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# Standard Specification for Bearing, Roller, Tapered, Single Row of Rollers (Metric Series)[1]

This standard is issued under the fixed designation F2591; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

*This standard has been approved for use by agencies of the U.S. Department of Defense.*

## 1. Scope

1.1 This specification covers requirements for metric series, tapered roller bearings with a single row of rollers.

1.2 *Intended Use*—The bearings covered in this specification are intended to be used in general industrial and vehicle applications where the operating temperature does not exceed 120°C (250°F).

1.3 This specification contains many of the requirements of DS3225, which was originally developed by the Department of Defense and maintained by the Defense Supply Center in Richmond. The following government activity codes may be found in the Department of Defense, Standardization Directory SD-1.[2]

| Preparing Activity | Custodians | Review Activities |
|---|---|---|
| DLA-GS4 | Army-AT | Army-AV |
| | Navy-MC | Navy –MC, SH |
| | Air Force-99 | Air Force-84 |
| | | Other-NS |

1.4 The values stated in SI units are to be regarded as standard. No other units of measurement are included in this standard.

1.5 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

## 2. Referenced Documents

2.1 *ABMA Standard:*[3]

ABMA 19.1 Tapered Roller Bearings—Radial, Metric Design

2.2 *ISO Standard:*[4]

ISO 5593 Rolling Bearings—Vocabulary

2.3 *Military Standard:*[5]

MIL-C-11796 Corrosion Preventative Compound, Petrolatum, Hot Application

2.4 *SAE Standard:*[6]

SAE AMS-STD-66 Steel: Chemical Composition and Hardenability

## 3. Terminology

3.1 *Definitions:*

3.1.1 For definitions of terms used in this specification refer to ISO 5593.

3.1.2 *effective load center*—dimension (a) locates a point on the inner ring (cone) axis that is the center of pressure of all resisting forces set up by the bearing rollers. All moments should be calculated from this point when determining bearing loading and shaft stresses. A minus value of (a) indicates that the center is inside the inner ring (cone) backface.

3.1.3 *K factor*—the K Factor is the ratio of the basic radial dynamic load rating to the basic static load rating.

3.1.4 *contact angle*—these bearing have a contact angle (α) between 10 and 19 degrees. The contact angle is the angle between the line of action of the roller load and a plane perpendicular to the bearing axis.

## 4. Ordering Information

4.1 Procurement documents should specify the following:

4.1.1 Title, number, and date of this specification,

4.1.2 Part Number (see 8.1),

4.1.3 Nominal dimensions of bearing (bore, outside diameter, bearing width),

4.1.4 Quantity required,

4.1.5 Inspection records required, and

[1] This specification is under the jurisdiction of ASTM Committee F34 on Rolling Element Bearings and is the direct responsibility of Subcommittee F34.04 on Automotive/Industrial Bearing.

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[2] The Military codes that are listed in SD-1 give the address and phone numbers of the DoD contacts. These are found in the DoD's ASSIST website http://assist.daps.dla.mil/online/start/.

[3] Available from Techstreet, 777 E. Eisenhower Parkway, Ann Arbor , MI 48108.

[4] Available from American National Standards Institute (ANSI), 25 W. 43rd St., 4th Floor, New York, NY 10036.

[5] Available from the DOD's Assist internet site located at: http://assist.daps.dla.mil/online/start/.

[6] Available from Society of Automotive Engineers (SAE), 400 Commonwealth Dr., Warrendale, PA 15096-0001.

4.1.6 Required packaging.

## 5. Materials and Manufacture

5.1 *Material:*

5.1.1 *Outer Ring (Cup), Inner Ring (Cone) and Rollers*—Bearing quality, carburizing grade alloy or through-hardening grade alloy steel in accordance with SAE AMS-STD-66.

5.1.2 *Cage*—Carbon steel (stamped) or powdered process steel (for example, Sinta Forge) may be used.

## 6. Physical Properties

6.1 *Hardness*—Outer ring (cup), inner ring (cone) and rollers shall be hardened to 58 to 64 HRC.

## 7. Dimensions, Mass, and Permissible Variations

7.1 *Dimensions:*

7.1.1 Dimensions $D_b$, $D_a$, $d_b$, $d_a$ are recommended shaft and housing shoulder diameters.

7.1.2 Dimensions R and r are the maximum fillet radii on the shaft and the housing respectively, which will be cleared by the bearing corner. See Fig. 1 and Table 1.

