1 | 52·8 | 52·5 | 52·2 | 51·8 | 51·5 | 51·2 | 50·9 | 50·6 |
| 3·50 | 50·3 | 50·0 | 49·7 | 49·4 | 49·2 | 48·9 | 48·6 | 48·3 | 48·0 | 47·7 |
| 3·60 | 47·5 | 47·2 | 46·9 | 46·7 | 46·4 | 46·1 | 45·9 | 45·6 | 45·4 | 45·1 |
| 3·70 | 44·9 | 44·6 | 44·4 | 44·1 | 43·9 | 43·6 | 43·4 | 43·1 | 42·9 | 42·7 |
| 3·80 | 42·4 | 42·2 | 42·0 | 41·7 | 41·5 | 41·3 | 41·1 | 40·9 | 40·6 | 40·4 |
| 3·90 | 40·2 | 40·0 | 39·8 | 39·6 | 39·4 | 39·1 | 38·9 | 38·7 | 38·5 | 38·3 |
| 4·00 | 38·1 | 37·9 | 37·7 | 37·6 | 37·3 | 37·1 | 37·0 | 36·8 | 36·6 | 36·4 |
| 4·10 | 36·2 | 36·0 | 35·8 | 35·7 | 35·5 | 35·3 | 35·1 | 34·9 | 34·8 | 34·6 |
| 4·20 | 34·4 | 34·2 | 34·1 | 33·9 | 33·7 | 33·6 | 33·4 | 33·2 | 33·1 | 32·9 |
| 4·30 | 32·8 | 32·6 | 32·4 | 32·3 | 32·1 | 32·0 | 31·8 | 31·7 | 31·5 | 31·4 |
| 4·40 | 31·2 | 31·1 | 30·9 | 30·8 | 30·6 | 30·5 | 30·3 | 30·2 | 30·0 | 29·9 |
| 4·50 | 29·8 | 29·6 | 29·5 | 29·3 | 29·2 | 29·1 | 28·9 | 28·8 | 28·7 | 28·5 |
| 4·60 | 28·4 | 28·3 | 28·1 | 28·0 | 27·9 | 27·8 | 27·6 | 27·5 | 27·4 | 27·3 |
| 4·70 | 27·1 | 27·0 | 26·9 | 26·8 | 26·6 | 26·5 | 26·4 | 26·3 | 26·2 | 26·1 |
| 4·80 | 25·9 | 25·8 | 25·7 | 25·6 | 25·5 | 25·4 | 25·3 | 25·1 | 25·0 | 24·9 |
| 4·90 | 24·8 | 24·7 | 24·6 | 24·5 | 24·4 | 24·3 | 24·2 | 24·1 | 24·0 | 23·9 |
| 5·00 | 23·8 | 23·7 | 23·6 | 23·5 | 23·4 | 23·3 | 23·2 | 23·1 | 23·0 | 22·9 |
| 5·10 | 22·8 | 22·7 | 22·6 | 22·5 | 22·4 | 22·3 | 22·2 | 22·1 | 22·0 | 21·9 |
| 5·20 | 21·8 | 21·7 | 21·6 | 21·6 | 21·5 | 21·4 | 21·3 | 21·2 | 21·1 | 21·0 |
| 5·30 | 20·9 | 20·9 | 20·8 | 20·7 | 20·6 | 20·5 | 20·4 | 20·3 | 20·3 | 20·2 |
| 5·40 | 20·1 | 20·0 | 19·9 | 19·9 | 19·8 | 19·7 | 19·6 | 19·5 | 19·5 | 19·4 |
| 5·50 | 19·3 | 19·2 | 19·2 | 19·1 | 19·0 | 18·9 | 18·9 | 18·8 | 18·7 | 18·6 |
| 5·60 | 18·6 | 18·5 | 18·4 | 18·3 | 18·3 | 18·2 | 18·1 | 18·1 | 18·0 | 17·9 |
| 5·70 | 17·8 | 17·8 | 17·7 | 17·6 | 17·6 | 17·5 | 17·4 | 17·4 | 17·3 | 17·2 |
| 5·80 | 17·2 | 17·1 | 17·0 | 17·0 | 16·9 | 16·8 | 16·8 | 16·7 | 16·7 | 16·6 |
| 5·90 | 16·5 | 16·5 | 16·4 | 16·3 | 16·3 | 16·2 | 16·2 | 16·1 | 16·0 | 16·0 |
| 6·00 | 15·9 | — | — | — | — | — | — | — | — | — |





## TABLE 4

DIAMETER OF BALL = 10 mm LOAD = 100 kgf $F/D^2 = 1$

| Diameter of impression | 0·00 | 0·01 | 0·02 | 0·03 | 0·04 | 0·05 | 0·06 | 0·07 | 0·08 | 0·09 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 2·50 | 20·0 | 19·9 | 19·7 | 19·6 | 19·4 | 19·3 | 19·1 | 19·0 | 18·8 | 18·7 |
| 2·60 | 18·5 | 18·4 | 18·2 | 18·1 | 17·9 | 17·8 | 17·7 | 17·5 | 17·4 | 17·3 |
| 2·70 | 17·1 | 17·0 | 16·9 | 16·8 | 16·6 | 16·5 | 16·4 | 16·3 | 16·2 | 16·0 |
| 2·80 | 15·9 | 15·8 | 15·7 | 15·6 | 15·5 | 15·4 | 15·2 | 15·1 | 15·0 | 14·9 |
| 2·90 | 14·8 | 14·7 | 14·6 | 14·5 | 14·4 | 14·3 | 14·2 | 14·1 | 14·0 | 13·9 |
| 3·00 | 13·8 | 13·7 | 13·6 | 13·5 | 13·5 | 13·4 | 13·3 | 13·2 | 13·1 | 13·0 |
| 3·10 | 12·9 | 12·8 | 12·8 | 12·7 | 12·6 | 12·5 | 12·4 | 12·3 | 12·3 | 12·2 |
| 3·20 | 12·1 | 12·0 | 12·0 | 11·9 | 11·8 | 11·7 | 11·7 | 11·6 | 11·5 | 11·4 |
| 3·30 | 11·4 | 11·3 | 11·2 | 11·2 | 11·1 | 11·0 | 11·0 | 10·9 | 10·8 | 10·8 |
| 3·40 | 10·7 | 10·6 | 10·6 | 10·5 | 10·4 | 10·4 | 10·3 | 10·2 | 10·2 | 10·1 |
| 3·50 | 10·1 | 10·0 | 9·95 | 9·89 | 9·83 | 9·77 | 9·72 | 9·66 | 9·61 | 9·55 |
| 3·60 | 9·50 | 9·44 | 9·39 | 9·33 | 9·28 | 9·23 | 9·18 | 9·12 | 9·07 | 9·02 |
| 3·70 | 8·97 | 8·92 | 8·87 | 8·82 | 8·77 | 8·72 | 8·68 | 8·63 | 8·58 | 8·53 |
| 3·80 | 8·49 | 8·44 | 8·39 | 8·35 | 8·30 | 8·26 | 8·21 | 8·17 | 8·13 | 8·08 |
| 3·90 | 8·04 | 8·00 | 7·95 | 7·91 | 7·87 | 7·83 | 7·79 | 7·75 | 7·71 | 7·67 |
| 4·00 | 7·63 | 7·59 | 7·55 | 7·51 | 7·47 | 7·43 | 7·39 | 7·35 | 7·32 | 7·28 |
| 4·10 | 7·24 | 7·20 | 7·17 | 7·13 | 7·10 | 7·06 | 7·02 | 6·99 | 6·95 | 6·92 |
| 4·20 | 6·88 | 6·85 | 6·82 | 6·78 | 6·75 | 6·71 | 6·68 | 6·65 | 6·62 | 6·58 |
| 4·30 | 6·55 | 6·52 | 6·49 | 6·46 | 6·42 | 6·39 | 6·36 | 6·33 | 6·30 | 6·27 |
| 4·40 | 6·24 | 6·21 | 6·18 | 6·15 | 6·12 | 6·09 | 6·06 | 6·04 | 6·01 | 5·98 |
| 4·50 | 5·95 | 5·92 | 5·90 | 5·87 | 5·84 | 5·81 | 5·79 | 5·76 | 5·73 | 5·71 |
| 4·60 | 5·68 | 5·65 | 5·63 | 5·60 | 5·58 | 5·55 | 5·53 | 5·50 | 5·48 | 5·45 |
| 4·70 | 5·43 | 5·40 | 5·38 | 5·35 | 5·33 | 5·30 | 5·28 | 5·26 | 5·23 | 5·21 |
| 4·80 | 5·19 | 5·16 | 5·14 | 5·12 | 5·10 | 5·07 | 5·05 | 5·03 | 5·01 | 4·98 |
| 4·90 | 4·96 | 4·94 | 4·92 | 4·90 | 4·88 | 4·86 | 4·83 | 4·81 | 4·79 | 4·77 |
| 5·00 | 4·75 | 4·73 | 4·71 | 4·69 | 4·67 | 4·65 | 4·63 | 4·61 | 4·59 | 4·57 |
| 5·10 | 4·55 | 4·53 | 4·51 | 4·50 | 4·48 | 4·46 | 4·44 | 4·42 | 4·40 | 4·38 |
| 5·20 | 4·37 | 4·35 | 4·33 | 4·31 | 4·29 | 4·28 | 4·26 | 4·24 | 4·22 | 4·21 |
| 5·30 | 4·19 | 4·17 | 4·15 | 4·14 | 4·12 | 4·10 | 4·09 | 4·07 | 4·05 | 4·04 |
| 5·40 | 4·02 | 4·00 | 3·99 | 3·97 | 3·96 | 3·94 | 3·92 | 3·91 | 3·89 | 3·88 |
| 5·50 | 3·86 | 3·85 | 3·83 | 3·82 | 3·80 | 3·79 | 3·77 | 3·76 | 3·74 | 3·73 |
| 5·60 | 3·71 | 3·70 | 3·68 | 3·67 | 3·65 | 3·64 | 3·63 | 3·61 | 3·60 | 3·58 |
| 5·70 | 3·57 | 3·56 | 3·54 | 3·53 | 3·51 | 3·50 | 3·49 | 3·47 | 3·46 | 3·45 |
| 5·80 | 3·43 | 3·42 | 3·41 | 3·39 | 3·38 | 3·37 | 3·36 | 3·34 | 3·33 | 3·32 |
| 5·90 | 3·31 | 3·29 | 3·28 | 3·27 | 3·26 | 3·24 | 3·23 | 3·22 | 3·21 | 3·20 |
| 6·00 | 3·18 | — | — | — | — | — | — | — | — | — |

