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ISO

INTERNATIONAL ORGANIZATION FOR STANDARDIZATION

ISO RECOMMENDATION

R 410

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

1st EDITION
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BRIEF HISTORY

The ISO Recommendation R 410, *Tables of Brinell Hardness Values (HB) for Use in Tests Made on Flat Surfaces*, was drawn up by the Co-ordinating Committee on the Mechanical Testing of Metals (METESCO), the Secretariat of which is held by the British Standards Institution (BSI).

Work on this question began in 1960 and led, in 1962, to the adoption of a document which the METESCO Secretariat turned over to the General Secretariat, with the request that it be subjected to the procedures that Draft ISO Recommendations customarily follow.

In August 1962, this document was circulated, as Draft ISO Recommendation (No. 531) to all the ISO Member Bodies for enquiry. It was approved, subject to a few modifications, by the following Member Bodies:

Australia	Germany	Portugal
Austria	India	Republic of South Africa
Belgium	Ireland	Romania
Burma	Italy	Sweden
Canada	Japan	Turkey
Chile	Netherlands	U.A.R.
Czechoslovakia	New Zealand	United Kingdom
Denmark	Norway	U.S.S.R.
Finland	Poland	Yugoslavia

One Member Body opposed the approval of the Draft: France.

The Draft was submitted simultaneously to the Secretariats of all the ISO Technical Committees. It was approved by the Secretariats of the following Technical Committees concerned with the question of mechanical tests:

ISO/TC 2, *Bolts, nuts and accessories.*
ISO/TC 17, *Steel.*
ISO/TC 25, *Cast iron.*
ISO/TC 26, *Copper and copper alloys.*

and was not disapproved by any Secretariat.

The Draft ISO Recommendation was then submitted by correspondence to the ISO Council, which decided, in December 1964, to accept it as an ISO RECOMMENDATION.

ISO Recommendation R 410 December 1964

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

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1. TABLES OF BRINELL HARDNESS VALUES (HB)

Without regard to the limitations imposed by practical conditions, the following tables have been calculated from the formula

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

where

F = Test load, in kilogrammes-force,
D = Diameter of the ball, in millimetres,
d = Diameter of identation, in millimetres.

The tables cover a range of identation diameters d between 0.25 D and 0.6 D.

In industrial tests carried out in accordance with ISO Recommendation R 79, *Brinell hardness test for steel*, and with corresponding ISO Recommendations for other metals*, and using testing machines in good order, the main cause of error is 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 appear in italic type so as to emphasize that the use of the Brinell test with a steel ball on products having a hardness greater than this value should be avoided. This limitation is not valid for the Modified Brinell test with a tungsten carbide ball, but the hardness obtained refers to a different scale.

* To date, two ISO Recommendations:
ISO Recommendation R 191, *Brinell hardness test for light metals and their alloys*, and
ISO Recommendation R 403, *Brinell hardness test for copper and copper alloys*.

TABLE 1

Diameter of ball 10 mm **Load = 3000 kgf** **$F/D^2 = 30$**

Diameter of indentation mm	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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	135	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 1000 kgf** **$F/D^2 = 10$**

Diameter of indentation mm	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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	145	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	45.5	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 indentation mm	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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	37.5	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 indentation mm	0.00		0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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	11.9	11.8	11.7	11.7	11.6	11.5	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 indentation mm	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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 indentation mm	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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
y.70	40.2	39.9	39.6	39.2	38.9	38.6	38.3	38.0	37.7	37.4
y.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 indentation mm	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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 indentation mm	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
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	9.95	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 – 2.5 mm **Load 187.5 kgf** **$F/D^2 = 30$**

Diameter of indentation mm	0.000	0.001	0.002	0.003	0.004	0.005	0.006	0.007	0.008	0.009
0.620						*601*	*599*	*597*	*596*	*594*
0.630	*592*	*590*	*588*	*586*	*584*	*582*	*581*	*579*	*577*	*575*
0.640	*573*	*571*	*569*	*568*	*566*	*564*	*562*	*561*	*559*	*557*
0.650	*555*	*554*	*552*	*550*	*548*	*547*	*545*	*543*	*542*	*540*
0.660	*538*	*537*	*535*	*533*	*532*	*530*	*528*	*527*	*525*	*524*
0.670	*522*	*521*	*519*	*517*	*516*	*514*	*513*	*511*	*510*	*508*
0.680	*506*	*505*	*504*	*502*	*500*	*499*	*497*	*496*	*495*	*493*
0.690	*492*	*490*	*489*	*487*	*486*	*484*	*483*	*482*	*480*	*479*
0.700	*477*	*476*	*475*	*473*	*472*	*471*	*469*	*468*	*467*	*465*
0.710	*464*	*462*	*461*	*460*	*459*	*457*	*456*	*455*	*453*	*452*
0.720	*451*	449	448	447	446	444	443	442	441	439
0.730	438	437	436	435	433	432	431	430	429	427
0.740	426	425	424	423	422	420	419	418	417	416
0.750	415	413	412	411	410	409	408	407	406	405
0.760	404	402	401	400	399	398	397	396	395	394
0.770	393	392	391	390	389	388	387	386	385	384
0.780	383	382	381	380	379	378	377	376	375	374
0.790	373	372	371	370	369	368	367	366	365	364
0.800	363	362	361	360	359	359	358	357	356	355
0.810	354	353	352	351	350	350	349	348	347	346
0.820	345	344	344	343	342	341	340	339	338	338
0.830	337	336	335	334	333	333	332	331	330	329
0.840	328	328	327	326	325	324	324	323	322	321
0.850	321	320	319	318	317	317	316	315	314	314
0.860	313	312	311	311	310	309	308	308	307	306
0.870	306	305	304	303	303	302	301	301	300	299
0.880	298	298	297	296	296	295	294	294	293	292
0.890	291	291	290	289	289	288	287	287	286	285
0.900	285	284	284	283	282	282	281	280	280	279
0.910	278	278	277	276	276	275	275	274	273	273
0.920	272	272	271	270	270	269	269	268	267	267
0.930	266	266	265	264	264	263	263	262	261	261
0.940	260	260	259	259	258	257	257	256	256	255
0.950	255	254	253	253	252	252	251	251	250	250
0.960	249	249	248	247	247	246	246	245	245	244
0.970	244	243	243	242	242	241	241	240	240	239
0.980	239	238	238	237	237	236	236	235	235	234
0.990	234	233	233	232	232	231	231	230	230	229
1.000	229	228	228	227	227	226	226	225	225	225
1.010	224	224	223	223	222	222	221	221	220	220
1.020	219	219	219	218	218	217	217	216	216	215
1.030	215	215	214	214	213	213	212	212	212	211
1.040	211	210	210	209	209	209	208	208	207	207
1.050	207	206	206	205	205	204	204	204	203	203
1.060	202	202	202	201	201	200	200	200	199	199
1.070	198	198	198	197	197	197	196	196	195	195
1.080	195	194	194	193	193	193	192	192	192	191
1.090	191	191	190	190	189	189	189	188	188	188
1.100	187	187	187	186	186	185	185	185	184	184
1.110	184	183	183	183	182	182	182	181	181	181
1.120	180	180	180	179	179	179	178	178	178	177
1.130	177	177	176	176	176	175	175	175	174	174
1.140	174	173	173	173	172	172	172	171	171	171
1.150	170	170	170	169	169	169	169	168	168	168