

ANSI/ABMA 22.1

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Army - AT
Navy - AS
Air Force - 99

Adopting Activity:
DLA-IS

(Project 3110-0971)

AMSC N/A

FSC 3110

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ANSI/AFBMA
Std. 22.1-1989

AMERICAN NATIONAL STANDARD
AFBMA STANDARD

SPHERICAL PLAIN RADIAL BEARINGS,
JOINT TYPE
METRIC DESIGN

Sponsor
**The Anti-Friction Bearing
Manufacturers Association**

Approved June 30, 1989
American National Standards Institute, Inc.

American National Standard

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Published by

**The Anti-Friction Bearing Manufacturers Association, Inc.
1101 Connecticut Ave. N.W., Suite 700
Washington, D.C. 20036**

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FOREWORD

(This foreword is not a part of American National Standard for Spherical Plain Bearings, Joint Type – Metric Design, ANSI/AFBMA Standard 22.1 – 1989)

This standard covers metric design spherical plain bearings of types which are presently in production in the U.S.A.

Typical utilization of swaged bearings, Series 1 and 2 in this Standard, includes airframe control surfaces, involving high load, oscillation and misalignment, normally with intermittent operation.

The typical use of fractured bearings, Series E & G in this Standard, involves slow rotation or oscillation with medium or heavy misaligned loading. The boundary dimensions and tolerances for these bearings conform to ISO 6124/1 and ISO 6125.

The dimensions and tolerances stated in this standard are based on metric units and are found in Part I of the various tables. A soft conversion to U.S. customary (inch-pound) units is provided in Part II of the various tables for the convenience of the user.

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, N.Y. 10018.

The officers of Sectional 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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Hydraulic Institute
National Machine Tool Builders Association
Society of Automotive Engineers
Society of Tribologists and Lubrication Engineers
U.S. Department of Defense, DISC
U.S. Department of the Navy

AFBMA Standards for Ball and Roller Bearings and Balls

- 1 — Terminology
- 4 — Tolerance Definitions and Gaging Practices
- 7 — Shaft and Housing Fits for Metric Radial Ball and Roller Bearings (Except Tapered Roller Bearings) Conforming to Basic Boundary Plans
- 8.1 — Ball and Roller Bearing Mounting Accessories, Metric Design
- 8.2 — Ball and Roller Bearing 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
- 14 — Housing 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 Cylindrical 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

An AFBMA Standard is intended as a guide to aid the manufacturer, the consumer and the general public. The existence of an AFBMA Standard does not in any respect preclude anyone, whether he has approved the Standard or not from manufacturing, marketing, purchasing, or using products, processes, or procedures not conforming to the standard. AFBMA Standards are subject to revision or withdrawal at any time and users who refer to an AFBMA Standard should satisfy themselves that they have the latest information from the Association.

SPHERICAL PLAIN RADIAL BEARINGS, JOINT TYPE

Metric Design

CONTENTS

Section	Page
1. Scope	1
2. Reference ANSI/AFBMA Standards	1
3. Terminology	1
4. Symbols	3
5. Boundary Dimensions	4
6. Tolerances	12
List of Tables	iii

LIST OF TABLES

Table No.	Page
BOUNDARY DIMENSIONS	
1 Series 1, Swaged Style – Narrow with Chamfered Outer Ring or Face Groove Outer Ring	
Dimensions shown in millimetres	4
Dimensions shown in inches	5
2 Series 2, Swaged Style – Wide with Chamfered Outer Ring or Face Groove Outer Ring	
Dimensions shown in millimetres	6
Dimensions shown in inches	7
3 Series E & G, Fractured Style	
Part 1 – Dimensions shown in millimetres	8
Part 2 – Dimensions shown in inches	10
BEARING TOLERANCES	
4 Series 1 & 2, Swaged Style – Narrow & Wide	12
5 Series E & G, Fractured Style – Wide	14

SPHERICAL PLAIN RADIAL BEARINGS, JOINT TYPE

Metric Design

1. SCOPE

1.1 General. This standard for spherical bearings, joint type (without rolling elements) has been established for the purpose of defining the characteristics of these bearings such as boundary dimensions, tolerances and terminology. This style of bearing consists of an outer ring having an inner concave sphered sliding contact surface and an inner ring having a matched outer convex sphered sliding contact surface. Two general styles, related to manufacturing method are included, swaged (1.2) and fractured (1.3).