7.2 *Tolerances*—Precision grade (Class B) shall be specified only when technically justified.

7.2.1 *Standard Grade (Class K)*—See Tables 2-5.

7.2.2 *Precision Grade (Class B)*—See Tables 6-9.

7.3 *Cage Clearance*— Designers should provide a clearance of 3.2 mm minimum between the outside edge of the cage and the housing counterbore.

## 8. Part Number

8.1 *Part Number*—The Part number shall consist of DS3225, followed by the dash number, followed by -K for a standard grade bearing or -B for a precision grade bearing.

8.1.1 *Examples:*

8.1.1.1 DS3225-15-K is a standard grade, 75 mm bore, 145 mm OD, 51 mm wide single row tapered roller bearing.

8.1.1.2 DS3225-15-B is a precision grade, 75 mm bore, 145 mm OD, 51 mm wide single row tapered roller bearing.

8.1.2 The ABMA (American Bearing Manufacturers Association) outer and inner numbers are for reference only and are not to be used for ordering purposes.

## 9. Lubrication

9.1 *Lubrication*—Unless specified otherwise, bearings shall be furnished without lubrication.

## 10. Preservation, Packaging and Packing

10.1 Packaging and packing shall be as specified in the acquisition document.

10.2 *Preservation:*

10.2.1 *Commercial Use*—Manufacturer shall coat bearing with rust preventative film.

10.2.2 *DoD Use*—Unless specified otherwise, bearings shall be furnished with preservative in accordance with MIL-C-11796, Class 3.

