

ANSI/ABMA 25.2

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ANSI/AFBMA  
Std. 25.2-1990

# **AMERICAN NATIONAL STANDARD AFBMA STANDARD**

## **ROLLING BEARINGS, LINEAR MOTION RECIRCULATING BALL, SLEEVE TYPE INCH SERIES**

Sponsored by

**The Anti-Friction Bearing  
Manufacturers Association, Inc.**

Approved November 16, 1990

**American National Standards Institute, Inc.**

## American National Standard

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### FOREWORD

(This foreword is not part of ANSI/AFBMA Standard 25.2, Rolling Bearings, Linear Motion, Recirculating Ball, Sleeve Type-Inch Series.)

This American National Standard specifies boundary dimensions and tolerances for inch design, sleeve type linear motion ball bearings with recirculating balls.

Suggestions for the improvement of this standard gained through experience with its use will be welcomed. These should be sent to the American National Standards Institute, Inc., 1430 Broadway, New York, NY 10018.

The officers of Accredited Standards Committee B3 of the American National Standards Institute and the organizations represented at the time this standard was submitted are as follows:

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# AFBMA Standards for Ball and Roller Bearings

- 1 —Terminology for Anti-Friction Ball and Roller Bearings and Parts
- 4 —Tolerance Definitions and Gauging Practices for Ball and Roller Bearings
- 7 —Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundary Plans
- 8.1 —Mounting Accessories, Metric Design
- 8.2 —Mounting Accessories, Inch Design
- 9 —Load Ratings and Fatigue Life for Ball Bearings
- 10 —Metal Balls
- 11 —Load Ratings and Fatigue Life for Roller Bearings
- 12.1 —Instrument Ball Bearings, Metric Design
- 12.2 —Instrument Ball Bearings, Inch Design
- 13 —Rolling Bearing Vibration and Noise (Methods of Measuring)
- 14 —Housings for Bearings with Spherical Outside Surfaces
- 15 —Ball Bearings with Spherical Outside Surfaces and Extended Inner Ring Width (Includes Eccentric Locking Collars)
- 16.1 —Airframe Ball, Roller, and Needle Roller Bearings, Metric Design
- 16.2 —Airframe Ball, Roller, and Needle Roller Bearings, Inch Design
- 17 —Needle Rollers, Metric Design
- 18.1 —Needle Roller Bearings, Radial, Metric Design
- 18.2 —Needle Roller Bearings, Radial, Inch Design
- 19 —Tapered Roller Bearings, Radial, Inch Design
- 19.1 —Tapered Roller Bearings, Radial, Metric Design
- 20 —Radial Bearings of Ball, Cylinder Roller and Spherical Roller Types, Metric Design
- 21.1 —Thrust Needle Roller and Cage Assemblies and Thrust Washers, Metric Design
- 21.2 —Thrust Needle Roller and Cage Assemblies and Thrust Washers, Inch Design
- 22.1 —Spherical Plain Radial Bearings, Joint Type—Metric Design
- 22.2 —Spherical Plain Radial Bearings, Joint Type—Inch Design
- 23.2 —Thrust Bearings of Tapered Roller Type—Inch Design
- 24.1 —Thrust Bearings of Ball, Cylindrical Roller and Spherical Roller Types—Metric Design
- 24.2 —Thrust Bearings of Ball and Cylindrical Roller Types—Inch Design
- 25.2 —Rolling Bearings, Linear Motion, Recirculating Ball, Sleeve Type—Inch Series

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# ROLLING BEARINGS, LINEAR MOTION RECIRCULATING BALL, SLEEVE TYPE INCH SERIES

## CONTENTS

Section	Page
1. Introduction . . . . .	1
2. Scope . . . . .	1
3. References . . . . .	1
4. Terminology . . . . .	1
4.1 Definitions . . . . .	1
4.2 Symbols . . . . .	1
5. Boundary Dimensions . . . . .	2
6. Tolerances . . . . .	2

## LIST OF TABLES

Table Number	Page
BOUNDARY DIMENSIONS	
1. Rolling Bearings, Linear Motion, Recirculating Ball, Sleeve Type	
Part 1 Dimensions in millimetres . . . . .	3
Part 2 Dimensions in inches . . . . .	3
TOLERANCES	
2. Tolerance Class L9	
Part 1 Dimensions in millimetres . . . . .	4
Part 2 Dimensions in inches . . . . .	4
3. Tolerance Class L7	
Part 1 Dimensions in millimetres . . . . .	4
Part 2 Dimensions in inches . . . . .	4
4. Tolerance Class L7A	
Part 1 Dimensions in millimetres . . . . .	5
Part 2 Dimensions in inches . . . . .	5
5. Tolerance Class L6	
Part 1 Dimensions in millimetres . . . . .	6
Part 2 Dimensions in inches . . . . .	6