1.2 Swaged. This style of bearing is manufactured utilizing a "swaging" or forming of the outer ring over the inner ring (ball). These bearings are Series 1 and 2 in this Standard.

1.3 Fractured. This style of bearing has the outer ring split or fractured in one position to facilitate manufacturing assembly of the rings. These bearings are Series 3 in this Standard.

2. REFERENCE ANSI/AFBMA STANDARDS

2.1 ANSI/AFBMA Std. 4, Tolerance Definitions and Gaging Practices for Ball and Roller Bearings.

3. TERMINOLOGY

3.1 Types of Bearings

3.1.1 Spherical Plain Bearing, Joint Type. A spherical plain bearing designed primarily to accommodate oscillatory, tilting and low speed rotational movements. Sliding motion is accommodated at the spherical contact surface and/or at the inner ring bore.

3.1.1.1 Spherical Plain Radial Bearings. A spherical plain bearing intended to support radial load.

3.1.1.2 Spherical Plain Angular Contact Bearing. A spherical plain bearing intended to support a combination of radial and axial loads. (Not covered by this Standard at this time.)

3.1.1.3 Spherical Plain Thrust Bearing. A spherical plain bearing intended to support primarily axial load. (Not covered by this Standard at this time.)

3.2 Bearing Components

3.2.1 Inner Ring. That part of a spherical plain bearing, joint type, having a convex sphered outer surface and a cylindrical inside surface.

3.2.2 Outer Ring. That part of a spherical plain bearing, joint type, having a concave sphered inner surface and a cylindrical outside surface.

3.2.2.1 One Piece Outer Ring. An outer ring manufactured and assembled in one piece, i.e., not divided or split in any way.

3.2.2.2 Swaged Outer Ring. A one piece outer ring manufactured by deformation of the outer ring material around the inner ring to obtain the sphered inner surface.

3.2.2.3 Single Fractured Outer Ring. An outer ring manufactured in one piece and subsequently split or fractured in one position in an axial plane, to facilitate manufacturing assembly.

3.3 Features

3.3.1 Core Cylindrical Surface. The inside surface of an inner ring having a basically cylindrical form.

3.3.2 Outside Cylindrical Surface. The outside surface of an outer ring having a basically cylindrical form.

3.3.3 Adhered Outer Surface. That surface of an inner ring intended to make sliding contact with an outer ring and having the form of part of the outside surface of a sphere whose center lies on the bearing axis.

3.3.4 Adhered Inner Surface. That surface of an outer ring intended to make sliding contact with an inner ring and having the form of part of the inside surface of a hollow sphere whose center lies on the bearing axis.

3.3.5 Sliding Contact Surface. The bore cylindrical surface of an inner ring or the sphered surface of an inner or outer ring.

3.3.6 Surface Liner. Self-lubricating material which may be affixed to one of the sphered sliding contact surfaces.

3.3.7 Side Faces. Those surfaces of a ring which are nominally perpendicular to the ring axis.

3.3.8 Bore Chamfers. The surfaces joining the bore surface and the side faces.

3.3.9 Outside Surface Chamfers. The surfaces joining an outside surface and the side faces.

3.3.10 Lubrication Groove. A circumferential groove in the bore cylindrical surface, the outside cylindrical surface, the sphered outer surface, or the sphered inner surface, intended for the purpose of conveying lubricant.

3.3.11 Lubrication Hole. A radial hole intended to convey lubricant to the sliding contact surfaces or to the distribution groove.

3.3.12 Distribution Groove. A groove intended to distribute lubricant across the width of a sliding contact surface.

3.3.13 Dirt Trap Groove. Circumferential groove in the sliding contact surface of an outer ring intended to prevent the entry of foreign matter.

3.3.14 Face Groove. A circumferential groove in the side face of an outer ring intended for use in fixing the outer ring in a housing.

3.3.15 Integral Seal. A seal that is an integral part of the bearing by being firmly fitted into one ring while in sliding contact with the other ring.

3.3.16 Swaging Groove. Groove in the face of the outer ring which is utilized to allow for staking or swaging of the bearing into a chamfered housing for retention.

3.4 Movements and Angles

3.4.1 Rotational Movement. Motion in which one ring rotates about its axis, the relative angular position of the axes of the rings remaining unchanged.

3.4.2 Tilting Movement. Motion in which the relative angular position of the axes of the rings changes.

3.4.3 Oscillatory Movement. Motion in which the direction of the movement reverses.

3.4.4 Angle of Tilt. The acute angle between the ring axes.

3.4.5 Angle of Oscillation. The angle of rotation, or tilt, during oscillatory movement between successive changes of directions.