## TABLE 5

DIAMETER OF BALL = 5 mm LOAD = 750 kgf $F/D^2 = 30$

| Diameter of Impression | 0·00 | 0·01 | 0·02 | 0·03 | 0·04 | 0·05 | 0·06 | 0·07 | 0·08 | 0·09 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 1·20 | — | — | — | — | — | *601* | *592* | *582* | *573* | *564* |
| 1·30 | *555* | *547* | *538* | *530* | *522* | *514* | *507* | *499* | *492* | *485* |
| 1·40 | *477* | *471* | *464* | *457* | *451* | 444 | 438 | 432 | 426 | 420 |
| 1·50 | 415 | 409 | 404 | 398 | 393 | 388 | 383 | 378 | 373 | 368 |
| 1·60 | 363 | 359 | 354 | 350 | 345 | 341 | 337 | 333 | 329 | 325 |
| 1·70 | 321 | 317 | 313 | 309 | 306 | 302 | 298 | 295 | 292 | 288 |
| 1·80 | 285 | 282 | 278 | 275 | 272 | 269 | 266 | 263 | 260 | 257 |
| 1·90 | 255 | 252 | 249 | 246 | 244 | 241 | 239 | 236 | 234 | 231 |
| 2·00 | 229 | 226 | 224 | 222 | 219 | 217 | 215 | 213 | 211 | 209 |
| 2·10 | 207 | 204 | 202 | 200 | 198 | 197 | 195 | 193 | 191 | 189 |
| 2·20 | 187 | 185 | 184 | 182 | 180 | 179 | 177 | 175 | 174 | 172 |
| 2·30 | 170 | 169 | 167 | 166 | 164 | 163 | 161 | 160 | 158 | 157 |
| 2·40 | 156 | 154 | 153 | 152 | 150 | 149 | 148 | 146 | 145 | 144 |
| 2·50 | 143 | 141 | 140 | 139 | 138 | 137 | 135 | 134 | 133 | 132 |
| 2·60 | 131 | 130 | 129 | 128 | 127 | 126 | 125 | 124 | 123 | 122 |
| 2·70 | 121 | 120 | 119 | 118 | 117 | 116 | 115 | 114 | 113 | 112 |
| 2·80 | 111 | 110 | 110 | 109 | 108 | 107 | 106 | 105 | 105 | 104 |
| 2·90 | 103 | 102 | 101 | 101 | 99·9 | 99·2 | 98·4 | 97·7 | 96·9 | 96·2 |
| 3·00 | 95·5 | — | — | — | — | — | — | — | — | — |





## TABLE 6

DIAMETER OF BALL = 5 mm LOAD = 250 kgf $F/D^2 = 10$

| Diameter of Impression | 0·00 | 0·01 | 0·02 | 0·03 | 0·04 | 0·05 | 0·06 | 0·07 | 0·08 | 0·09 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 1·20 | — | — | — | — | — | 200 | 197 | 194 | 191 | 188 |
| 1·30 | 185 | 182 | 179 | 177 | 174 | 171 | 169 | 166 | 164 | 162 |
| 1·40 | 159 | 157 | 155 | 152 | 150 | 148 | 146 | 144 | 142 | 140 |
| 1·50 | 138 | 136 | 135 | 133 | 131 | 129 | 128 | 126 | 124 | 123 |
| 1·60 | 121 | 120 | 118 | 117 | 115 | 114 | 112 | 111 | 110 | 108 |
| 1·70 | 107 | 106 | 104 | 103 | 102 | 101 | 99·5 | 98·3 | 97·2 | 96·1 |
| 1·80 | 95·0 | 93·9 | 92·8 | 91·8 | 90·7 | 89·7 | 88·7 | 87·7 | 86·8 | 85·8 |
| 1·90 | 84·9 | 83·9 | 83·0 | 82·1 | 81·3 | 80·4 | 79·5 | 78·7 | 77·9 | 77·1 |
| 2·00 | 76·3 | 75·5 | 74·7 | 73·9 | 73·2 | 72·4 | 71·7 | 71·0 | 70·2 | 69·5 |
| 2·10 | 68·8 | 68·2 | 67·5 | 66·8 | 66·2 | 65·5 | 64·9 | 64·2 | 63·6 | 63·0 |
| 2·20 | 62·4 | 61·8 | 61·2 | 60·6 | 60·1 | 59·5 | 59·0 | 58·4 | 57·9 | 57·3 |
| 2·30 | 56·8 | 56·3 | 55·8 | 55·3 | 54·8 | 54·3 | 53·8 | 53·3 | 52·8 | 52·3 |
| 2·40 | 51·9 | 51·4 | 51·0 | 50·5 | 50·1 | 49·6 | 49·2 | 48·8 | 48·3 | 47·9 |
| 2·50 | 47·5 | 47·1 | 46·7 | 46·3 | 45·9 | 45·5 | 45·1 | 44·8 | 44·4 | 44·0 |
| 2·60 | 43·7 | 43·3 | 42·9 | 42·6 | 42·2 | 41·9 | 41·5 | 41·2 | 40·9 | 40·5 |
| 2·70 | 40·2 | 39·9 | 39·6 | 39·2 | 38·9 | 38·6 | 38·3 | 38·0 | 37·7 | 37·4 |
| 2·80 | 37·1 | 36·8 | 36·5 | 36·3 | 36·0 | 35·7 | 35·4 | 35·1 | 34·9 | 34·6 |
| 2·90 | 34·3 | 34·1 | 33·8 | 33·6 | 33·3 | 33·1 | 32·8 | 32·6 | 32·3 | 32·1 |
| 3·00 | 31·8 | — | — | — | — | — | — | — | — | — |

## TABLE 7

DIAMETER OF BALL = 5 mm LOAD = 125 kgf $F/D^2 = 5$

| Diameter of impression | 0·00 | 0·01 | 0·02 | 0·03 | 0·04 | 0·05 | 0·06 | 0·07 | 0·08 | 0·09 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 1·20 | — | — | — | — | — | 100 | 98·6 | 97·1 | 95·5 | 94·0 |
| 1·30 | 92·6 | 91·1 | 89·7 | 88·4 | 87·0 | 85·7 | 84·4 | 83·2 | 81·9 | 80·8 |
| 1·40 | 79·6 | 78·4 | 77·3 | 76·2 | 75·1 | 74·1 | 73·0 | 72·0 | 71·0 | 70·1 |
| 1·50 | 69·1 | 68·2 | 67·3 | 66·4 | 65·5 | 64·6 | 63·8 | 62·9 | 62·1 | 61·3 |
| 1·60 | 60·5 | 59·8 | 59·0 | 58·3 | 57·5 | 56·8 | 56·1 | 55·4 | 54·8 | 54·1 |
| 1·70 | 53·4 | 52·8 | 52·2 | 51·5 | 50·9 | 50·3 | 49·7 | 49·2 | 48·6 | 48·0 |
| 1·80 | 47·5 | 46·9 | 46·4 | 45·9 | 45·4 | 44·9 | 44·4 | 43·9 | 43·4 | 42·9 |
| 1·90 | 42·4 | 42·0 | 41·5 | 41·1 | 40·6 | 40·2 | 39·8 | 39·4 | 38·9 | 38·5 |
| 2·00 | 38·1 | 37·7 | 37·3 | 37·0 | 36·6 | 36·2 | 35·8 | 35·5 | 35·1 | 34·8 |
| 2·10 | 34·4 | 34·1 | 33·7 | 33·4 | 33·1 | 32·8 | 32·4 | 32·1 | 31·8 | 31·5 |
| 2·20 | 31·2 | 30·9 | 30·6 | 30·3 | 30·0 | 29·8 | 29·5 | 29·2 | 28·9 | 28·7 |
| 2·30 | 28·4 | 28·1 | 27·9 | 27·6 | 27·4 | 27·1 | 26·9 | 26·6 | 26·4 | 26·2 |
| 2·40 | 25·9 | 25·7 | 25·5 | 25·3 | 25·0 | 24·8 | 24·6 | 24·4 | 24·2 | 24·0 |
| 2·50 | 23·8 | 23·6 | 23·4 | 23·2 | 23·0 | 22·8 | 22·6 | 22·4 | 22·2 | 22·0 |
| 2·60 | 21·8 | 21·6 | 21·5 | 21·3 | 21·1 | 20·9 | 20·8 | 20·6 | 20·4 | 20·3 |
| 2·70 | 20·1 | 19·9 | 19·8 | 19·6 | 19·5 | 19·3 | 19·2 | 19·0 | 18·9 | 18·7 |
| 2·80 | 18·6 | 18·4 | 18·3 | 18·1 | 18·0 | 17·8 | 17·7 | 17·6 | 17·4 | 17·3 |
| 2·90 | 17·2 | 17·0 | 16·9 | 16·8 | 16·7 | 16·5 | 16·4 | 16·3 | 16·2 | 16·0 |
| 3·00 | 15·9 | — | — | — | — | — | — | — | — | — |





## TABLE 8

DIAMETER OF BALL = 5 mm LOAD = 25 kgf $F/D^2 = 1$

| Diameter of impression | 0·00 | 0·01 | 0·02 | 0·03 | 0·04 | 0·05 | 0·06 | 0·07 | 0·08 | 0·09 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 1·20 | — | — | — | — | — | 20·0 | 19·7 | 19·4 | 19·1 | 18·8 |
| 1·30 | 18·5 | 18·2 | 17·9 | 17·7 | 17·4 | 17·1 | 16·9 | 16·6 | 16·4 | 16·2 |
| 1·40 | 15·9 | 15·7 | 15·5 | 15·2 | 15·0 | 14·8 | 14·6 | 14·4 | 14·2 | 14·0 |
| 1·50 | 13·8 | 13·6 | 13·5 | 13·3 | 13·1 | 12·9 | 12·8 | 12·6 | 12·4 | 12·3 |
| 1·60 | 12·1 | 12·0 | 11·8 | 11·7 | 11·5 | 11·4 | 11·2 | 11·1 | 11·0 | 10·8 |
| 1·70 | 10·7 | 10·6 | 10·4 | 10·3 | 10·2 | 10·1 | 9·96 | 9·83 | 9·72 | 9·61 |
| 1·80 | 9·50 | 9·39 | 9·28 | 9·18 | 9·07 | 8·97 | 8·87 | 8·77 | 8·68 | 8·58 |
| 1·90 | 8·49 | 8·39 | 8·30 | 8·21 | 8·13 | 8·04 | 7·95 | 7·87 | 7·79 | 7·71 |
| 2·00 | 7·63 | 7·55 | 7·47 | 7·39 | 7·32 | 7·24 | 7·17 | 7·10 | 7·02 | 6·95 |
| 2·10 | 6·88 | 6·82 | 6·75 | 6·68 | 6·62 | 6·55 | 6·49 | 6·42 | 6·36 | 6·30 |
| 2·20 | 6·24 | 6·18 | 6·12 | 6·06 | 6·01 | 5·95 | 5·90 | 5·84 | 5·79 | 5·73 |
| 2·30 | 5·68 | 5·63 | 5·58 | 5·53 | 5·48 | 5·43 | 5·38 | 5·33 | 5·28 | 5·23 |
| 2·40 | 5·19 | 5·14 | 5·10 | 5·05 | 5·01 | 4·96 | 4·92 | 4·88 | 4·83 | 4·79 |
| 2·50 | 4·75 | 4·71 | 4·67 | 4·63 | 4·59 | 4·55 | 4·51 | 4·48 | 4·44 | 4·40 |
| 2·60 | 4·37 | 4·33 | 4·29 | 4·26 | 4·22 | 4·19 | 4·15 | 4·12 | 4·09 | 4·05 |
| 2·70 | 4·02 | 3·99 | 3·96 | 3·92 | 3·89 | 3·86 | 3·83 | 3·80 | 3·77 | 3·74 |
| 2·80 | 3·71 | 3·68 | 3·65 | 3·63 | 3·60 | 3·57 | 3·54 | 3·51 | 3·49 | 3·46 |
| 2·90 | 3·43 | 3·41 | 3·38 | 3·36 | 3·33 | 3·31 | 3·28 | 3·26 | 3·23 | 3·21 |
| 3·00 | 3·18 | — | — | — | — | — | — | — | — | — |