# LIST OF FIGURES

**Figure  
Number**

**Page**

- |   |   |
|---|---|
| 1. Symbols for Boundary Dimensions. . . . . | 2 |
|---|---|



# ROLLING BEARINGS LINEAR MOTION, RECIRCULATING BALL, SLEEVE TYPE-INCH SERIES

## 1. INTRODUCTION

Linear motion bearings provide for rectilinear motion as opposed to rotational motion. The type of bearing described in this standard uses balls which circulate in a number of closed loops in the cylindrical bearing body which surrounds the shaft. See Figure 1.

Linear bearings are typically applied to meet one or more of the following criteria:

- a. Smooth anti-friction motion, free from stick-slip or chatter.
- b. Low force required to produce relative linear motion between the bearing and shaft.

These requirements, as well as others, can be met by appropriate use of the various linear bearing types (closed type, adjustable type, open type). The appropriate selection of bearing type and specification should be established between the manufacturer and the user.

## 2. SCOPE

This Standard gives the general plan for boundary dimensions, tolerances and terminology for recirculating ball, sleeve type, linear motion bearings.

This standard applies only to the size range covered by Table 1, Boundary Dimensions.

## 3. REFERENCES

ANSI/AFBMA Standard 1—Terminology for Anti-Friction Ball and Roller Bearings

ANSI/AFBMA Standard 4—Tolerance Definitions and Gauging Practices for Ball and Roller Bearings

## 4. TERMINOLOGY

### 4.1 Definitions

For the purposes of this National Standard, the following definitions apply:

**4.1.1 Linear bearing**—A basically cylindrical sleeve with a number of closed loops of circulating balls which is designed to achieve linear rolling motion along a shaft.

**4.1.2 Shaft**—The hardened cylindrical rod along which a linear bearing traverses.

**4.1.3 Nominal outside diameter**—The diameter of the cylinder containing the theoretical surface of a basically cylindrical outside surface.

**4.1.4 Nominal ball complement bore diameter**—The diameter of the cylinder inscribed inside the inner balls.

**4.1.5 Nominal bearing width**—Distance between two theoretical end faces designated to bound the width of the linear motion rolling bearing.

**4.1.6 Radial runout**—The difference between the largest and the smallest radial distance between the outside surface of the cylindrical sleeve and the centerline of the ball complement bore diameter.

**4.1.7 Closed type**—That type in which the outer sleeve is continuous, or virtually continuous, whereby adjustment of clearance between the ball complement bore and the shaft can be achieved only by selection of the housing fit, shaft precision class, and the bearing.

**4.1.8 Adjustable type**—That type which has elastic features which permit mechanical adjustment of the clearance between the ball complement bore and the shaft.

**4.1.9 Open type**—That type in which a longitudinal section is removed to provide clearance over shaft support rails.

### 4.2 Symbols

See Figure 1.

$F_w$  —Nominal ball complement bore diameter.

$F_{w \min}$  —Smallest single diameter of the ball complement bore.

- $\Delta F_{w \min}$  — Deviation of the smallest single diameter ball complement bore from the nominal ball complement bore diameter (difference between  $F_{w \min}$  and  $F_w$ ).
- $D$  — Nominal outside diameter.
- $D_{mp}$  — Single plane mean outside diameter.
- $\Delta D_{mp}$  — Single plane mean outside diameter deviation from the nominal outside diameter (difference between  $D_{mp}$  and  $D$ ).
- $D_1$  — Snap ring groove diameter.
- $C$  — Nominal bearing width.
- $C_s$  — Single bearing width.
- $\Delta C_s$  — Deviation of a single bearing width from nominal bearing width (difference between  $C_s$  and  $C$ ).
- $C_1$  — Nominal distance between the outer faces of the snap ring grooves. Symmetrical with respect to the bearing width.
- $C_{1s}$  — Single distance between the outer faces of the snap ring grooves.
- $\Delta C_{1s}$  — Deviation of a single distance between the outer faces of the snap ring grooves from the nominal snap ring groove distance (difference between  $C_{1s}$  and  $C_1$ ).