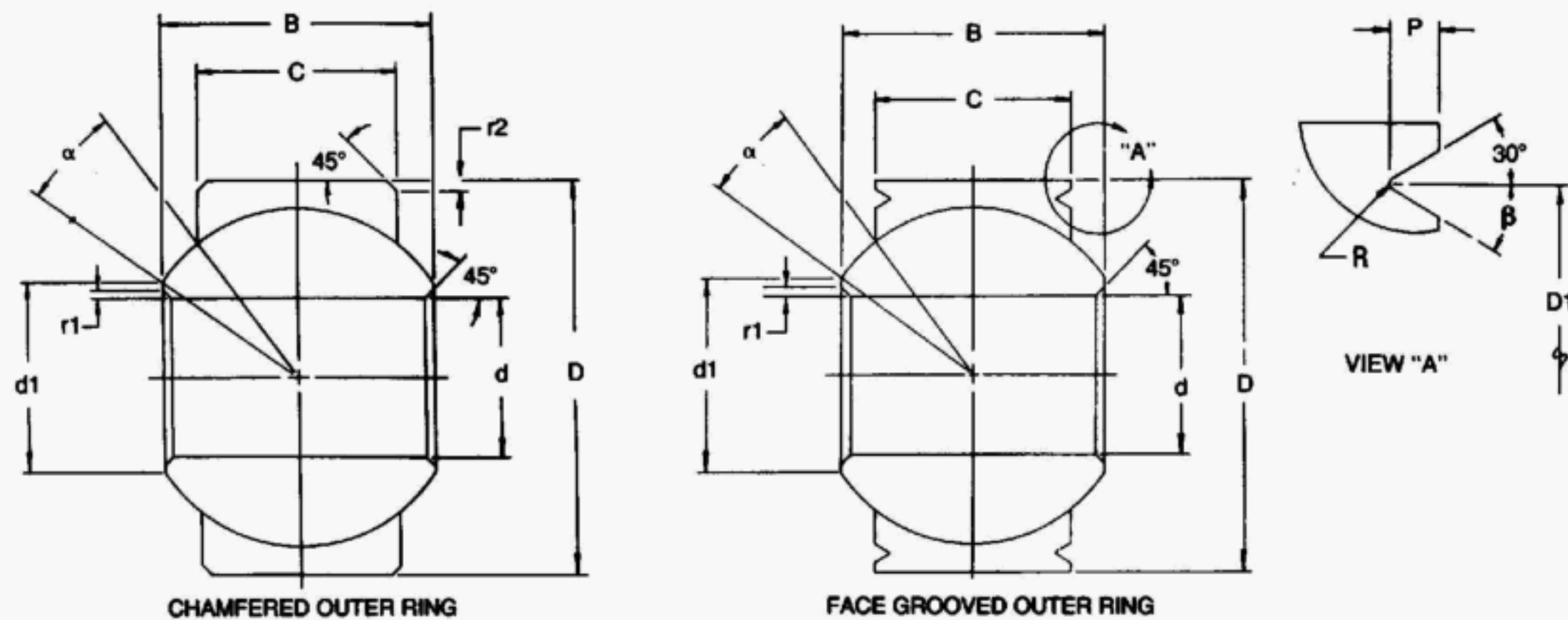
4. SYMBOLS*

d	= bearing bore diameter, nominal
d_1	= outer diameter of inner ring face
D	= bearing outside diameter, nominal
D_1	= pitch groove diameter, nominal
Δd_{mp}	= single plane mean bore diameter deviation
Δd_s	= single bore deviation
ΔD_{mp}	= single plane mean outside diameter deviation
ΔD_s	= single outside diameter deviation
B	= inner ring width, nominal
ΔB_s	= deviation of single inner ring width
C	= outer ring width, nominal
ΔC_s	= deviation of a single outer ring width
r_1	= inner ring chamfer dimension, height and width
r_2	= outer ring chamfer dimension, height and width
α	= angle of tilt; maximum displacement angle which can be formed by the outer ring with the inner ring with the spherical track of and outer ring fully in contact with the inner ring
R	= radius of face groove in outer ring
P	= depth of face groove in outer ring
β	= groove inner angle

* See ANSI/AFBMA Standard 4 for definitions.