## TABLE 9

DIAMETER OF BALL = 2 mm LOAD = 120 kgf $F/D^2 = 30$

| Diameter of impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·500 | *601* | *599* | *597* | *594* | *592* | *589* | *587* | *585* | *582* | *580* |
| 0·510 | *578* | *575* | *573* | *571* | *569* | *566* | *564* | *562* | *560* | *558* |
| 0·520 | *555* | *553* | *551* | *549* | *547* | *545* | *543* | *540* | *538* | *536* |
| 0·530 | *534* | *532* | *530* | *528* | *526* | *524* | *522* | *520* | *518* | *516* |
| 0·540 | *514* | *512* | *510* | *508* | *507* | *505* | *503* | *501* | *499* | *497* |
| 0·550 | *495* | *494* | *492* | *490* | *488* | *486* | *485* | *483* | *481* | *479* |
| 0·560 | *477* | *476* | *474* | *472* | *471* | *469* | *467* | *466* | *464* | *462* |
| 0·570 | *461* | *459* | *457* | *456* | *454* | *452* | *451* | 449 | 448 | 446 |
| 0·580 | 444 | 443 | 441 | 440 | 438 | 437 | 435 | 434 | 432 | 431 |
| 0·590 | 429 | 428 | 426 | 425 | 423 | 422 | 420 | 419 | 417 | 416 |
| 0·600 | 415 | 413 | 412 | 410 | 409 | 408 | 406 | 405 | 404 | 402 |
| 0·610 | 401 | 399 | 398 | 397 | 395 | 394 | 393 | 392 | 390 | 389 |
| 0·620 | 388 | 386 | 385 | 384 | 383 | 381 | 380 | 379 | 378 | 376 |
| 0·630 | 375 | 374 | 373 | 372 | 370 | 369 | 368 | 367 | 366 | 364 |
| 0·640 | 363 | 362 | 361 | 360 | 359 | 357 | 356 | 355 | 354 | 353 |
| 0·650 | 352 | 351 | 350 | 348 | 347 | 346 | 345 | 344 | 343 | 342 |
| 0·660 | 341 | 340 | 339 | 338 | 337 | 336 | 335 | 334 | 333 | 332 |
| 0·670 | 331 | 330 | 329 | 327 | 326 | 326 | 325 | 324 | 323 | 322 |
| 0·680 | 321 | 320 | 319 | 318 | 317 | 316 | 315 | 314 | 313 | 312 |
| 0·690 | 311 | 310 | 309 | 308 | 307 | 306 | 306 | 305 | 304 | 303 |
| 0·700 | 302 | 301 | 300 | 299 | 298 | 298 | 297 | 296 | 295 | 294 |
| 0·710 | 293 | 292 | 292 | 291 | 290 | 289 | 288 | 287 | 286 | 286 |
| 0·720 | 285 | 284 | 283 | 282 | 282 | 281 | 280 | 279 | 278 | 278 |
| 0·730 | 277 | 276 | 275 | 274 | 274 | 273 | 272 | 271 | 271 | 270 |
| 0·740 | 269 | 268 | 268 | 267 | 266 | 265 | 265 | 264 | 263 | 262 |
| 0·750 | 262 | 261 | 260 | 260 | 259 | 258 | 257 | 257 | 256 | 255 |
| 0·760 | 255 | 254 | 253 | 253 | 252 | 251 | 250 | 250 | 249 | 248 |
| 0·770 | 248 | 247 | 246 | 246 | 245 | 244 | 244 | 243 | 242 | 242 |
| 0·780 | 241 | 241 | 240 | 239 | 239 | 238 | 237 | 237 | 236 | 235 |
| 0·790 | 235 | 234 | 234 | 233 | 232 | 232 | 231 | 231 | 230 | 229 |
| 0·800 | 229 | 228 | 228 | 227 | 226 | 226 | 225 | 225 | 224 | 223 |
| 0·810 | 223 | 222 | 222 | 221 | 221 | 220 | 219 | 219 | 218 | 218 |
| 0·820 | 217 | 217 | 216 | 216 | 215 | 214 | 214 | 213 | 213 | 212 |
| 0·830 | 212 | 211 | 211 | 210 | 210 | 209 | 209 | 208 | 208 | 207 |
| 0·840 | 207 | 206 | 205 | 205 | 204 | 204 | 203 | 203 | 202 | 202 |
| 0·850 | 201 | 201 | 200 | 200 | 199 | 199 | 198 | 198 | 198 | 197 |





## TABLE 9 (continued)

| Diameter of impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·860 | 197 | 196 | 196 | 195 | 195 | 194 | 194 | 193 | 193 | 192 |
| 0·870 | 192 | 191 | 191 | 190 | 190 | 190 | 189 | 189 | 188 | 188 |
| 0·880 | 187 | 187 | 186 | 186 | 185 | 185 | 185 | 184 | 184 | 183 |
| 0·890 | 183 | 182 | 182 | 182 | 181 | 181 | 180 | 180 | 179 | 179 |
| 0·900 | 179 | 178 | 178 | 177 | 177 | 176 | 176 | 176 | 175 | 175 |
| 0·910 | 174 | 174 | 174 | 173 | 173 | 172 | 172 | 172 | 171 | 171 |
| 0·920 | 170 | 170 | 170 | 169 | 169 | 168 | 168 | 168 | 167 | 167 |
| 0·930 | 167 | 166 | 166 | 165 | 165 | 165 | 164 | 164 | 164 | 163 |
| 0·940 | 163 | 162 | 162 | 162 | 161 | 161 | 161 | 160 | 160 | 159 |
| 0·950 | 159 | 159 | 158 | 158 | 158 | 157 | 157 | 157 | 156 | 156 |
| 0·960 | 156 | 155 | 155 | 156 | 154 | 154 | 154 | 153 | 153 | 153 |
| 0·970 | 152 | 152 | 152 | 151 | 151 | 151 | 150 | 150 | 150 | 149 |
| 0·980 | 149 | 149 | 148 | 148 | 148 | 147 | 147 | 147 | 146 | 146 |
| 0·990 | 146 | 145 | 146 | 145 | 144 | 144 | 144 | 143 | 143 | 143 |
| 1·000 | 143 | 142 | 142 | 142 | 141 | 141 | 141 | 140 | 140 | 140 |
| 1·010 | 140 | 139 | 139 | 139 | 138 | 138 | 138 | 137 | 137 | 137 |
| 1·020 | 137 | 136 | 136 | 136 | 135 | 135 | 135 | 135 | 134 | 134 |
| 1·030 | 134 | 133 | 133 | 133 | 133 | 132 | 132 | 132 | 132 | 131 |
| 1·040 | 131 | 131 | 130 | 130 | 130 | 130 | 129 | 129 | 129 | 129 |
| 1·050 | 128 | 128 | 128 | 127 | 127 | 127 | 127 | 126 | 126 | 126 |
| 1·060 | 126 | 125 | 126 | 125 | 125 | 124 | 124 | 124 | 124 | 123 |
| 1·070 | 123 | 123 | 123 | 122 | 122 | 122 | 122 | 121 | 121 | 121 |
| 1·080 | 121 | 120 | 120 | 120 | 120 | 119 | 119 | 119 | 119 | 118 |
| 1·090 | 118 | 118 | 118 | 118 | 117 | 117 | 117 | 117 | 116 | 116 |
| 1·100 | 116 | 116 | 115 | 115 | 115 | 115 | 114 | 114 | 114 | 114 |
| 1·110 | 114 | 113 | 113 | 113 | 113 | 112 | 112 | 112 | 112 | 112 |
| 1·120 | 111 | 111 | 111 | 111 | 110 | 110 | 110 | 110 | 110 | 109 |
| 1·130 | 109 | 109 | 109 | 109 | 108 | 108 | 108 | 108 | 107 | 107 |
| 1·140 | 107 | 107 | 107 | 106 | 106 | 106 | 106 | 106 | 106 | 106 |
| 1·150 | 106 | 105 | 106 | 104 | 104 | 104 | 104 | 104 | 103 | 103 |
| 1·160 | 103 | 103 | 103 | 102 | 102 | 102 | 102 | 102 | 101 | 101 |
| 1·170 | 101 | 101 | 101 | 100 | 100 | 100 | 99·9 | 99·7 | 99·5 | 99·4 |
| 1·180 | 99·2 | 99·0 | 98·8 | 98·6 | 98·4 | 98·2 | 98·0 | 97·9 | 97·7 | 97·5 |
| 1·190 | 97·3 | 97·1 | 96·9 | 96·8 | 96·6 | 96·4 | 96·2 | 96·0 | 95·9 | 95·7 |
| 1·200 | 95·5 | — | — | — | — | — | — | — | — | — |

## TABLE 10

DIAMETER OF BALL = 2 mm LOAD = 40 kgf $F/D^2 = 10$

| Diameter of impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·500 | 200 | 200 | 199 | 198 | 197 | 196 | 196 | 195 | 194 | 193 |
| 0·510 | 193 | 192 | 191 | 190 | 190 | 189 | 188 | 187 | 187 | 186 |
| 0·520 | 185 | 184 | 184 | 183 | 182 | 182 | 181 | 180 | 179 | 179 |
| 0·530 | 178 | 177 | 177 | 176 | 175 | 175 | 174 | 173 | 173 | 172 |
| 0·540 | 171 | 171 | 170 | 169 | 169 | 168 | 168 | 167 | 166 | 166 |
| 0·550 | 165 | 165 | 164 | 163 | 163 | 162 | 162 | 161 | 160 | 160 |
| 0·560 | 159 | 159 | 158 | 157 | 157 | 156 | 156 | 155 | 155 | 154 |
| 0·570 | 154 | 153 | 152 | 152 | 151 | 151 | 150 | 150 | 149 | 149 |
| 0·580 | 148 | 148 | 147 | 147 | 146 | 146 | 145 | 145 | 144 | 144 |
| 0·590 | 143 | 143 | 142 | 142 | 141 | 141 | 140 | 140 | 139 | 139 |
| 0·600 | 138 | 138 | 137 | 137 | 136 | 136 | 135 | 135 | 135 | 134 |
| 0·610 | 134 | 133 | 133 | 132 | 132 | 131 | 131 | 131 | 130 | 130 |
| 0·620 | 129 | 129 | 128 | 128 | 128 | 127 | 127 | 126 | 126 | 125 |
| 0·630 | 125 | 125 | 124 | 124 | 123 | 123 | 123 | 122 | 122 | 121 |
| 0·640 | 121 | 121 | 120 | 120 | 120 | 119 | 119 | 118 | 118 | 118 |
| 0·650 | 117 | 117 | 117 | 116 | 116 | 115 | 115 | 115 | 114 | 114 |
| 0·660 | 114 | 113 | 113 | 113 | 112 | 112 | 112 | 111 | 111 | 111 |
| 0·670 | 110 | 110 | 110 | 109 | 109 | 109 | 108 | 108 | 108 | 107 |
| 0·680 | 107 | 107 | 106 | 106 | 106 | 105 | 105 | 105 | 104 | 104 |
| 0·690 | 104 | 103 | 103 | 103 | 102 | 102 | 102 | 102 | 101 | 101 |
| 0·700 | 101 | 100 | 100 | 99·8 | 99·5 | 99·2 | 98·9 | 98·6 | 98·3 | 98·0 |
| 0·710 | 97·7 | 97·5 | 97·2 | 96·9 | 96·6 | 96·3 | 96·1 | 95·8 | 95·5 | 95·2 |
| 0·720 | 95·0 | 94·7 | 94·4 | 94·1 | 93·9 | 93·6 | 93·3 | 93·1 | 92·8 | 92·5 |
| 0·730 | 92·3 | 92·0 | 91·8 | 91·5 | 91·2 | 91·0 | 90·7 | 90·5 | 90·2 | 90·0 |
| 0·740 | 89·7 | 89·5 | 89·2 | 89·0 | 88·7 | 88·5 | 88·2 | 88·0 | 87·7 | 87·5 |
| 0·750 | 87·2 | 87·0 | 86·8 | 86·5 | 86·3 | 86·0 | 85·8 | 85·6 | 85·3 | 85·1 |
| 0·760 | 84·9 | 84·6 | 84·4 | 84·2 | 83·9 | 83·7 | 83·5 | 83·3 | 83·0 | 82·8 |
| 0·770 | 82·6 | 82·4 | 82·1 | 81·9 | 81·7 | 81·5 | 81·3 | 81·0 | 80·8 | 80·6 |
| 0·780 | 80·4 | 80·2 | 80·0 | 79·8 | 79·5 | 79·3 | 79·1 | 78·9 | 78·7 | 78·5 |
| 0·790 | 78·3 | 78·1 | 77·9 | 77·7 | 77·5 | 77·3 | 77·1 | 76·9 | 76·7 | 76·5 |
| 0·800 | 76·3 | 76·1 | 75·9 | 75·7 | 75·5 | 75·3 | 75·1 | 74·9 | 74·7 | 74·5 |
| 0·810 | 74·3 | 74·1 | 73·9 | 73·7 | 73·6 | 73·3 | 73·2 | 73·0 | 72·8 | 72·6 |
| 0·820 | 72·4 | 72·2 | 72·0 | 71·9 | 71·7 | 71·5 | 71·3 | 71·1 | 71·0 | 70·8 |
| 0·830 | 70·6 | 70·4 | 70·2 | 70·1 | 69·9 | 69·7 | 69·5 | 69·4 | 69·2 | 69·0 |
| 0·840 | 68·8 | 68·7 | 68·5 | 68·3 | 68·2 | 68·0 | 67·8 | 67·7 | 67·5 | 67·3 |
| 0·850 | 67·1 | 67·0 | 66·8 | 66·7 | 66·5 | 66·3 | 66·2 | 66·0 | 65·8 | 65·7 |