- $C_2$  — Nominal snap ring groove width.
- $C_3$  — Nominal bearing width with external seals.
- $E$  — Width of the sector opening at diameter  $F_w$  in the open type bearing.
- $E_1$  — Width of the longitudinal cut in the adjustable type steel bearing.
- $K_{ea}$  — Radial runout of assembled bearing.
- $\alpha$  — Included angle of the sector opening in an open type bearing.

## 5. Boundary Dimensions

The boundary dimensions are given by Table 1.

## 6. Tolerances

The classes of precision to which the linear motion rolling bearings are manufactured are known as L9, L7, L7A and L6. The tolerances are tabulated in Tables 2 through 5.

Tolerance classes L9, L7 and L6 are applicable to the closed type. Tolerance class L7A is applicable to the adjustable and open types

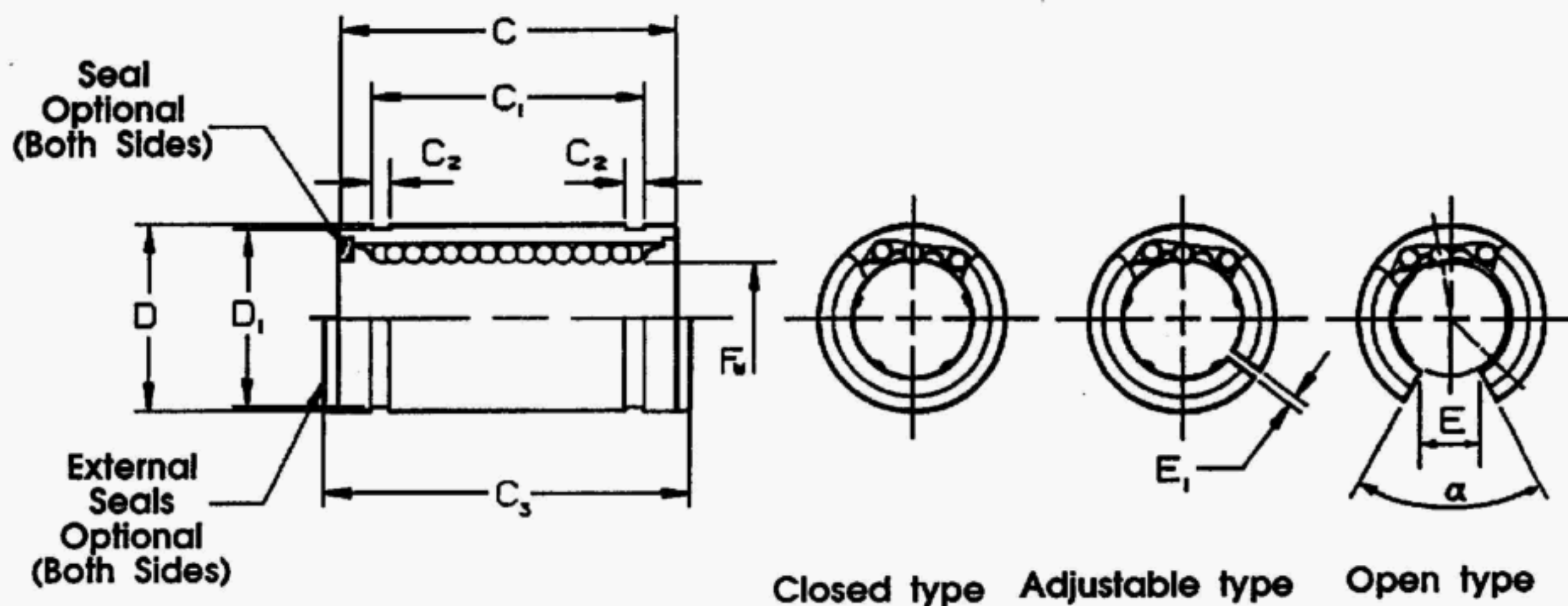


Figure 1 Symbols for boundary dimensions

**Note:** Retaining ring grooves are located symmetrically within the width of the sleeve.



TABLE 1  
Rolling Bearings, Linear Motion, Recirculating Ball, Sleeve Type  
Boundary Dimensions