5. BOUNDARY DIMENSIONS

TABLE 1
BOUNDARY DIMENSIONS
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES 1, SWAGED STYLE — NARROW

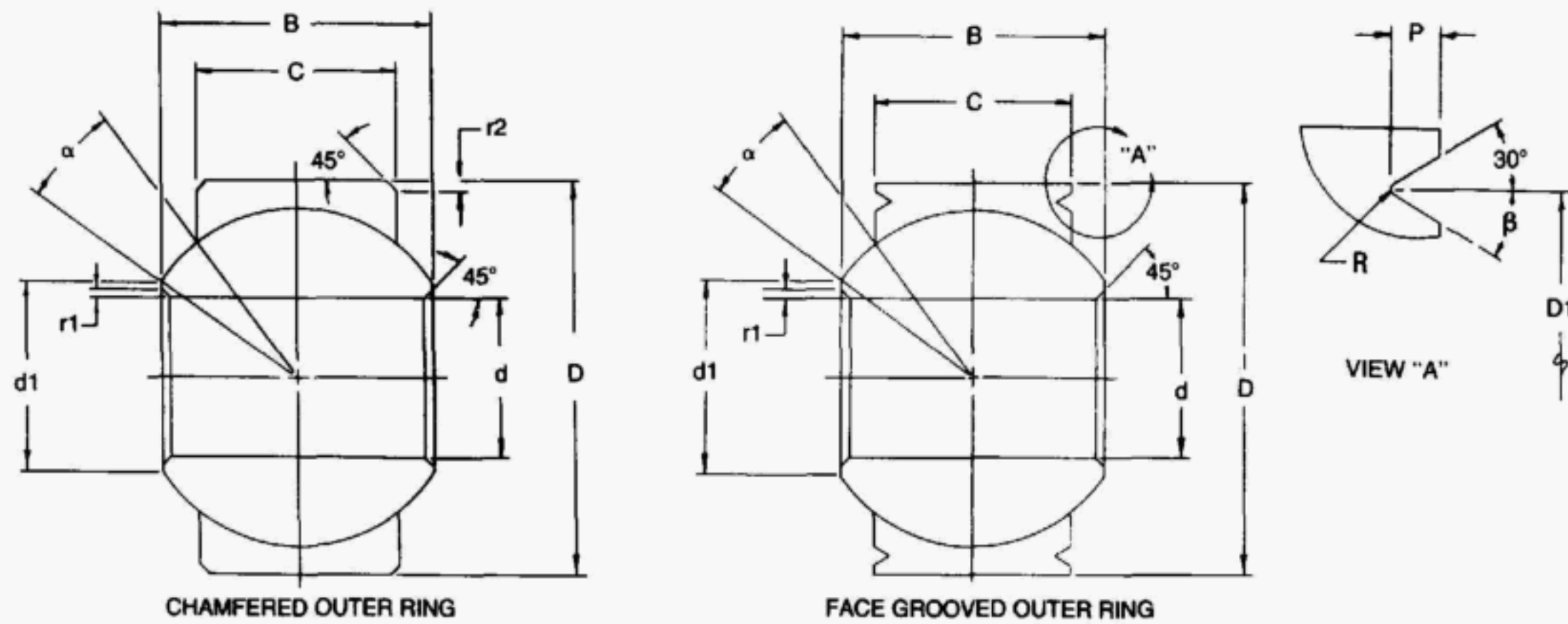


Part I

Dimensions in millimetres
 Mass in grams, Angles in degrees

d	D	C	B	d _{1min}	r _{1s}	min	r _{2s} max	A _{max}	D ₁	P	R	α _{min}	β	Mass ≈
5	14	5.5	7	8.6	0.1	0.3	0.6	0.80	12.2	0.7	0.2	9	20	7
6	16	6.5	9	9.0	0.1	0.3	0.6	0.80	14.2	0.7	0.2	14	20	9
8	18	7	10	10.2	0.1	0.3	0.6	0.80	16.2	0.7	0.2	15	20	12
10	21	8	10.5	11.9	0.1	0.5	0.8	0.90	18.4	0.9	0.3	11	30	20
12	25	10	13	15.0	0.1	0.5	0.8	0.90	22.4	0.9	0.3	10	30	32
15	29	12	15	20.5	0.1	0.5	0.8	1.00	26.4	0.9	0.3	8	30	50
17	31	13.5	16	21.7	0.1	0.5	0.8	1.00	28.4	0.9	0.3	7	30	59
22	40	18	22	27.1	0.1	0.6	1.0	1.20	36.8	1.4	0.3	8	30	126
25	45	20	25	29.6	0.1	0.6	1.0	1.20	41.8	1.4	0.3	8	30	185
30	51	24	28	35.5	0.1	0.6	1.0	1.20	47.8	1.4	0.3	6	30	300
35	57	26	31	41.7	0.1	0.8	1.2	1.50	53.8	1.4	0.3	7	30	340
40	64	29	34	47.0	0.1	0.8	1.2	1.50	60.8	1.4	0.3	6	30	460
45	72	32	37	52.2	0.1	0.8	1.2	1.50	68.8	1.4	0.3	5	30	630
50	80	34	41	59.2	0.1	0.8	1.2	1.50	76.8	1.4	0.3	7	30	870