## TABLE 10 (continued)

| Diameter of impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·860 | 65·5 | 65·4 | 65·2 | 65·0 | 64·9 | 64·7 | 64·6 | 64·4 | 64·2 | 64·1 |
| 0·870 | 63·9 | 63·8 | 63·6 | 63·5 | 63·3 | 63·2 | 63·0 | 62·9 | 62·7 | 62·6 |
| 0·880 | 62·4 | 62·3 | 62·1 | 62·0 | 61·8 | 61·7 | 61·5 | 61·4 | 61·2 | 61·1 |
| 0·890 | 60·9 | 60·8 | 60·6 | 60·5 | 60·4 | 60·2 | 60·1 | 59·9 | 59·8 | 59·7 |
| 0·900 | 59·5 | 59·4 | 59·2 | 59·1 | 59·0 | 58·8 | 58·7 | 58·5 | 58·4 | 58·3 |
| 0·910 | 58·1 | 58·0 | 57·9 | 57·7 | 57·6 | 57·5 | 57·3 | 57·2 | 57·1 | 56·9 |
| 0·920 | 56·8 | 56·7 | 56·5 | 56·4 | 56·3 | 56·1 | 56·0 | 55·9 | 55·8 | 55·6 |
| 0·930 | 55·5 | 55·4 | 55·3 | 55·1 | 55·0 | 54·9 | 54·8 | 54·6 | 54·5 | 54·4 |
| 0·940 | 54·3 | 54·1 | 54·0 | 53·9 | 53·8 | 53·6 | 53·5 | 53·4 | 53·3 | 53·2 |
| 0·950 | 53·0 | 52·9 | 52·8 | 52·7 | 52·6 | 52·5 | 52·3 | 52·2 | 52·1 | 52·0 |
| 0·960 | 51·9 | 51·8 | 51·6 | 51·5 | 51·4 | 51·3 | 51·2 | 51·1 | 51·0 | 50·8 |
| 0·970 | 50·7 | 50·6 | 50·5 | 50·4 | 50·3 | 50·2 | 50·1 | 50·0 | 49·8 | 49·7 |
| 0·980 | 49·6 | 49·5 | 49·4 | 49·3 | 49·2 | 49·1 | 49·0 | 48·9 | 48·8 | 48·7 |
| 0·990 | 48·6 | 48·5 | 48·3 | 48·2 | 48·1 | 48·0 | 47·9 | 47·8 | 47·7 | 47·6 |
| 1·000 | 47·5 | 47·4 | 47·3 | 47·2 | 47·1 | 47·0 | 46·9 | 46·8 | 46·7 | 46·6 |
| 1·010 | 46·5 | 46·4 | 46·3 | 46·2 | 46·1 | 46·0 | 45·9 | 45·8 | 45·7 | 45·6 |
| 1·020 | 45·5 | 45·4 | 45·3 | 45·2 | 45·1 | 45·1 | 45·0 | 44·9 | 44·8 | 44·7 |
| 1·030 | 44·6 | 44·5 | 44·4 | 44·3 | 44·2 | 44·1 | 44·0 | 43·9 | 43·8 | 43·7 |
| 1·040 | 43·7 | 43·6 | 43·5 | 43·4 | 43·3 | 43·2 | 43·1 | 43·0 | 42·9 | 42·8 |
| 1·050 | 42·8 | 42·7 | 42·6 | 42·5 | 42·4 | 42·3 | 42·2 | 42·1 | 42·1 | 42·0 |
| 1·060 | 41·9 | 41·8 | 41·7 | 41·6 | 41·5 | 41·5 | 41·4 | 41·3 | 41·2 | 41·1 |
| 1·070 | 41·0 | 40·9 | 40·9 | 40·8 | 40·7 | 40·6 | 40·5 | 40·5 | 40·4 | 40·3 |
| 1·080 | 40·2 | 40·1 | 40·0 | 40·0 | 39·9 | 39·8 | 39·7 | 39·6 | 39·6 | 39·5 |
| 1·090 | 39·4 | 39·3 | 39·2 | 39·2 | 39·1 | 39·0 | 38·9 | 38·9 | 38·8 | 38·7 |
| 1·100 | 38·6 | 38·5 | 38·5 | 38·4 | 38·3 | 38·2 | 38·2 | 38·1 | 38·0 | 37·9 |
| 1·110 | 37·9 | 37·8 | 37·7 | 37·6 | 37·6 | 37·5 | 37·4 | 37·3 | 37·3 | 37·2 |
| 1·120 | 37·1 | 37·0 | 37·0 | 36·9 | 36·8 | 36·8 | 36·7 | 36·6 | 36·5 | 36·5 |
| 1·130 | 36·4 | 36·3 | 36·3 | 36·2 | 36·1 | 36·0 | 36·0 | 35·9 | 35·8 | 35·8 |
| 1·140 | 35·7 | 35·6 | 35·6 | 35·5 | 35·4 | 35·3 | 35·3 | 35·2 | 35·1 | 35·1 |
| 1·150 | 35·0 | 34·9 | 34·9 | 34·8 | 34·7 | 34·7 | 34·6 | 34·5 | 34·5 | 34·4 |
| 1·160 | 34·3 | 34·3 | 34·2 | 34·1 | 34·1 | 34·0 | 33·9 | 33·9 | 33·8 | 33·8 |
| 1·170 | 33·7 | 33·6 | 33·6 | 33·5 | 33·4 | 33·4 | 33·3 | 33·2 | 33·2 | 33·1 |
| 1·180 | 33·1 | 33·0 | 32·9 | 32·9 | 32·8 | 32·7 | 32·7 | 32·6 | 32·6 | 32·5 |
| 1·190 | 32·4 | 32·4 | 32·3 | 32·3 | 32·2 | 32·1 | 32·1 | 32·0 | 32·0 | 31·9 |
| 1·200 | 31·8 | — | — | — | — | — | — | — | — | — |

## TABLE 11

DIAMETER OF BALL = 2 mm LOAD = 20 kgf $F/D^2 = 5$

| Diameter of Impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·500 | 100 | 99·8 | 99·4 | 99·0 | 98·6 | 98·2 | 97·8 | 97·4 | 97·1 | 96·7 |
| 0·510 | 96·3 | 95·9 | 95·5 | 95·1 | 94·8 | 94·4 | 94·0 | 93·7 | 93·3 | 92·9 |
| 0·520 | 92·6 | 92·2 | 91·8 | 91·5 | 91·1 | 90·8 | 90·4 | 90·1 | 89·7 | 89·4 |
| 0·530 | 89·0 | 88·7 | 88·4 | 88·0 | 87·7 | 87·3 | 87·0 | 86·7 | 86·4 | 86·0 |
| 0·540 | 85·7 | 85·4 | 85·1 | 84·7 | 84·4 | 84·1 | 83·8 | 83·5 | 83·2 | 82·9 |
| 0·550 | 82·6 | 82·3 | 81·9 | 81·6 | 81·3 | 81·0 | 80·8 | 80·5 | 80·2 | 79·9 |
| 0·560 | 79·6 | 79·3 | 79·0 | 78·7 | 78·4 | 78·1 | 77·9 | 77·6 | 77·3 | 77·0 |
| 0·570 | 76·8 | 76·5 | 76·2 | 75·9 | 75·7 | 75·4 | 75·1 | 74·9 | 74·6 | 74·3 |
| 0·580 | 74·1 | 73·8 | 73·6 | 73·3 | 73·0 | 72·8 | 72·5 | 72·3 | 72·0 | 71·8 |
| 0·590 | 71·5 | 71·3 | 71·0 | 70·8 | 70·5 | 70·3 | 70·1 | 69·8 | 69·6 | 69·3 |
| 0·600 | 69·1 | 68·9 | 68·6 | 68·4 | 68·2 | 67·9 | 67·7 | 67·5 | 67·3 | 67·0 |
| 0·610 | 66·8 | 66·6 | 66·4 | 66·1 | 65·9 | 65·7 | 65·5 | 65·3 | 65·0 | 64·8 |
| 0·620 | 64·6 | 64·4 | 64·2 | 64·0 | 63·8 | 63·6 | 63·3 | 63·1 | 62·9 | 62·7 |
| 0·630 | 62·5 | 62·3 | 62·1 | 61·9 | 61·7 | 61·5 | 61·3 | 61·1 | 60·9 | 60·7 |
| 0·640 | 60·5 | 60·3 | 60·1 | 60·0 | 59·8 | 59·6 | 59·4 | 59·2 | 59·0 | 58·8 |
| 0·650 | 58·6 | 58·5 | 58·3 | 58·1 | 57·9 | 57·7 | 57·5 | 57·4 | 57·2 | 57·0 |
| 0·660 | 56·8 | 56·6 | 56·5 | 56·3 | 56·1 | 55·9 | 55·8 | 55·6 | 55·4 | 55·3 |
| 0·670 | 55·1 | 54·9 | 54·8 | 54·6 | 54·4 | 54·3 | 54·1 | 53·9 | 53·8 | 53·6 |
| 0·680 | 53·4 | 53·3 | 53·1 | 52·9 | 52·8 | 52·6 | 52·5 | 52·3 | 52·2 | 52·0 |
| 0·690 | 51·8 | 51·7 | 51·5 | 51·4 | 51·2 | 51·1 | 50·9 | 50·8 | 50·6 | 50·5 |
| 0·700 | 50·3 | 50·2 | 50·0 | 49·9 | 49·7 | 49·6 | 49·4 | 49·3 | 49·2 | 49·0 |
| 0·710 | 48·9 | 48·7 | 48·6 | 48·4 | 48·3 | 48·2 | 48·0 | 47·9 | 47·7 | 47·6 |
| 0·720 | 47·5 | 47·3 | 47·2 | 47·1 | 46·9 | 46·8 | 46·7 | 46·5 | 46·4 | 46·3 |
| 0·730 | 46·1 | 46·0 | 45·9 | 45·7 | 45·6 | 45·5 | 45·4 | 45·2 | 45·1 | 45·0 |
| 0·740 | 44·9 | 44·7 | 44·6 | 44·5 | 44·4 | 44·2 | 44·1 | 44·0 | 43·9 | 43·7 |
| 0·750 | 43·6 | 43·5 | 43·4 | 43·3 | 43·1 | 43·0 | 42·9 | 42·8 | 42·7 | 42·6 |
| 0·760 | 42·4 | 42·3 | 42·2 | 42·1 | 42·0 | 41·9 | 41·7 | 41·6 | 41·5 | 41·4 |
| 0·770 | 41·3 | 41·2 | 41·1 | 41·0 | 40·9 | 40·7 | 40·6 | 40·5 | 40·4 | 40·3 |
| 0·780 | 40·2 | 40·1 | 40·0 | 39·9 | 39·8 | 39·7 | 39·6 | 39·5 | 39·4 | 39·2 |
| 0·790 | 39·1 | 39·0 | 38·9 | 38·8 | 38·7 | 38·6 | 38·5 | 38·4 | 38·3 | 38·2 |
| 0·800 | 38·1 | 38·0 | 37·9 | 37·8 | 37·7 | 37·6 | 37·5 | 37·4 | 37·3 | 37·2 |
| 0·810 | 37·1 | 37·1 | 37·0 | 36·9 | 36·8 | 36·7 | 36·6 | 36·5 | 36·4 | 36·3 |
| 0·820 | 36·2 | 36·1 | 36·0 | 35·9 | 35·8 | 35·7 | 35·7 | 35·6 | 35·5 | 35·4 |
| 0·830 | 35·3 | 35·2 | 35·1 | 35·0 | 34·9 | 34·9 | 34·8 | 34·7 | 34·6 | 34·5 |
| 0·840 | 34·4 | 34·3 | 34·2 | 34·2 | 34·1 | 34·0 | 33·9 | 33·8 | 33·7 | 33·7 |
| 0·850 | 33·6 | 33·5 | 33·4 | 33·3 | 33·2 | 33·2 | 33·1 | 33·0 | 32·9 | 32·8 |