## 11. Keywords

11.1 bearing; DS3225; single row bearing; tapered roller bearing

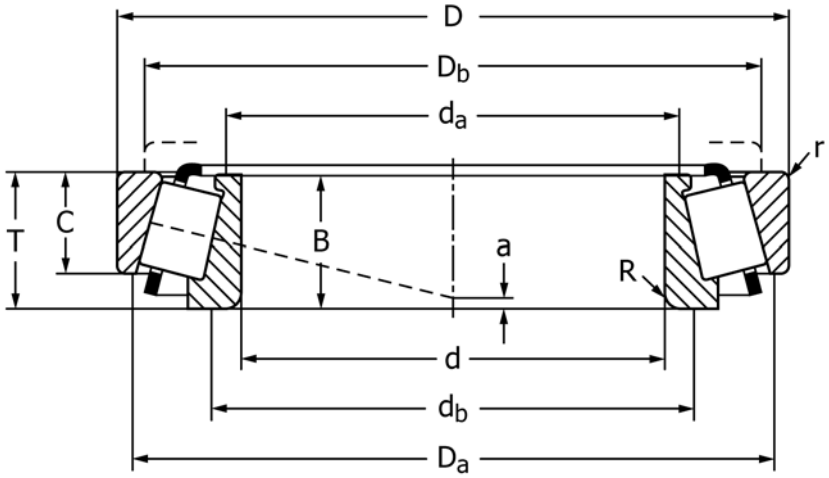


**FIG. 1 Schematic Drawing, Metric Series, Single Row, Tapered Roller Bearing**

**TABLE 1 Metric Series, Single Row, Tapered Roller Bearing Dimensions**

| Dash No. | ABMA Bearing Number (see 8.1) Outer (Cup) | Inner (Cone) | d Bore | D O.D. | T Brg. Width | B Inner (Cone) Width | C Outer (Cup) Width | R Max. Shaft Fillet Rad. | r Max. Hsg. Fillet Rad. | $d_b$ Recommended Shoulder Diameter Shaft | $d_a$ Recommended Shoulder Diameter Shaft | $D_b$ Recommended Shoulder Diameter Housing | $D_a$ Recommended Shoulder Diameter Housing | K Factor | Basic Dynamic Load Rating (kN) Radial | Basic Dynamic Load Rating (kN) Thrust | a Eff. Load Center |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | JLM104948 | JLM104910 | 50 | 82 | 21.5 | 21.5 | 17.0 | 3.0 | 0.5 | 60 | 55.0 | 76 | 78.0 | 1.91 | 15.0 | 7.85 | -5.4 |
| 2 | JM205149 | JM205110 | 50 | 90 | 28.0 | 28.0 | 23.0 | 3.0 | 2.5 | 63 | 57.0 | 80 | 85.0 | 1.78 | 22.2 | 12.45 | -7.6 |
| 3 | JHM807045 | JHM807012 | 50 | 105 | 37.0 | 36.0 | 29.0 | 3.0 | 2.5 | 69 | 63.0 | 90 | 100.0 | 1.20 | 31.8 | 26.6 | -7.5 |
| 4 | JLM506849 | JLM506810 | 55 | 90 | 23.0 | 23.0 | 18.5 | 1.5 | 0.5 | 63 | 61.0 | 82 | 86.0 | 1.45 | 16.85 | 11.65 | -2.8 |
| 5 | JM207049 | JM207010 | 55 | 95 | 29.0 | 29.0 | 23.5 | 1.5 | 2.5 | 64 | 62.0 | 85 | 91.0 | 1.74 | 24.0 | 13.8 | -7.6 |
| 6 | JH307749 | JH307710 | 55 | 110 | 39.0 | 39.0 | 32.0 | 3.0 | 2.5 | 71 | 64.1 | 97 | 104.0 | 1.69 | 37.8 | 22.4 | -11.7 |
| 7 | JLM508748 | JLM508710 | 60 | 95 | 24.0 | 24.0 | 19.0 | 5.0 | 2.5 | 75 | 66.0 | 85 | 91.0 | 1.45 | 18.2 | 12.6 | -2.7 |
| 8 | JLM710949 | JLM710910 | 65 | 105 | 24.0 | 23.0 | 18.5 | 3.0 | 1.0 | 78 | 72.0 | 96 | 100.5 | 1.29 | 19.8 | 15.35 | -0.3 |
| 9 | JM511946 | JM511910 | 65 | 110 | 28.0 | 28.0 | 22.5 | 3.0 | 2.5 | 78 | 72.0 | 99 | 105.0 | 1.45 | 26.2 | 18.0 | -3.4 |
| 10 | JH211749 | JH211710 | 65 | 120 | 39.0 | 38.5 | 32.0 | 3.0 | 2.5 | 80 | 74.0 | 107 | 114.0 | 1.73 | 41.0 | 23.6 | -10.8 |
| 11 | JLM813049 | JLM813010 | 70 | 110 | 26.0 | 25.0 | 20.5 | 1.0 | 2.5 | 78 | 77.0 | 98 | 105.0 | 1.20 | 22.0 | 18.2 | +0.4 |
| 12 | JM612949 | JM612910 | 70 | 115 | 29.0 | 29.0 | 23.0 | 3.0 | 2.5 | 83 | 77.0 | 103 | 110.0 | 1.36 | 27.4 | 20.2 | -2.5 |
| 13 | JLM714149 | JLM714110 | 75 | 115 | 25.0 | 25.0 | 19.0 | 3.0 | 2.5 | 87 | 81.0 | 104 | 110.0 | 1.27 | 22.0 | 17.3 | +0.4 |