Part 1

Dimensions in Millimetres, Angles in Degrees

					Optional					
F <sub>w</sub>	D	D <sub>1 max</sub>	C	C <sub>1 min</sub>	C <sub>1 min</sub>	C <sub>2 min</sub>	C <sub>3 max</sub>	E <sub>1 min</sub>	E <sub>min</sub>	α <sub>min</sub>
3.175	7.938	7.366	12.700	9.119		0.711				
4.762	9.525	8.941	14.275	10.693		0.711				
6.350	12.700	12.014	19.050	12.725	12.725	0.991	23.825			
9.525	15.875	15.189	22.225	15.900	17.501	0.991	26.975	0.787		
12.700	22.225	21.539	31.750	24.206	25.705	1.168	38.100	0.965	7.137	50
15.875	28.575	27.178	38.100	27.788	27.661	1.422	44.450	1.194	9.525	45
19.050	31.750	30.353	41.275	29.362	31.725	1.422	47.625	1.194	10.312	40
25.400	39.688	38.252	57.150	44.247	47.320	1.727	66.675	1.397	14.300	40
31.750	50.800	48.514	66.675	50.546		1.727	79.375	1.600	15.875	40
38.100	60.325	57.531	76.200	60.884		2.184	87.325	1.600	19.050	40
50.800	76.200	73.304	101.600	80.696		2.616	120.650	2.388	25.400	50
63.500	95.250	90.856	127.000	100.559		3.048	146.050	2.769	31.750	50
76.200	114.300	109.626	152.400	119.609		3.048	177.800	3.175	38.100	50
101.600	152.400	146.126	203.200	158.445		3.531	228.600	3.175	50.800	50

Part 2

Dimensions in Inches, Angles in Degrees

					Optional					
F <sub>w</sub>	D	D <sub>1 max</sub>	C	C <sub>1 min</sub>	C <sub>1 min</sub>	C <sub>2 min</sub>	C <sub>3 max</sub>	E <sub>1 min</sub>	E <sub>min</sub>	α <sub>min</sub>
0.1250	0.3125	0.290	0.500	0.359		0.028				
0.1875	0.3750	0.352	0.562	0.421		0.028				
0.2500	0.5000	0.473	0.750	0.501	0.501	0.039	0.938			
0.3750	0.6250	0.598	0.875	0.626	0.689	0.039	1.062	0.031		
0.5000	0.8750	0.848	1.250	0.953	1.012	0.046	1.500	0.038	0.281	50
0.6250	1.1250	1.070	1.500	1.094	1.089	0.056	1.750	0.047	0.375	45
0.7500	1.2500	1.195	1.625	1.156	1.249	0.056	1.875	0.047	0.406	40
1.0000	1.5625	1.506	2.250	1.742	1.863	0.068	2.625	0.055	0.563	40
1.2500	2.0000	1.910	2.625	1.990		0.068	3.125	0.063	0.625	40
1.5000	2.3750	2.265	3.000	2.397		0.086	3.438	0.063	0.750	40
2.0000	3.0000	2.886	4.000	3.177		0.103	4.750	0.094	1.000	50
2.5000	3.7500	3.577	5.000	3.959		0.120	5.750	0.109	1.250	50
3.0000	4.5000	4.316	6.000	4.709		0.120	7.000	0.125	1.500	50
4.0000	6.0000	5.753	8.000	6.238		0.139	9.000	0.125	2.000	50

NOTE: For the open and adjustable types, D and D<sub>1 max</sub> dimensions apply after sleeves are split and/or fitted into thick section ring gage D with zero deviation.

**TABLE 2**  
 Rolling Bearings, Linear Motion, Recirculating Ball, Sleeve Type  
 Tolerances for Ball Complement Bore Diameter, Outside Diameter,  
 Width and Snap Ring Groove Location  
 Tolerance Class L9  
 For Use With Closed Types

## Part 1

Tolerances in Millimetres

$F_w$		$\Delta F_{w \min}$		$\Delta D_{mp}$		$\Delta C_s$		$\Delta C_{1s}$	
Over	Incl.	High	Low	High	Low	High	Low	High	Low
—	12.700	+0.051	0	0	-0.038	0	-0.508	+0.305	0
12.700	15.875	+0.051	0	0	-0.051	0	-0.508	+0.305	0
15.875	25.400	+0.051	0	0	-0.051	0	-0.635	+0.305	0
25.400	38.100	+0.051	0	0	-0.051	0	-0.762	+0.457	0