## TABLE 11 (continued)

| Diameter of Impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·860 | 32·8 | 32·7 | 32·6 | 32·5 | 32·4 | 32·4 | 32·3 | 32·2 | 32·1 | 32·0 |
| 0·870 | 32·0 | 31·9 | 31·8 | 31·7 | 31·7 | 31·6 | 31·5 | 31·4 | 31·4 | 31·3 |
| 0·880 | 31·2 | 31·1 | 31·1 | 31·0 | 30·9 | 30·8 | 30·8 | 30·7 | 30·6 | 30·5 |
| 0·890 | 30·5 | 30·4 | 30·3 | 30·3 | 30·2 | 30·1 | 30·0 | 30·0 | 29·9 | 29·8 |
| 0·900 | 29·8 | 29·7 | 29·6 | 29·5 | 29·5 | 29·4 | 29·3 | 29·3 | 29·2 | 29·1 |
| 0·910 | 29·1 | 29·0 | 28·9 | 28·9 | 28·8 | 28·7 | 28·7 | 28·6 | 28·5 | 28·5 |
| 0·920 | 28·4 | 28·3 | 28·3 | 28·2 | 28·1 | 28·1 | 28·0 | 27·9 | 27·9 | 27·8 |
| 0·930 | 27·8 | 27·7 | 27·6 | 27·6 | 27·5 | 27·4 | 27·4 | 27·3 | 27·3 | 27·2 |
| 0·940 | 27·1 | 27·1 | 27·0 | 26·9 | 26·9 | 26·8 | 26·8 | 26·7 | 26·6 | 26·6 |
| 0·950 | 26·5 | 26·5 | 26·4 | 26·3 | 26·3 | 26·2 | 26·2 | 26·1 | 26·1 | 26·0 |
| 0·960 | 25·9 | 25·9 | 25·8 | 25·8 | 25·7 | 25·6 | 25·6 | 25·5 | 25·5 | 25·4 |
| 0·970 | 25·4 | 25·3 | 25·3 | 25·2 | 25·1 | 25·1 | 25·0 | 25·0 | 24·9 | 24·9 |
| 0·980 | 24·8 | 24·8 | 24·7 | 24·7 | 24·6 | 24·5 | 24·5 | 24·4 | 24·4 | 24·3 |
| 0·990 | 24·3 | 24·2 | 24·2 | 24·1 | 24·1 | 24·0 | 24·0 | 23·9 | 23·9 | 23·8 |
| 1·000 | 23·8 | 23·7 | 23·7 | 23·6 | 23·6 | 23·5 | 23·5 | 23·4 | 23·4 | 23·3 |
| 1·010 | 23·3 | 23·2 | 23·2 | 23·1 | 23·1 | 23·0 | 23·0 | 22·9 | 22·9 | 22·8 |
| 1·020 | 22·8 | 22·7 | 22·7 | 22·6 | 22·6 | 22·5 | 22·5 | 22·4 | 22·4 | 22·3 |
| 1·030 | 22·3 | 22·2 | 22·2 | 22·1 | 22·1 | 22·1 | 22·0 | 22·0 | 21·9 | 21·9 |
| 1·040 | 21·8 | 21·8 | 21·7 | 21·7 | 21·6 | 21·6 | 21·6 | 21·5 | 21·5 | 21·4 |
| 1·050 | 21·4 | 21·3 | 21·3 | 21·2 | 21·2 | 21·2 | 21·1 | 21·1 | 21·0 | 21·0 |
| 1·060 | 20·9 | 20·9 | 20·9 | 20·8 | 20·8 | 20·7 | 20·7 | 20·6 | 20·6 | 20·6 |
| 1·070 | 20·5 | 20·5 | 20·4 | 20·4 | 20·3 | 20·3 | 20·3 | 20·2 | 20·2 | 20·1 |
| 1·080 | 20·1 | 20·1 | 20·0 | 20·0 | 19·9 | 19·9 | 19·9 | 19·8 | 19·8 | 19·7 |
| 1·090 | 19·7 | 19·7 | 19·6 | 19·6 | 19·5 | 19·5 | 19·5 | 19·4 | 19·4 | 19·3 |
| 1·100 | 19·3 | 19·3 | 19·2 | 19·2 | 19·2 | 19·1 | 19·1 | 19·0 | 19·0 | 19·0 |
| 1·110 | 18·9 | 18·9 | 18·9 | 18·8 | 18·8 | 18·7 | 18·7 | 18·7 | 18·6 | 18·6 |
| 1·120 | 18·6 | 18·5 | 18·5 | 18·5 | 18·4 | 18·4 | 18·3 | 18·3 | 18·3 | 18·2 |
| 1·130 | 18·2 | 18·2 | 18·1 | 18·1 | 18·1 | 18·0 | 18·0 | 18·0 | 17·9 | 17·9 |
| 1·140 | 17·8 | 17·8 | 17·8 | 17·7 | 17·7 | 17·7 | 17·6 | 17·6 | 17·6 | 17·5 |
| 1·150 | 17·5 | 17·5 | 17·4 | 17·4 | 17·4 | 17·3 | 17·3 | 17·3 | 17·2 | 17·2 |
| 1·160 | 17·2 | 17·1 | 17·1 | 17·1 | 17·0 | 17·0 | 17·0 | 16·9 | 16·9 | 16·9 |
| 1·170 | 16·8 | 16·8 | 16·8 | 16·7 | 16·7 | 16·7 | 16·7 | 16·6 | 16·6 | 16·6 |
| 1·180 | 16·5 | 16·5 | 16·5 | 16·4 | 16·4 | 16·4 | 16·3 | 16·3 | 16·3 | 16·2 |
| 1·190 | 16·2 | 16·2 | 16·2 | 16·1 | 16·1 | 16·1 | 16·0 | 16·0 | 16·0 | 15·9 |
| 1·200 | 15·9 | — | — | — | — | — | — | — | — | — |

