Hardness Correction

Hardness Correction Table

Corrections to be added to Rockwell "C" readings taken on the spherical surface for equivalent measure on parallel flats. These correction factors apply only to chrome and AISI-Type 440 stainless steel balls.

Hardness readings of balls taken on spherical surfaces are affected by the curvature and hardness of the ball. Because of these factors, corrections are necessarily added to the hardness read on ball surface to obtain the equivalent hardness on a flat surface. For ball sizes not shown, interpolate between values at right.

Rockwell "C" Readings

(Curved surface)	Ball Diameters											
	5/16"	3/8"	7/16"	1/2"	9/16"	5/8"	11/16"	3/4"	13/16"	7/8"	15/16"	1"
55	3.1	2.5	2.1	1.8	1.6	1.4	1.3	1.1	1.0	1.0	.8	.8
56	2.9	2.4	2.0	1.6	1.5	1.3	1.2	1.0	.9	.9	.7	.7
57	2.7	2.2	1.8	1.5	1.4	1.2	1.1	.9	.8	.8	.7	.6
58	2.6	2.1	1.7	1.4	1.2	1.1	1.0	.8	.7	.7	.6	.5
59	2.4	1.9	1.6	1.3	1.1	1.0	.9	.7	.7	.6	.5	.4
60	2.2	1.8	1.5	1.2	1.0	.9	.8	.7	.6	.5	.5	.4
61	2.0	1.6	1.3	1.0	.9	.8	.7	.6	.5	.5	.4	.3
62	1.8	1.5	1.2	.9	.8	.7	.6	.5	.4	.4	.4	.3
63	1.7	1.3	1.0	.8	.7	.5	.5	.4	.4	.3	.3	.2
64	1.5	1.2	.9	.6	.5	.4	.3	.3	.3	.2	.2	.2
65	1.3	1.0	.7	.5	.4	.3	.2	.2	.2	.2	.1	.1
66	1.1	.8	.6	.4	.3	.2	.1	.1	.1	.1	–	–

Hardness Conversion Table: (Conversions are only valid for readings taken on parallel flats.)

Rockwell "C" Scale	Brinell† 3000 Kilogram Load	Rockwell "C" Scale	Rockwell "B" Scale	Brinell† 3000 Kilogram Load	Rockwell "B"Scale	Brinell† 3000 Kilogram Load
66	–	40	–	371	94	205
65	739	39	–	362	93	200
64	722	38	–	353	92	195
63	705	37	–	344	91	190
62	688	36	–	336	90	185
61	670	35	–	327	89	180
60	654	34	–	319	88	176
59	634	33	–	311	87	172
58	615	32	–	301	86	169
57	595	31	–	294	85	165
56	577	30	–	286	84	162
55	560	29	–	279	83	159
54	543	28	–	271	82	156
53	525	27	–	264	81	153
52	500	26	–	258	80	150
51	487	25	–	253	79	147
50	475	24	–	247	78	144
49	464	23	100.0	243	77	141
48	451	22	99.0	237	76	139
47	442	21	98.5	231	75	137
46	432	20	97.8	226	74	135
45	421	(19)	97.0	222	73	132
44	409	(18)	96.7	219	72	130
43	400	(17)	96.1	215	71	127
42	390	(16)	95.5	212	70	125
41	381	(15)	94.7	208	–	–

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Corrosion Resistance Properties

BALL MATERIALS	Industrial Atmosphere	Hydraulic Oils (Petroleum)	Fresh Water	Salt Water	Food Products	Fruit & Veg. Juices	Milk	Alcohol	HCl-40%	Sulfuric Acid-40%	Phosphoric Acid-40%	Nitric Acid-50%	Citric Acid	Ammonia Liquids
52100 CHROME	C	A	D	D	–	–	–	C	–	–	–	–	C	B
440C STAINLESS	B	A	C	C	B	–	A	A	D	D	A	A	A	A
302 STAINLESS	B	A	B	B	A	–	A	–	–	–	A	–	–	–
316 STAINLESS	B	A	A	A	A	A	A	A	D	D	A	A	A	A
BRASS	C	B	C	C	D	–	C	C	–	D	D	–	D	–
MONEL	C	A	A	B	D	C	C	A	D	–	C	–	–	A
NYLON	A	A	A	A	–	A	A	A	D	D	D	D	C	–
VITON®	A	A	A	A	A	A	A	A	A	A	A	A	A	D
CERAMIC	A	A	A	A	A	A	A	A	C	D	C	A	A	A
TITANIUM	–	–	–	–	–	–	–	A	C	C	–	A	A	–

Numbers indicating order of preference

A = excellent B = good C = fair D = poor – = test data not available

ABMA Definitions

Grades and Tolerances (ABMA STD-10)

(2.12) Grade: A specific combination of dimensional form and surface roughness tolerance. A ball grade is designated by a grade number.