## Part 2

Tolerances in Inches

$F_w$		$\Delta F_{w \min}$		$\Delta D_{mp}$		$\Delta C_s$		$\Delta C_{1s}$	
Over	Incl.	High	Low	High	Low	High	Low	High	Low
—	0.5000	+0.002	0	0	-0.0015	0	-0.020	+0.012	0
0.5000	0.6250	+0.002	0	0	-0.002	0	-0.020	+0.012	0
0.6250	1.0000	+0.002	0	0	-0.002	0	-0.025	+0.012	0
1.0000	1.5000	+0.002	0	0	-0.002	0	-0.030	+0.018	0

**TABLE 3**  
 Rolling Bearings, Linear Motion, Recirculating Ball, Sleeve Type  
 Tolerances for Ball Complement Bore Diameter, Outside Diameter,  
 Width and Snap Ring Groove Location  
 Tolerance Class L7  
 For Use with Closed Types

## Part 1

Tolerances in Millimetres

$F_w$		$\Delta F_{w \min}$		$\Delta D_{mp}$		$\Delta C_s$		$\Delta C_{1s}$		Optional $\Delta C_{1s}$	
Over	Incl.	High	Low	High	Low	High	Low	High	Low	High	Low
—	9.525	0	-0.013	0	-0.010	0	-0.381	+0.305	0	+0.305	0
9.525	25.400	0	-0.013	0	-0.010	0	-0.381	+0.305	0	+0.559	0
25.400	38.100	0	-0.015	0	-0.013	0	-0.508	+0.457	0		
38.100	50.800	0	-0.020	0	-0.015	0	-0.508	+0.457	0		
50.800	63.500	0	-0.025	0	-0.020	0	-0.635	+0.457	0		
63.500	76.200	0	-0.030	0	-0.025	0	-0.762	+0.457	0		
76.200	101.600	0	-0.051	0	-0.030	0	-1.016	+0.610	0		

## Part 2

Tolerances in Inches

$F_w$		$\Delta F_{w \min}$		$\Delta D_{mp}$		$\Delta C_s$		$\Delta C_{1s}$		Optional $\Delta C_{1s}$	
Over	Incl.	High	Low	High	Low	High	Low	High	Low	High	Low
—	0.3750	0	-0.0005	0	-0.0004	0	-0.015	+0.012	0	+0.012	0
0.375	1.0000	0	-0.0005	0	-0.0004	0	-0.015	+0.012	0	+0.022	0
1.0000	1.5000	0	-0.0006	0	-0.0005	0	-0.020	+0.018	0		
1.5000	2.0000	0	-0.0008	0	-0.0006	0	-0.020	+0.018	0		
2.0000	2.5000	0	-0.0010	0	-0.0008	0	-0.025	+0.018	0		
2.5000	3.0000	0	-0.0012	0	-0.0010	0	-0.030	+0.018	0		
3.0000	4.0000	0	-0.0020	0	-0.0012	0	-0.040	+0.024	0		

TABLE 4  
Rolling Bearings, Linear Motion, Recirculating Ball, Sleeve Type  
Tolerances for Ball Complement Bore Diameter, Outside Diameter,  
Width and Snap Ring Groove Location  
Tolerance Class L7A<sup>(1)</sup>  
For Use with Adjustable and Open Types

Part 1

Tolerances in Millimetres

$F_w$		$\Delta F_{w \min}^{(2)}$		$\Delta C_s$		$\Delta C_{1s}$		Optional $\Delta C_{1s}$	
Over	Incl.	High	Low	High	Low	High	Low	High	Low
—	9.525	+0.013	−0.013	0	−0.381	+0.305	0	+0.305	0
9.525	25.400	+0.013	−0.013	0	−0.381	+0.305	0	+0.559	0
25.400	38.100	+0.015	−0.015	0	−0.508	+0.457	0		
38.100	50.800	+0.020	−0.020	0	−0.508	+0.457	0		
50.800	63.500	+0.025	−0.025	0	−0.635	+0.457	0		
63.500	76.200	+0.030	−0.030	0	−0.762	+0.457	0		
76.200	101.600	+0.051	−0.051	0	−1.016	+0.610	0		