## TABLE 12

DIAMETER OF BALL = 2 mm LOAD = 4 kgf $F/D^2 = 1$

| Diameter of impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·500 | 20·0 | 20·0 | 19·9 | 19·8 | 19·7 | 19·6 | 19·6 | 19·5 | 19·4 | 19·3 |
| 0·510 | 19·3 | 19·2 | 19·1 | 19·0 | 19·0 | 18·9 | 18·8 | 18·7 | 18·7 | 18·6 |
| 0·520 | 18·5 | 18·4 | 18·4 | 18·3 | 18·2 | 18·2 | 18·1 | 18·0 | 17·9 | 17·9 |
| 0·530 | 17·8 | 17·7 | 17·7 | 17·6 | 17·5 | 17·5 | 17·4 | 17·3 | 17·3 | 17·2 |
| 0·540 | 17·1 | 17·1 | 17·0 | 16·9 | 16·9 | 16·8 | 16·8 | 16·7 | 16·6 | 16·6 |
| 0·550 | 16·5 | 16·5 | 16·4 | 16·3 | 16·3 | 16·2 | 16·2 | 16·1 | 16·0 | 16·0 |
| 0·560 | 15·9 | 15·9 | 15·8 | 15·7 | 15·7 | 15·6 | 15·6 | 15·5 | 15·5 | 15·4 |
| 0·570 | 15·4 | 15·3 | 15·2 | 15·2 | 15·1 | 15·1 | 15·0 | 15·0 | 14·9 | 14·9 |
| 0·580 | 14·8 | 14·8 | 14·7 | 14·7 | 14·6 | 14·6 | 14·5 | 14·5 | 14·4 | 14·4 |
| 0·590 | 14·3 | 14·3 | 14·2 | 14·2 | 14·1 | 14·1 | 14·0 | 14·0 | 13·9 | 13·9 |
| 0·600 | 13·8 | 13·8 | 13·7 | 13·7 | 13·6 | 13·6 | 13·5 | 13·5 | 13·5 | 13·4 |
| 0·610 | 13·4 | 13·3 | 13·3 | 13·2 | 13·2 | 13·1 | 13·1 | 13·1 | 13·0 | 13·0 |
| 0·620 | 12·9 | 12·9 | 12·8 | 12·8 | 12·8 | 12·7 | 12·7 | 12·6 | 12·6 | 12·5 |
| 0·630 | 12·5 | 12·5 | 12·4 | 12·4 | 12·3 | 12·3 | 12·3 | 12·2 | 12·2 | 12·1 |
| 0·640 | 12·1 | 12·1 | 12·0 | 12·0 | 12·0 | 11·9 | 11·9 | 11·8 | 11·8 | 11·8 |
| 0·650 | 11·7 | 11·7 | 11·7 | 11·6 | 11·6 | 11·5 | 11·5 | 11·5 | 11·4 | 11·4 |
| 0·660 | 11·4 | 11·3 | 11·3 | 11·3 | 11·2 | 11·2 | 11·2 | 11·1 | 11·1 | 11·1 |
| 0·670 | 11·0 | 11·0 | 11·0 | 10·9 | 10·9 | 10·9 | 10·8 | 10·8 | 10·8 | 10·7 |
| 0·680 | 10·7 | 10·7 | 10·6 | 10·6 | 10·6 | 10·5 | 10·5 | 10·5 | 10·4 | 10·4 |
| 0·690 | 10·4 | 10·3 | 10·3 | 10·3 | 10·2 | 10·2 | 10·2 | 10·2 | 10·1 | 10·1 |
| 0·700 | 10·1 | 10·0 | 10·0 | 9·98 | 9·95 | 9·92 | 9·89 | 9·86 | 9·83 | 9·80 |
| 0·710 | 9·77 | 9·75 | 9·72 | 9·69 | 9·66 | 9·63 | 9·61 | 9·58 | 9·55 | 9·52 |
| 0·720 | 9·50 | 9·47 | 9·44 | 9·41 | 9·39 | 9·36 | 9·33 | 9·31 | 9·28 | 9·25 |
| 0·730 | 9·23 | 9·20 | 9·18 | 9·15 | 9·12 | 9·10 | 9·07 | 9·05 | 9·02 | 9·00 |
| 0·740 | 8·97 | 8·95 | 8·92 | 8·90 | 8·87 | 8·85 | 8·82 | 8·80 | 8·77 | 8·75 |
| 0·750 | 8·72 | 8·70 | 8·68 | 8·65 | 8·63 | 8·60 | 8·58 | 8·56 | 8·53 | 8·51 |
| 0·760 | 8·49 | 8·46 | 8·44 | 8·42 | 8·39 | 8·37 | 8·35 | 8·33 | 8·30 | 8·28 |
| 0·770 | 8·26 | 8·24 | 8·21 | 8·19 | 8·17 | 8·15 | 8·13 | 8·10 | 8·08 | 8·06 |
| 0·780 | 8·04 | 8·02 | 8·00 | 7·98 | 7·95 | 7·93 | 7·91 | 7·89 | 7·87 | 7·85 |
| 0·790 | 7·83 | 7·81 | 7·79 | 7·77 | 7·75 | 7·73 | 7·71 | 7·69 | 7·67 | 7·65 |
| 0·800 | 7·63 | 7·61 | 7·59 | 7·57 | 7·55 | 7·53 | 7·51 | 7·49 | 7·47 | 7·45 |
| 0·810 | 7·43 | 7·41 | 7·39 | 7·37 | 7·35 | 7·33 | 7·32 | 7·30 | 7·28 | 7·26 |
| 0·820 | 7·24 | 7·22 | 7·20 | 7·19 | 7·17 | 7·15 | 7·13 | 7·11 | 7·10 | 7·08 |
| 0·830 | 7·06 | 7·04 | 7·02 | 7·01 | 6·99 | 6·97 | 6·95 | 6·94 | 6·92 | 6·90 |
| 0·840 | 6·88 | 6·87 | 6·85 | 6·83 | 6·82 | 6·80 | 6·78 | 6·77 | 6·75 | 6·73 |
| 0·850 | 6·71 | 6·70 | 6·68 | 6·67 | 6·65 | 6·63 | 6·62 | 6·60 | 6·58 | 6·57 |





## TABLE 12 (continued)

| Diameter of impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·860 | 6·55 | 6·54 | 6·52 | 6·50 | 6·49 | 6·47 | 6·46 | 6·44 | 6·42 | 6·41 |
| 0·870 | 6·39 | 6·38 | 6·36 | 6·35 | 6·33 | 6·32 | 6·30 | 6·29 | 6·27 | 6·26 |
| 0·880 | 6·24 | 6·23 | 6·21 | 6·20 | 6·18 | 6·17 | 6·15 | 6·14 | 6·12 | 6·11 |
| 0·890 | 6·09 | 6·08 | 6·06 | 6·05 | 6·04 | 6·02 | 6·01 | 5·99 | 5·98 | 5·97 |
| 0·900 | 5·95 | 5·94 | 5·92 | 5·91 | 5·90 | 5·88 | 5·87 | 5·85 | 5·84 | 5·83 |
| 0·910 | 5·81 | 5·80 | 5·79 | 5·77 | 5·76 | 5·75 | 5·73 | 5·72 | 5·71 | 5·69 |
| 0·920 | 5·68 | 5·67 | 5·65 | 5·64 | 5·63 | 5·61 | 5·60 | 5·59 | 5·58 | 5·56 |
| 0·930 | 5·55 | 5·54 | 5·53 | 5·51 | 5·50 | 5·49 | 5·48 | 5·46 | 5·45 | 5·44 |
| 0·940 | 5·43 | 5·41 | 5·40 | 5·39 | 5·38 | 5·36 | 5·36 | 5·34 | 5·33 | 5·32 |
| 0·950 | 5·30 | 5·29 | 5·28 | 5·27 | 5·26 | 5·25 | 5·23 | 5·22 | 5·21 | 5·20 |
| 0·960 | 5·19 | 5·18 | 5·16 | 5·15 | 5·14 | 5·13 | 5·12 | 5·11 | 5·10 | 5·08 |
| 0·970 | 5·07 | 5·06 | 5·05 | 5·04 | 5·03 | 5·02 | 5·01 | 5·00 | 4·98 | 4·97 |
| 0·980 | 4·96 | 4·95 | 4·94 | 4·93 | 4·92 | 4·91 | 4·90 | 4·89 | 4·88 | 4·87 |
| 0·990 | 4·86 | 4·85 | 4·83 | 4·82 | 4·81 | 4·80 | 4·79 | 4·78 | 4·77 | 4·76 |
| 1·000 | 4·75 | 4·74 | 4·73 | 4·72 | 4·71 | 4·70 | 4·69 | 4·68 | 4·67 | 4·66 |
| 1·010 | 4·65 | 4·64 | 4·63 | 4·62 | 4·61 | 4·60 | 4·59 | 4·58 | 4·57 | 4·56 |
| 1·020 | 4·55 | 4·54 | 4·53 | 4·52 | 4·51 | 4·51 | 4·50 | 4·49 | 4·48 | 4·47 |
| 1·030 | 4·46 | 4·45 | 4·44 | 4·43 | 4·42 | 4·41 | 4·40 | 4·39 | 4·38 | 4·37 |
| 1·040 | 4·37 | 4·36 | 4·35 | 4·34 | 4·33 | 4·32 | 4·31 | 4·30 | 4·29 | 4·28 |
| 1·050 | 4·28 | 4·27 | 4·26 | 4·25 | 4·24 | 4·23 | 4·22 | 4·21 | 4·21 | 4·20 |
| 1·060 | 4·19 | 4·18 | 4·17 | 4·16 | 4·15 | 4·15 | 4·14 | 4·13 | 4·12 | 4·11 |
| 1·070 | 4·10 | 4·09 | 4·09 | 4·08 | 4·07 | 4·06 | 4·05 | 4·05 | 4·04 | 4·03 |
| 1·080 | 4·02 | 4·01 | 4·00 | 4·00 | 3·99 | 3·98 | 3·97 | 3·96 | 3·96 | 3·95 |
| 1·090 | 3·94 | 3·93 | 3·92 | 3·92 | 3·91 | 3·90 | 3·89 | 3·89 | 3·88 | 3·87 |
| 1·100 | 3·86 | 3·85 | 3·85 | 3·84 | 3·83 | 3·82 | 3·82 | 3·81 | 3·80 | 3·79 |
| 1·110 | 3·79 | 3·78 | 3·77 | 3·76 | 3·76 | 3·75 | 3·74 | 3·73 | 3·73 | 3·72 |
| 1·120 | 3·71 | 3·70 | 3·70 | 3·69 | 3·68 | 3·68 | 3·67 | 3·66 | 3·65 | 3·65 |
| 1·130 | 3·64 | 3·63 | 3·63 | 3·62 | 3·61 | 3·60 | 3·60 | 3·59 | 3·58 | 3·58 |
| 1·140 | 3·57 | 3·56 | 3·56 | 3·55 | 3·54 | 3·53 | 3·53 | 3·52 | 3·51 | 3·51 |
| 1·150 | 3·50 | 3·49 | 3·49 | 3·48 | 3·47 | 3·47 | 3·46 | 3·45 | 3·45 | 3·44 |
| 1·160 | 3·43 | 3·43 | 3·42 | 3·41 | 3·41 | 3·40 | 3·39 | 3·39 | 3·38 | 3·38 |
| 1·170 | 3·37 | 3·36 | 3·36 | 3·35 | 3·34 | 3·34 | 3·33 | 3·32 | 3·32 | 3·31 |
| 1·180 | 3·31 | 3·30 | 3·29 | 3·29 | 3·28 | 3·27 | 3·27 | 3·26 | 3·26 | 3·25 |
| 1·190 | 3·24 | 3·24 | 3·23 | 3·23 | 3·22 | 3·21 | 3·21 | 3·20 | 3·20 | 3·19 |
| 1·200 | 3·18 | — | — | — | — | — | — | — | — | — |

## TABLE 13

DIAMETER OF BALL = 1 mm LOAD = 30 kgf $F/D^2 = 30$

| Diameter of impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·250 | *601* | *597* | *592* | *587* | *582* | *578* | *573* | *569* | *564* | *560* |
| 0·260 | *555* | *551* | *547* | *543* | *538* | *534* | *530* | *526* | *522* | *518* |
| 0·270 | *514* | *510* | *507* | *503* | *499* | *495* | *492* | *488* | *485* | *481* |
| 0·280 | *477* | *474* | *471* | *467* | *464* | *461* | *457* | *454* | *451* | 448 |
| 0·290 | 444 | 441 | 438 | 435 | 432 | 429 | 426 | 423 | 420 | 417 |
| 0·300 | 415 | 412 | 409 | 406 | 404 | 401 | 398 | 395 | 393 | 390 |
| 0·310 | 388 | 385 | 383 | 380 | 378 | 375 | 373 | 370 | 368 | 366 |
| 0·320 | 363 | 361 | 359 | 356 | 354 | 352 | 350 | 347 | 345 | 343 |
| 0·330 | 341 | 339 | 337 | 335 | 333 | 331 | 329 | 326 | 326 | 323 |
| 0·340 | 321 | 319 | 317 | 315 | 313 | 311 | 309 | 307 | 306 | 304 |
| 0·350 | 302 | 300 | 298 | 297 | 295 | 293 | 292 | 290 | 288 | 286 |
| 0·360 | 285 | 283 | 282 | 280 | 278 | 277 | 275 | 274 | 272 | 271 |
| 0·370 | 269 | 268 | 266 | 265 | 263 | 262 | 260 | 259 | 257 | 256 |
| 0·380 | 255 | 253 | 252 | 250 | 249 | 248 | 246 | 245 | 244 | 242 |
| 0·390 | 241 | 240 | 239 | 237 | 236 | 235 | 234 | 232 | 231 | 230 |
| 0·400 | 229 | 228 | 226 | 225 | 224 | 223 | 222 | 221 | 219 | 218 |
| 0·410 | 217 | 216 | 215 | 214 | 213 | 212 | 211 | 210 | 209 | 208 |
| 0·420 | 207 | 205 | 204 | 203 | 202 | 201 | 200 | 199 | 198 | 198 |
| 0·430 | 197 | 196 | 195 | 194 | 193 | 192 | 191 | 190 | 189 | 188 |
| 0·440 | 187 | 186 | 185 | 185 | 184 | 183 | 182 | 181 | 180 | 179 |
| 0·450 | 179 | 178 | 177 | 176 | 175 | 174 | 174 | 173 | 172 | 171 |
| 0·460 | 170 | 170 | 169 | 168 | 167 | 167 | 166 | 165 | 164 | 164 |
| 0·470 | 163 | 162 | 161 | 161 | 160 | 159 | 158 | 158 | 157 | 156 |
| 0·480 | 156 | 155 | 154 | 154 | 153 | 152 | 152 | 151 | 150 | 150 |
| 0·490 | 149 | 148 | 148 | 147 | 146 | 146 | 145 | 144 | 144 | 143 |
| 0·500 | 143 | 142 | 141 | 141 | 140 | 140 | 139 | 138 | 138 | 137 |
| 0·510 | 137 | 136 | 135 | 135 | 134 | 134 | 133 | 133 | 132 | 132 |
| 0·520 | 131 | 130 | 130 | 129 | 129 | 128 | 128 | 127 | 127 | 126 |
| 0·530 | 126 | 125 | 125 | 124 | 124 | 123 | 123 | 122 | 122 | 121 |
| 0·540 | 121 | 120 | 120 | 119 | 119 | 118 | 118 | 117 | 117 | 116 |
| 0·550 | 116 | 115 | 115 | 114 | 114 | 114 | 113 | 113 | 112 | 112 |
| 0·560 | 111 | 111 | 110 | 110 | 110 | 109 | 109 | 108 | 108 | 107 |
| 0·570 | 107 | 107 | 106 | 106 | 106 | 106 | 106 | 104 | 104 | 103 |
| 0·580 | 103 | 103 | 102 | 102 | 101 | 101 | 101 | 100 | 99·9 | 99·5 |
| 0·590 | 99·2 | 98·8 | 98·4 | 98·0 | 97·7 | 97·3 | 96·9 | 96·6 | 96·2 | 95·9 |
| 0·600 | 95·5 | — | — | — | — | — | — | — | — | — |