| 14 | JM714249 | JM714210 | 75 | 120 | 31.0 | 29.5 | 25.0 | 3.0 | 2.5 | 88 | 82.9 | 108 | 115.0 | 1.31 | 30.2 | 23.0 | -2.0 |
| 15 | JH415647 | JH415610 | 75 | 145 | 51.0 | 51.0 | 42.0 | 3.0 | 2.5 | 94 | 89.0 | 129 | 139.0 | 1.61 | 65.5 | 40.6 | -14.4 |
| 16 | JM515649 | JM515610 | 80 | 130 | 35.0 | 34.0 | 28.5 | 3.0 | 2.5 | 94 | 88.0 | 117 | 125.0 | 1.50 | 38.0 | 25.4 | -5.2 |
| 17 | JM716649 | JM716610 | 85 | 130 | 30.0 | 29.0 | 24.0 | 3.0 | 2.5 | 98 | 92.0 | 117 | 125.0 | 1.31 | 31.6 | 24.0 | -0.2 |
| 18 | JHM516849 | JHM516810 | 85 | 140 | 39.0 | 38.0 | 31.5 | 3.0 | 2.5 | 100 | 94.0 | 125 | 134.0 | 1.43 | 45.5 | 32.0 | -5.9 |
| 19 | JH217249 | JH217210 | 85 | 150 | 46.0 | 46.0 | 38.0 | 3.0 | 2.5 | 101 | 95.0 | 134 | 142.0 | 1.76 | 62.0 | 35.2 | -11.9 |
| 20 | JM718149 | JM718110 | 90 | 145 | 35.0 | 34.0 | 27.0 | 3.0 | 2.5 | 106 | 99.0 | 131 | 138.8 | 1.31 | 42.0 | 32.0 | -2.0 |
| 21 | JHM318448 | JHM318410 | 90 | 155 | 44.0 | 44.0 | 35.5 | 3.0 | 2.5 | 106 | 100.0 | 140 | 148.0 | 1.71 | 61.0 | 35.8 | -10.0 |
| 22 | JM719149 | JM719113 | 95 | 150 | 35.0 | 34.0 | 27.0 | 3.0 | 2.5 | 109 | 104.0 | 135 | 143.0 | 1.32 | 41.6 | 31.6 | -1.6 |
| 23 | JM720249 | JM720210 | 100 | 155 | 36.0 | 35.0 | 28.0 | 3.0 | 2.5 | 115 | 109.0 | 140 | 149.0 | 1.24 | 44.8 | 36.2 | +0.3 |
| 24 | JHM720249 | JHM720210 | 100 | 160 | 41.0 | 40.0 | 32.0 | 3.0 | 2.5 | 117 | 109.4 | 143 | 153.9 | 1.24 | 54.5 | 43.8 | -2.5 |
| 25 | JM822049 | JM822010 | 110 | 165 | 35.0 | 35.0 | 26.5 | 3.0 | 2.5 | 125 | 119.0 | 149 | 159.0 | 1.18 | 45.0 | 38.2 | +3.0 |
| 26 | JHM522649 | JHM522610 | 110 | 180 | 47.0 | 46.0 | 38.0 | 3.0 | 2.5 | 127 | 122.0 | 162 | 172.0 | 1.44 | 72.0 | 50.0 | -6.0 |
| 27 | JHM534149 | JHM534110 | 170 | 230 | 39.0 | 38.0 | 31.0 | 3.0 | 2.5 | 184 | 178.0 | 217 | 224.0 | 1.52 | 69.0 | 45.5 | +4.6 |
| 28 | JM344449 | JM734410 | 170 | 240 | 46.0 | 44.5 | 37.0 | 3.0 | 2.5 | 185 | 180.0 | 222 | 232.0 | 1.34 | 88.5 | 66.0 | +5.0 |
| 29 | JM736149 | JM736110 | 180 | 250 | 47.0 | 45.0 | 37.0 | 3.0 | 2.5 | 196 | 190.5 | 232 | 242.6 | 1.22 | 91.5 | 75.0 | +9.0 |
| 30 | JM738249 | JM738210 | 190 | 260 | 46.0 | 44.0 | 36.5 | 3.0 | 2.5 | 206 | 200.0 | 242 | 252.0 | 1.22 | 85.5 | 70.0 | +10.8 |
| 31 | JHM840449 | JHM840410 | 200 | 300 | 65.0 | 62.0 | 51.0 | 3.5 | 2.5 | 223 | 214.8 | 273 | 288.9 | 1.12 | 147.5 | 132.0 | +8.1 |

