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Ball Grades

ISO 3290 Standards govern the dimensional characteristics of metallic balls. The ABMA (Formerly AFBMA) now uses ISO 3290. MBA classifies balls under the ISO 3290 standard when possible. Some ball types are still made to the old AFBMA standards, and the relevant standard will be specified in our listings.

There are many factors involved in ball grades, but for most purposes the ovality tolerance should suffice. The ovality tolerance and the surface finish are the main factors determined by ball grade, with further specifications of the diametrical tolerance within a ball lot.

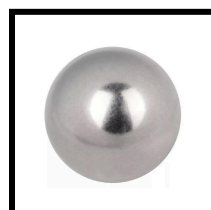
The diametrical tolerance variation only applies to balls supplied as part of a ball lot. For general supply, a much larger variation is possible. The table lists the acceptable diametrical tolerance variation for general supply, and also the tolerance for special orders in ball lots. Orders for ball-lots are by special arrangement, and will be based on the required ball gauge for the lot.

The ISO 3290 diametrical tolerance does not mean that all balls will be within the tolerance of the nominal size. The tolerance applies to the ball gauge size, not the nominal size. On manufacture, ball lots can be supplied with various ball gauges. The ball gauge may be specified as 0 which is the nominal size exactly, or it might be below or above nominal size. The ISO 3290 diametrical tolerances will apply to all the balls within a ball lot to ensure that the balls are as close to identical as possible.

The table below compares ISO 3290 with the former AFBMA grades.

It should be noted that a low grade number is higher precision, and a large grade number is lower precision. Each grade on the charts also meets the specifications of all the grades below it (for example, a Grade 10 ball can rightly be classified as Grade 40, because it exceeds all the requirements of Grade 40).

See the tables on the next pages...



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Ball Grades - ISO & AFBMA (Metallic)

Grade	Ovality		Surface Roughness (Ra Max μ m)	Diametrical Tolerance Allowed Within a Ball Lot Ball Lot Specified by Gauge		Diametrical Tolerance Without Ball Lot Specified Not Part of the Standard	
	mm	Inches		mm	Inches	mm	Inches
AFBMA 3	+/- 0.000076	+/- 0.000003	0.012	+/- 0.000152	+/- 0.000006	+/- 0.000762	+/- 0.000030
ISO 3	+/- 0.00008	+/- 0.000003	0.010	+/- 0.00008	+/- 0.000003		
AFBMA 5	+/- 0.000127	+/- 0.000005	0.020	+/- 0.000254	+/- 0.000010	+/- 0.00127	+/- 0.000050
ISO 5	+/- 0.00013	+/- 0.000005	0.014	+/- 0.00013	+/- 0.000005		
ISO 10	+/- 0.00025	+/- 0.000010	0.020	+/- 0.00025	+/- 0.000010		
AFBMA 10	+/- 0.000254	+/- 0.000010	0.025	+/- 0.00051	+/- 0.000020	+/- 0.00254	+/- 0.000100
ISO 16	+/- 0.00040	+/- 0.000016	0.025	+/- 0.00040	+/- 0.000016		
ISO 20	+/- 0.00050	+/- 0.000020	0.032	+/- 0.00050	+/- 0.000020		
AFBMA 20	+/- 0.000508	+/- 0.000020	0.032	+/- 0.00102	+/- 0.000040	+/- 0.00254	+/- 0.000100
ISO 24	+/- 0.00060	+/- 0.000024	0.040	+/- 0.00060	+/- 0.000024		
AFBMA 25	+/- 0.000635	+/- 0.000025	0.050	+/- 0.00127	+/- 0.000050	+/- 0.00254	+/- 0.000100
ISO 28	+/- 0.00070	+/- 0.000028	0.050	+/- 0.00070	+/- 0.000028		
ISO 40	+/- 0.00100	+/- 0.000039	0.060	+/- 0.00100	+/- 0.000039		
AFBMA 40	+/- 0.001016	+/- 0.000040	0.070	+/- 0.00203	+/- 0.000080	+/- 0.00508	+/- 0.000200
AFBMA 50	+/- 0.001270	+/- 0.000050	0.080	+/- 0.00254	+/- 0.000100	+/- 0.00508	+/- 0.000200
ISO 60	+/- 0.001500	+/- 0.000059	0.080	+/- 0.00150	+/- 0.000059		
ISO 100	+/- 0.002500	+/- 0.000098	0.100	+/- 0.00250	+/- 0.000098		
AFBMA 100	+/- 0.002540	+/- 0.000100	0.125	+/- 0.00508	+/- 0.000200	+/- 0.01270	+/- 0.000500
ISO 200	+/- 0.005000	+/- 0.000197	0.150	+/- 0.00500	+/- 0.000197		
AFBMA 200	+/- 0.005080	+/- 0.000200	0.200	+/- 0.02540	+/- 0.001000	+/- 0.02540	+/- 0.001000
AFBMA 500	+/- 0.012700	+/- 0.000500	-	+/- 0.05080	+/- 0.002000	+/- 0.05080	+/- 0.002000
AFBMA 1000	+/- 0.025400	+/- 0.001000	-	+/- 0.12700	+/- 0.005000	+/- 0.12700	+/- 0.005000
AFBMA 2000	+/- 0.050800	+/- 0.002000	-	+/- 0.12700	+/- 0.005000	+/- 0.12700	+/- 0.005000

*** These tables should be read as a general guide only. The relevant standards should be consulted to check accuracy.





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Ball Grades (Plastic)

Grade	Ovality		Diametrical Tolerance	
	mm	Inches	mm	Inches
0	+/- 0.0127	+/- 0.0003	+/- 0.0127	+/- 0.0005
I	+/- 0.0127	+/- 0.0005	+/- 0.0254	+/- 0.0010
IIP	+/- 0.0254	+/- 0.0010	+/- 0.0508	+/- 0.0020
II	+/- 0.0254	+/- 0.0010	+/- 0.0508	+/- 0.0020
III	+/- 0.1270	+/- 0.0050	+/- 0.1270	+/- 0.0050

*** These tables should be read as a general guide only. The relevant standards should be consulted to check accuracy.

Tolerances in Simple Terms:

A tolerance is the amount of variation allowed. If I require a box of 1000 screws +/- 5, this means I can accept a box containing anything from 995 to 1005 screws. If a supplier states they can supply a box of 1000 +/- 2, this means their box contains anything from 998 to 1002 screws. The higher accuracy still meets my requirement of +/- 5. The same principle applies for tolerances of size, clearance, hardness or anything else.

See also:

[Abec Information](#)

[Bearing Precision](#)

[Bearing Tolerances for 440C & Chrome Steel](#)

[Bearing Tolerances for 316 Stainless & Plastic](#)