## TABLE 14

DIAMETER OF BALL = 1 mm LOAD = 10 kgf $F/D^2 = 10$

| Diameter of impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·250 | 200 | 199 | 197 | 196 | 194 | 193 | 191 | 190 | 188 | 187 |
| 0·260 | 185 | 184 | 182 | 181 | 179 | 178 | 177 | 175 | 174 | 173 |
| 0·270 | 171 | 170 | 169 | 168 | 166 | 165 | 164 | 163 | 162 | 160 |
| 0·280 | 159 | 158 | 157 | 156 | 155 | 154 | 152 | 151 | 150 | 149 |
| 0·290 | 148 | 147 | 146 | 145 | 144 | 143 | 142 | 141 | 140 | 139 |
| 0·300 | 138 | 137 | 136 | 135 | 135 | 134 | 133 | 132 | 131 | 130 |
| 0·310 | 129 | 128 | 128 | 127 | 126 | 125 | 124 | 123 | 123 | 122 |
| 0·320 | 121 | 120 | 120 | 119 | 118 | 117 | 117 | 116 | 115 | 114 |
| 0·330 | 114 | 113 | 112 | 112 | 111 | 110 | 110 | 109 | 108 | 108 |
| 0·340 | 107 | 106 | 106 | 105 | 104 | 104 | 103 | 102 | 102 | 101 |
| 0·350 | 101 | 100 | 99·5 | 98·9 | 98·3 | 97·7 | 97·2 | 96·6 | 96·1 | 95·5 |
| 0·360 | 95·0 | 94·4 | 93·9 | 93·3 | 92·8 | 92·3 | 91·8 | 91·2 | 90·7 | 90·2 |
| 0·370 | 89·7 | 89·2 | 88·7 | 88·2 | 87·7 | 87·2 | 86·8 | 86·3 | 85·8 | 85·3 |
| 0·380 | 84·9 | 84·4 | 83·9 | 83·5 | 83·0 | 82·6 | 82·1 | 81·7 | 81·3 | 80·8 |
| 0·390 | 80·4 | 80·0 | 79·5 | 79·1 | 78·7 | 78·3 | 77·9 | 77·5 | 77·1 | 76·7 |
| 0·400 | 76·3 | 75·9 | 75·5 | 75·1 | 74·7 | 74·3 | 73·9 | 73·5 | 73·2 | 72·8 |
| 0·410 | 72·4 | 72·0 | 71·7 | 71·3 | 71·0 | 70·6 | 70·2 | 69·9 | 69·5 | 69·2 |
| 0·420 | 68·8 | 68·5 | 68·2 | 67·8 | 67·5 | 67·1 | 66·8 | 66·5 | 66·2 | 65·8 |
| 0·430 | 65·5 | 65·2 | 64·9 | 64·6 | 64·2 | 63·9 | 63·6 | 63·3 | 63·0 | 62·7 |
| 0·440 | 62·4 | 62·1 | 61·8 | 61·5 | 61·2 | 60·9 | 60·6 | 60·4 | 60·1 | 59·8 |
| 0·450 | 59·5 | 59·2 | 59·0 | 58·7 | 58·4 | 58·1 | 57·9 | 57·6 | 57·3 | 57·1 |
| 0·460 | 56·8 | 56·5 | 56·3 | 56·0 | 55·8 | 55·5 | 55·3 | 55·0 | 54·8 | 54·5 |
| 0·470 | 54·3 | 54·0 | 53·8 | 53·5 | 53·3 | 53·0 | 52·8 | 52·6 | 52·3 | 52·1 |
| 0·480 | 51·9 | 51·6 | 51·4 | 51·2 | 51·0 | 50·7 | 50·5 | 50·3 | 50·1 | 49·8 |
| 0·490 | 49·6 | 49·4 | 49·2 | 49·0 | 48·8 | 48·6 | 48·3 | 48·1 | 47·9 | 47·7 |
| 0·500 | 47·5 | 47·3 | 47·1 | 46·9 | 46·7 | 46·5 | 46·3 | 46·1 | 45·9 | 45·7 |
| 0·510 | 45·5 | 45·3 | 45·1 | 45·0 | 44·8 | 44·6 | 44·4 | 44·2 | 44·0 | 43·8 |
| 0·520 | 43·7 | 43·5 | 43·3 | 43·1 | 42·9 | 42·8 | 42·6 | 42·4 | 42·2 | 42·1 |
| 0·530 | 41·9 | 41·7 | 41·6 | 41·4 | 41·2 | 41·0 | 40·9 | 40·7 | 40·5 | 40·4 |
| 0·540 | 40·2 | 40·0 | 39·9 | 39·7 | 39·6 | 39·4 | 39·2 | 39·1 | 38·9 | 38·8 |
| 0·550 | 38·6 | 38·5 | 38·3 | 38·2 | 38·0 | 37·9 | 37·7 | 37·6 | 37·4 | 37·3 |
| 0·560 | 37·1 | 37·0 | 36·8 | 36·7 | 36·5 | 36·4 | 36·3 | 36·1 | 36·0 | 35·8 |
| 0·570 | 35·7 | 35·6 | 35·4 | 35·3 | 35·1 | 35·0 | 34·9 | 34·7 | 34·6 | 34·5 |
| 0·580 | 34·3 | 34·2 | 34·1 | 33·9 | 33·8 | 33·7 | 33·6 | 33·4 | 33·3 | 33·2 |
| 0·590 | 33·1 | 32·9 | 32·8 | 32·7 | 32·6 | 32·4 | 32·3 | 32·2 | 32·1 | 32·0 |
| 0·600 | 31·8 | — | — | — | — | — | — | — | — | — |

## TABLE 15

DIAMETER OF BALL = 1 mm LOAD = 5 kgf $F/D^2 = 5$

| Diameter of impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·250 | 100 | 99·4 | 98·6 | 97·8 | 97·1 | 96·3 | 95·5 | 94·8 | 94·0 | 93·3 |
| 0·260 | 92·6 | 91·8 | 91·1 | 90·4 | 89·7 | 89·0 | 88·4 | 87·7 | 87·0 | 86·4 |
| 0·270 | 85·7 | 85·1 | 84·4 | 83·8 | 83·2 | 82·6 | 81·9 | 81·3 | 80·8 | 80·2 |
| 0·280 | 79·6 | 79·0 | 78·4 | 77·9 | 77·3 | 76·8 | 76·2 | 75·7 | 75·1 | 74·6 |
| 0·290 | 74·1 | 73·6 | 73·0 | 72·5 | 72·0 | 71·5 | 71·0 | 70·5 | 70·1 | 69·6 |
| 0·300 | 69·1 | 68·6 | 68·2 | 67·7 | 67·3 | 66·8 | 66·4 | 65·9 | 65·5 | 65·0 |
| 0·310 | 64·6 | 64·2 | 63·8 | 63·3 | 62·9 | 62·5 | 62·1 | 61·7 | 61·3 | 60·9 |
| 0·320 | 60·5 | 60·1 | 59·8 | 59·4 | 59·0 | 58·6 | 58·3 | 57·9 | 57·5 | 57·2 |
| 0·330 | 56·8 | 56·5 | 56·1 | 55·8 | 55·4 | 55·1 | 54·8 | 54·4 | 54·1 | 53·8 |
| 0·340 | 53·4 | 53·1 | 52·8 | 52·5 | 52·2 | 51·8 | 51·5 | 51·2 | 50·9 | 50·6 |
| 0·350 | 50·3 | 50·0 | 49·7 | 49·4 | 49·2 | 48·9 | 48·6 | 48·3 | 48·0 | 47·7 |
| 0·360 | 47·5 | 47·2 | 46·9 | 46·7 | 46·4 | 46·1 | 45·9 | 45·6 | 45·4 | 45·1 |
| 0·370 | 44·9 | 44·6 | 44·4 | 44·1 | 43·9 | 43·6 | 43·4 | 43·1 | 42·9 | 42·7 |
| 0·380 | 42·4 | 42·2 | 42·0 | 41·7 | 41·5 | 41·3 | 41·1 | 40·9 | 40·6 | 40·4 |
| 0·390 | 40·2 | 40·0 | 39·8 | 39·6 | 39·4 | 39·1 | 38·9 | 38·7 | 38·5 | 38·3 |
| 0·400 | 38·1 | 37·9 | 37·7 | 37·5 | 37·3 | 37·1 | 37·0 | 36·8 | 36·6 | 36·4 |
| 0·410 | 36·2 | 36·0 | 35·8 | 35·7 | 35·5 | 35·3 | 35·1 | 34·9 | 34·8 | 34·6 |
| 0·420 | 34·4 | 34·2 | 34·1 | 33·9 | 33·7 | 33·6 | 33·4 | 33·2 | 33·1 | 32·9 |
| 0·430 | 32·8 | 32·6 | 32·4 | 32·3 | 32·1 | 32·0 | 31·8 | 31·7 | 31·5 | 31·4 |
| 0·440 | 31·2 | 31·1 | 30·9 | 30·8 | 30·6 | 30·5 | 30·3 | 30·2 | 30·0 | 29·9 |
| 0·450 | 29·8 | 29·6 | 29·5 | 29·3 | 29·2 | 29·1 | 28·9 | 28·8 | 28·7 | 28·5 |
| 0·460 | 28·4 | 28·3 | 28·1 | 28·0 | 27·9 | 27·8 | 27·6 | 27·5 | 27·4 | 27·3 |
| 0·470 | 27·1 | 27·0 | 26·9 | 26·8 | 26·6 | 26·5 | 26·4 | 26·3 | 26·2 | 26·1 |
| 0·480 | 25·9 | 25·8 | 25·7 | 25·6 | 25·5 | 25·4 | 25·3 | 25·1 | 25·0 | 24·9 |
| 0·490 | 24·8 | 24·7 | 24·6 | 24·5 | 24·4 | 24·3 | 24·2 | 24·1 | 24·0 | 23·9 |
| 0·500 | 23·8 | 23·7 | 23·6 | 23·5 | 23·4 | 23·3 | 23·2 | 23·1 | 23·0 | 22·9 |
| 0·510 | 22·8 | 22·7 | 22·6 | 22·5 | 22·4 | 22·3 | 22·2 | 22·1 | 22·0 | 21·9 |
| 0·520 | 21·8 | 21·7 | 21·6 | 21·6 | 21·5 | 21·4 | 21·3 | 21·2 | 21·1 | 21·0 |
| 0·530 | 20·9 | 20·9 | 20·8 | 20·7 | 20·6 | 20·5 | 20·4 | 20·3 | 20·3 | 20·2 |
| 0·540 | 20·1 | 20·0 | 19·9 | 19·9 | 19·8 | 19·7 | 19·6 | 19·5 | 19·5 | 19·4 |
| 0·550 | 19·3 | 19·2 | 19·2 | 19·1 | 19·0 | 18·9 | 18·9 | 18·8 | 18·7 | 18·6 |
| 0·560 | 18·6 | 18·5 | 18·4 | 18·3 | 18·3 | 18·2 | 18·1 | 18·1 | 18·0 | 17·9 |
| 0·570 | 17·8 | 17·8 | 17·7 | 17·6 | 17·6 | 17·5 | 17·4 | 17·4 | 17·3 | 17·2 |
| 0·580 | 17·2 | 17·1 | 17·0 | 17·0 | 16·9 | 16·8 | 16·8 | 16·7 | 16·7 | 16·6 |
| 0·590 | 16·5 | 16·5 | 16·4 | 16·3 | 16·3 | 16·2 | 16·2 | 16·1 | 16·0 | 16·0 |
| 0·600 | 15·9 | — | — | — | — | — | — | — | — | — |