Part 2

Tolerances in Inches

$F_w$		$\Delta F_{w \min}^{(2)}$		$\Delta C_s$		$\Delta C_{1s}$		Optional $\Delta C_{1s}$	
Over	Incl.	High	Low	High	Low	High	Low	High	Low
—	0.3750	+0.0005	−0.0005	0	−0.015	+0.012	0	+0.012	0
0.3750	1.0000	+0.0005	−0.0005	0	−0.015	+0.012	0	+0.022	0
1.0000	1.5000	+0.0006	−0.0006	0	−0.020	+0.018	0		
1.5000	2.0000	+0.0008	−0.0008	0	−0.020	+0.018	0		
2.0000	2.5000	+0.0010	−0.0010	0	−0.025	+0.018	0		
2.5000	3.0000	+0.0012	−0.0012	0	−0.030	+0.018	0		
3.0000	4.0000	+0.0020	−0.0020	0	−0.040	+0.024	0		

NOTE: 1) Tolerance Class L7 has been further subdivided into tolerances as applied to closed bearings and as applied to open or adjustable bearings. Those tolerances pertaining to open or adjustable types are suffixed by the letter A such as L7A.

2) For adjustable and open types,  $\Delta F_{w \min}$  applies to values after the sleeves are split and/or fitted into ring gage D with zero deviation.



TABLE 5  
Rolling Bearings, Linear Motion, Recirculating Ball, Sleeve Type  
Tolerances for Ball Complement Bore Diameter, Outside Diameter, Width,  
Snap Ring Groove Location and Radial Runout  
Tolerance Class L6  
For Use with Closed Types

Part 1

Tolerances in Millimetres

$F_w$		$\Delta F_{w \min}$		$\Delta D_{mp}$		$\Delta C_s$		$\Delta C_{is}$		$K_{ss}$
Over	Incl.	High	Low	High	Low	High	Low	High	Low	Max
—	25.400	0	−0.008	0	−0.010	0	−0.381	+0.305	0	0.013
25.400	38.100	0	−0.010	0	−0.013	0	−0.508	+0.457	0	0.025
38.100	50.800	0	−0.010	0	−0.015	0	−0.508	+0.457	0	0.025
50.800	63.500	0	−0.013	0	−0.020	0	−0.635	+0.457	0	0.038
63.500	76.200	0	−0.015	0	−0.025	0	−0.762	+0.457	0	0.038
76.200	101.600	0	−0.025	0	−0.030	0	−1.016	+0.610	0	0.051

Part 2

Tolerances in Inches

$F_w$		$\Delta F_{w \min}$		$\Delta D_{mp}$		$\Delta C_s$		$\Delta C_{is}$		$K_{ss}$
Over	Incl.	High	Low	High	Low	High	Low	High	Low	Max
—	1.0000	0	−0.0003	0	−0.0004	0	−0.015	+0.012	0	0.0005
1.0000	1.5000	0	−0.0004	0	−0.0005	0	−0.020	+0.018	0	0.0010
1.5000	2.0000	0	−0.0004	0	−0.0006	0	−0.020	+0.018	0	0.0010
2.0000	2.5000	0	−0.0005	0	−0.0008	0	−0.025	+0.018	0	0.0015
2.5000	3.0000	0	−0.0006	0	−0.0010	0	−0.030	+0.018	0	0.0015
3.0000	4.0000	0	−0.0010	0	−0.0012	0	−0.040	+0.024	0	0.0020

# American National Standards

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The Standards Institute provides the machinery for creating voluntary standards. It serves to eliminate duplication of standards activities and to weld conflicting standards into single, nationally accepted standards under the designation "American National Standards."

Each standard represents general agreement among maker, seller, and user groups as to the best current practice with regard to some specific problem. Thus the completed standards cut across the whole fabric of production, distribution, and consumption of goods and services. American National Standards, by reason of Institute procedures, reflect a national consensus of manufacturers, consumers, and scientific, technical, and professional organizations, and governmental agencies. The completed standards are used widely by industry and commerce and often by municipal, state, and federal governments.

The Standards Institute, under whose auspices this work is being done, is the United States clearinghouse and coordinating body for voluntary standards activity on the national level. It is a federation of trade associations, technical societies, professional groups, and consumer organizations. Some 1000 companies are affiliated with the Institute as company members.

The American National Standards Institute is the United States member of the International Organization for Standardization (ISO) and the International Electrotechnical Commission (IEC). Through these channels U.S. standards interests make their positions felt on the international level. American National Standards are on file in the libraries of the national standards bodies of more than 60 countries.

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