**TABLE 2 Inner Ring (Cone) Bore Tolerance (Class K)**

| Inner Ring Bore (d) | | | |
|---|---|---|---|
| Size Range, mm | | Tolerance, µm | |
| Over | Incl. | Plus | Minus |
| 30 | 50 | 0 | -12 |
| 50 | 80 | 0 | -15 |
| 80 | 120 | 0 | -20 |
| 120 | 180 | 0 | -25 |
| 180 | 250 | 0 | -30 |

**TABLE 3 Outer Ring (Cup) Outside Diameter Tolerance (Class K)**

| Outer Ring O.D. (D) | | | |
|---|---|---|---|
| Size Range, mm | | Tolerance, µm | |
| Over | Incl. | Plus | Minus |
| 80 | 120 | 0 | -18 |
| 120 | 150 | 0 | -20 |
| 150 | 180 | 0 | -25 |
| 180 | 250 | 0 | -30 |
| 250 | 315 | 0 | -35 |

**TABLE 4 Bearing Overall Width Tolerance (Class K)**

| Bearing Width (T) | | | |
|---|---|---|---|
| Bore Size Range, mm | | Tolerance, µm | |
| Over | Incl. | Plus | Minus |
| 18 | 80 | 200 | 0 |
| 80 | 120 | 200 | -200 |
| 120 | 250 | 350 | -250 |

**TABLE 5 Maximum Radial Runout of Assembled Bearing (Class K)**

| Maximum Radial Runout | | |
|---|---|---|
| Outer Ring O.D. (D), mm | | Tolerance, µm |
| Over | Incl. | |
| 80 | 180 | 35 |
| 120 | 150 | 40 |
| 150 | 180 | 45 |
| 180 | 250 | 50 |
| 250 | 315 | 60 |

**TABLE 6 Inner Ring (Cone) Bore Tolerance (Class B)**

| Inner Ring Bore (d) | | | |
|---|---|---|---|
| Size Range, mm | | Tolerance, µm | |
| Over | Incl. | Plus | Minus |
| 30 | 50 | 0 | -8 |
| 50 | 80 | 0 | -9 |
| 80 | 120 | 0 | -10 |
| 120 | 180 | 0 | -13 |
| 180 | 315 | 0 | -15 |

**TABLE 7 Outer Ring (Cup) Outside Diameter Tolerance (Class B)**

| Outer Ring (Cup) O.D. (D) | | | |
|---|---|---|---|
| Size Range, mm | | Tolerance, µm | |
| Over | Incl. | Plus | Minus |
| 80 | 120 | 0 | -10 |
| 120 | 150 | 0 | -11 |
| 150 | 180 | 0 | -13 |
| 180 | 250 | 0 | -15 |
| 250 | 315 | 0 | -18 |

**TABLE 8 Bearing Overall Width Tolerance (Class B)**

| Bearing Width (T) | | | |
|---|---|---|---|
| Bore Size Range, mm | | Tolerance, µm | |
| Over | Incl. | Plus | Minus |
| 18 | 120 | 200 | -200 |
| 120 | 180 | 200 | -250 |
| 180 | 250 | 200 | -300 |

**TABLE 9 Maximum Radial Runout of Assembled Bearing (Class B)**

| Maximum Radial Runnout | | |
|---|---|---|
| Outer Ring O.D. (D), mm | | Tolerance, µm |
| Over | Incl. | |
| 80 | 180 | 4.0 |
| 180 | 315 | 5.0 |

# APPENDIX

**(Nonmandatory Information)**

## X1. BEARING LOAD RATINGS AND RATING LIFE

### X1.1 Basic Dynamic Load Rating

X1.1.1 The Basic Dynamic Load Rating is that constant stationary load which a group of apparently identical bearings with stationary outer rings (cups) can endure for a rating life of 90 million revolutions of the inner ring (cone). The basic dynamic load ratings listed herein are based on a rated life of 90 million revolutions or 3000 h at 500 revolutions per min.

X1.1.2 To compare the load ratings in this specification with other load ratings whose basis for ratings are other than 90 million revolution or 3000 h at 500 rpm, use the following formula:

$$C = \text{Other Bearing Load Rating} \times (R_1/500)^{1/f} \times (H_1/3000)^{1/f} \quad \text{(X1.1)}$$

where:

$R_1$ = rotational speed (in rpm) at which other bearing is rated,
$H_1$ = hours at which other bearing is rated, and
$f$ = other bearing fatigue factor.

### X1.2 Rating Life (Hours)

X1.2.1 The rating life is the number of hours at some constant speed of the inner ring (cone) that 90 % of a group of

apparently identical bearings will complete or exceed before first evidence of fatigue develops. The magnitude of the rated life in hours is found from the following:

$$L10 = \left[\left(1.5 \times 10^6\right)/R\right] \times \left(C/P\right)^{10/3} \text{ h} \qquad \text{(X1.2)}$$

where:

$C$ = basic dynamic load rating,

$P$ = equivalent load (combined radial and thrust load) kN, and

$R$ = rotational speed, in revolutions per minute.

X1.2.2 The average life is approximately four times the rated life.