## TABLE 16

DIAMETER OF BALL = 1 mm LOAD = 1 kgf $F/D^2 = 1$

| Diameter of impression | 0·000 | 0·001 | 0·002 | 0·003 | 0·004 | 0·005 | 0·006 | 0·007 | 0·008 | 0·009 |
|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | |
| 0·250 | 20·0 | 19·9 | 19·7 | 19·6 | 19·4 | 19·3 | 19·1 | 19·0 | 18·8 | 18·7 |
| 0·260 | 18·5 | 18·4 | 18·2 | 18·1 | 17·9 | 17·8 | 17·7 | 17·5 | 17·4 | 17·3 |
| 0·270 | 17·1 | 17·0 | 16·9 | 16·8 | 16·6 | 16·5 | 16·4 | 16·3 | 16·2 | 16·0 |
| 0·280 | 15·9 | 15·8 | 15·7 | 15·6 | 15·5 | 15·4 | 15·2 | 15·1 | 15·0 | 14·9 |
| 0·290 | 14·8 | 14·7 | 14·6 | 14·5 | 14·4 | 14·3 | 14·2 | 14·1 | 14·0 | 13·9 |
| 0·300 | 13·8 | 13·7 | 13·6 | 13·5 | 13·5 | 13·4 | 13·3 | 13·2 | 13·1 | 13·0 |
| 0·310 | 12·9 | 12·8 | 12·8 | 12·7 | 12·6 | 12·5 | 12·4 | 12·3 | 12·3 | 12·2 |
| 0·320 | 12·1 | 12·0 | 12·0 | 11·9 | 11·8 | 11·7 | 11·7 | 11·6 | 11·5 | 11·4 |
| 0·330 | 11·4 | 11·3 | 11·2 | 11·2 | 11·1 | 11·0 | 11·0 | 10·9 | 10·8 | 10·8 |
| 0·340 | 10·7 | 10·6 | 10·6 | 10·5 | 10·4 | 10·4 | 10·3 | 10·2 | 10·2 | 10·1 |
| 0·350 | 10·1 | 10·0 | 9·95 | 9·89 | 9·83 | 9·77 | 9·72 | 9·66 | 9·61 | 9·55 |
| 0·360 | 9·50 | 9·44 | 9·39 | 9·33 | 9·28 | 9·23 | 9·18 | 9·12 | 9·07 | 9·02 |
| 0·370 | 8·97 | 8·92 | 8·87 | 8·82 | 8·77 | 8·72 | 8·68 | 8·63 | 8·58 | 8·53 |
| 0·380 | 8·49 | 8·44 | 8·39 | 8·35 | 8·30 | 8·26 | 8·21 | 8·17 | 8·13 | 8·08 |
| 0·390 | 8·04 | 8·00 | 7·95 | 7·91 | 7·87 | 7·83 | 7·79 | 7·75 | 7·71 | 7·67 |
| 0·400 | 7·63 | 7·59 | 7·55 | 7·51 | 7·47 | 7·43 | 7·39 | 7·35 | 7·32 | 7·28 |
| 0·410 | 7·24 | 7·20 | 7·17 | 7·13 | 7·10 | 7·06 | 7·02 | 6·99 | 6·95 | 6·92 |
| 0·420 | 6·88 | 6·85 | 6·82 | 6·78 | 6·75 | 6·71 | 6·68 | 6·65 | 6·62 | 6·58 |
| 0·430 | 6·55 | 6·52 | 6·49 | 6·46 | 6·42 | 6·39 | 6·36 | 6·33 | 6·30 | 6·27 |
| 0·440 | 6·24 | 6·21 | 6·18 | 6·15 | 6·12 | 6·09 | 6·06 | 6·04 | 6·01 | 5·98 |
| 0·450 | 5·95 | 5·92 | 5·90 | 5·87 | 5·84 | 5·81 | 5·79 | 5·76 | 5·73 | 5·71 |
| 0·460 | 5·68 | 5·65 | 5·63 | 5·60 | 5·58 | 5·55 | 5·53 | 5·50 | 5·48 | 5·45 |
| 0·470 | 5·43 | 5·40 | 5·38 | 5·35 | 5·33 | 5·30 | 5·28 | 5·26 | 5·23 | 5·21 |
| 0·480 | 5·19 | 5·16 | 5·14 | 5·12 | 5·10 | 5·07 | 5·05 | 5·03 | 5·01 | 4·98 |
| 0·490 | 4·96 | 4·94 | 4·92 | 4·90 | 4·88 | 4·86 | 4·83 | 4·81 | 4·79 | 4·77 |
| 0·500 | 4·75 | 4·73 | 4·71 | 4·69 | 4·67 | 4·65 | 4·63 | 4·61 | 4·59 | 4·57 |
| 0·510 | 4·55 | 4·53 | 4·51 | 4·50 | 4·48 | 4·46 | 4·44 | 4·42 | 4·40 | 4·38 |
| 0·520 | 4·37 | 4·35 | 4·33 | 4·31 | 4·29 | 4·28 | 4·26 | 4·24 | 4·22 | 4·21 |
| 0·530 | 4·19 | 4·17 | 4·15 | 4·14 | 4·12 | 4·10 | 4·09 | 4·07 | 4·05 | 4·04 |
| 0·540 | 4·02 | 4·00 | 3·99 | 3·97 | 3·96 | 3·94 | 3·92 | 3·91 | 3·89 | 3·88 |
| 0·550 | 3·86 | 3·85 | 3·83 | 3·82 | 3·80 | 3·79 | 3·77 | 3·76 | 3·74 | 3·73 |
| 0·560 | 3·71 | 3·70 | 3·68 | 3·67 | 3·65 | 3·64 | 3·63 | 3·61 | 3·60 | 3·58 |
| 0·570 | 3·57 | 3·56 | 3·54 | 3·53 | 3·51 | 3·50 | 3·49 | 3·47 | 3·46 | 3·45 |
| 0·580 | 3·43 | 3·42 | 3·41 | 3·39 | 3·38 | 3·37 | 3·36 | 3·34 | 3·33 | 3·32 |
| 0·590 | 3·31 | 3·29 | 3·28 | 3·27 | 3·26 | 3·24 | 3·23 | 3·22 | 3·21 | 3·20 |
| 0·600 | 3·18 | — | — | — | — | — | — | — | — | — |

## APPENDIX B

## MINIMUM THICKNESS OF TEST PIECE

For convenience when carrying out tests in accordance with this standard, the following tables, which are based on the requirements of Clause 8*b*, give the minimum thickness of test pieces for selected ball diameters, loads and hardness values.

$F/D^2 = 1$

| Ball dia. | Load | Brinell hardness value (HB) | | | | |
|---|---|---|---|---|---|---|
| | | 3 | 5 | 10 | 15 | 20 |
| | | Minimum thickness | | | | |
| mm | kgf | in | in | in | in | in |
| 1 | 1 | 0·033 | 0·020 | 0·010 | 0·007 | — |
| 2 | 4 | 0·067 | 0·040 | 0·020 | 0·013 | 0·010 |
| 5 | 25 | 0·167 | 0·100 | 0·050 | 0·033 | 0·025 |
| 10 | 100 | 0·334 | 0·201 | 0·100 | 0·067 | 0·050 |

$F/D^2 = 5$

| Ball dia. | Load | Brinell hardness value (HB) | | | | |
|---|---|---|---|---|---|---|
| | | 15 | 30 | 50 | 75 | 100 |
| | | Minimum thickness | | | | |
| mm | kgf | in | in | in | in | in |
| 1 | 5 | 0·033 | 0·017 | 0·010 | 0·007 | — |
| 2 | 20 | 0·067 | 0·033 | 0·020 | 0·013 | 0·010 |
| 5 | 125 | 0·167 | 0·084 | 0·050 | 0·033 | 0·025 |
| 10 | 500 | 0·334 | 0·167 | 0·100 | 0·067 | 0·050 |





$F/D^2 = 10$

| Ball dia. | Load | Brinell hardness value (HB) | | | | |
|---|---|---|---|---|---|---|
| | | 30 | 75 | 120 | 160 | 200 |
| | | Minimum thickness | | | | |
| mm | kgf | in | in | in | in | in |
| 1 | 10 | 0·033 | 0·013 | 0·008 | — | — |
| 2 | 40 | 0·067 | 0·027 | 0·017 | 0·013 | 0·010 |
| 5 | 250 | 0·167 | 0·067 | 0·042 | 0·031 | 0·025 |
| 10 | 1 000 | 0·334 | 0·134 | 0·084 | 0·063 | 0·050 |

$F/D^2 = 30$

| Ball dia. | Load | Brinell hardness value (HB) | | | | |
|---|---|---|---|---|---|---|
| | | 100 | 200 | 300 | 400 | 450 |
| | | Minimum thickness | | | | |
| mm | kgf | in | in | in | in | in |
| 1 | 30 | 0·030 | 0·015 | 0·010 | — | — |
| 2 | 120 | 0·060 | 0·030 | 0·020 | 0·015 | 0·013 |
| 5 | 750 | 0·150 | 0·075 | 0·050 | 0·038 | 0·033 |
| 10 | 3 000 | 0·301 | 0·150 | 0·100 | 0·075 | 0·067 |

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