(2.4) Ball Diameter Variation: The difference between the largest and the smallest actual single diameter of one ball.

(2.8) Lot Diameter Variation: The difference between the mean diameter of the largest ball and that of the smallest ball in the lot.

(2.9) Nominal Ball Diameter Tolerance: The maximum allowable deviation of any ball lot mean diameter from the nominal ball diameter.

Mechanical Characteristics

Hardness: The measure of resistance to penetration of the ball surface or truncated flat of the ball by a specific indenting shape.

Ball Diameter (ABMA STD-10)

(2.1) Nominal Ball Diameter: The diameter value that is used for the purpose of general identification of a ball size, e.g., 1/4", 6mm, etc.

(2.13) Ball Gage: The prescribed small amount by which the lot mean diameter should differ from nominal diameter, this amount being one of an established series of amounts. A ball gage, in combination with the ball grade and nominal ball diameter, should be considered as the most exact ball size specification to be used by a customer for ordering purposes.

(2.11) Specific Diameter: The amount by which the lot mean diameter differs from the nominal diameter, accurate to the container marking increment for that grade. The specific
diameter should be marked on the unit container.

(2.10) Container Marking Increment: The standard unit steps in micrometers or in millionths of an inch, used to express the specific diameter.

How Ball Diameter Is Indicated

Example:

Nominal Ball Diameter. . . . . 1/2"

Ball Gage . . . . . 1/2" + .0003

Specific Diameter. . . . . 1/2" + .000325

Surface Qualities

Surface Roughness: Surface roughness consists of all those irregularities which form surface relief and which are conventionally defined within the area where deviations of form and waviness are eliminated.

Waviness: The more widely spaced circumferential component of surface texture.

Danaher Motion Statement of Standard Measurement Conditions:

Diameter: Between two parallel flat carbide gage surfaces under 4 oz. gage force with size corrected to zero gage pressure per ABMA Std. 10.

Deviation from Spherical Form: Determined by rotation of the ball against a linear transducer with less than 4 grams gage force. The resulting polar chart is interpreted using the minimum circumscribed circle method (MCC) per ABMA Std. 10, Appendix A1.1 and AMS 889.3.

Surface Roughness: Determined by a stylus type instrument with the ball stationary. Compliance with Ra limits specified in ABMA Std. 10, Table 3 will be interpreted using a cutoff of .003 for ball radii up to .050, .01 for ball radii up to .130, and .03 over .130, with filtration to optimize the number of cutoffs used to calculate the results.

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Grading Charts

Grades and Tolerances – Inches							
Grade	Size Range	Deviation from Spherical Form	Lot Diameter Variation	Allowable Ball Gage Variation	Nominal Ball Diameter Tolerance	Marking Increments	Maximum Surface Roughness† in Microinches "Ra"
3	.006-1/2"	.000003	±.000003	±.00003	–	0.00001	0.5
5	.006-1/2"	.000005	±.000005	±.00005	–	0.00001	0.8
10	.006-7/8"	.000010	±.000010	±.00005	–	0.00001	1.0
25	.006-1"	.000025	±.000025	±.00010	–	0.00001	2.0
50	.006-1"	.000050	±.000050	–	±.000200	0.00005	3.0
100	.006-1"	.000100	±.000100	–	±.000500	–	5.0
200	.006-1"	.000200	±.000200	–	±.001000	–	8.0
1000	.006-1"	.001000	±.001000	–	±.005000	–	–

† Maximum surface roughness arithmetic average.

Grades and Tolerances – Metric (Millimeter)							
DIN Grade	ABMA Grade	Deviation from Spherical Form	Lot Diameter Variation	Allowable Ball Gage Variation	Nominal Ball Diameter Tolerance	Marking Increments	Maximum Surface Roughness† in Micrometers "Ra"
–	3	.00008	±.000080	±.0008	–	.00025	0.012
–	5	.00013	±.000013	±.0013	–	.00025	0.020
I	10	.00025	±.000250	±.0013	–	.00025	0.025
II	25	.00060	±.000600	±.0025	–	.00025	0.051
III	50	.00120	±.001200	–	±.0051	.00127	0.076
IV	100	.00250	±.002500	–	±.0381	–	0.127
–	200	.00500	±.005000	–	±.0250	–	0.203
V	1000	.02500	±.025000	–	±.1270	–	–

† Maximum surface roughness arithmetic average.