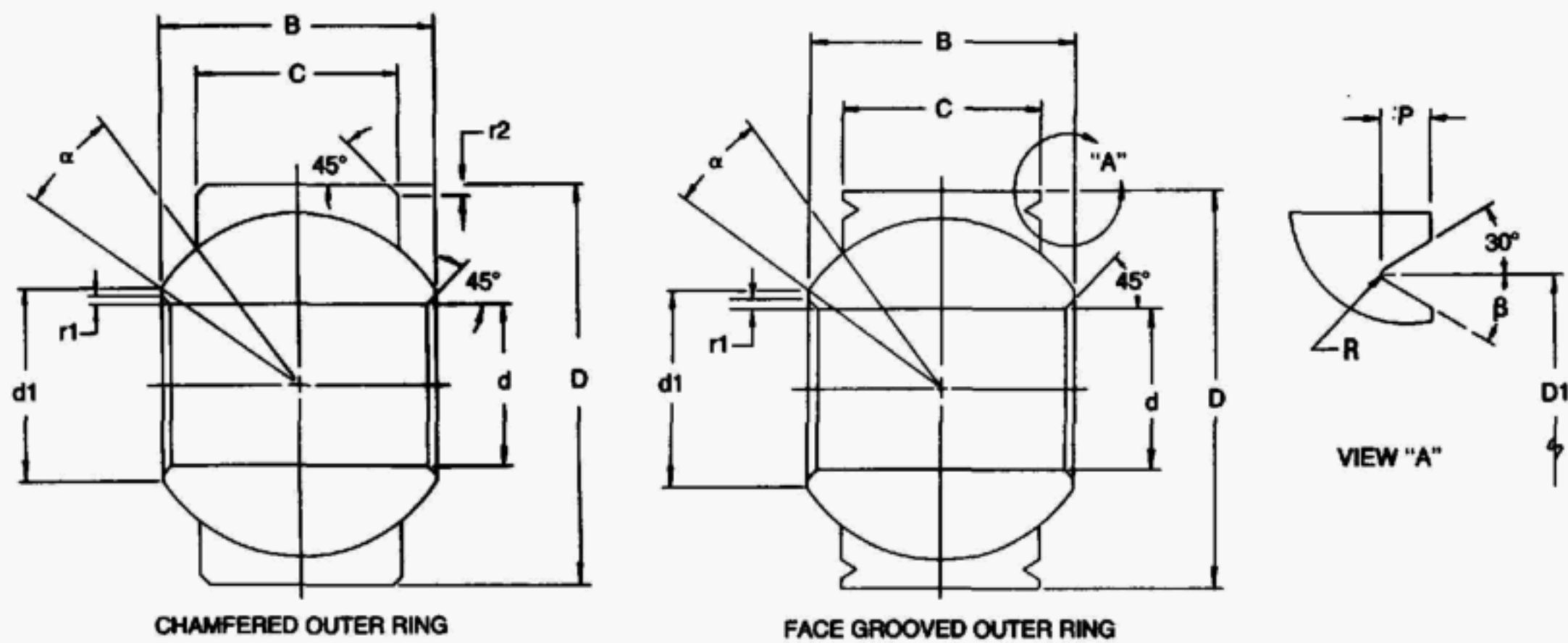
TABLE 1
BOUNDARY DIMENSIONS
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES 1, SWAGED STYLE — NARROW

**Part II**

Dimensions in inches
 Mass in pounds, Angles in degrees

d	D	C	B	d _{1min}	r _{1z}	r _{2z}		A _{max}	D ₁	P	R	α _{min}	β	Mass ≈
						min	max							
0.1984	0.5512	0.217	0.276	0.339	0.004	0.012	0.024	0.031	0.480	0.028	0.008	9	20	0.015
0.2381	0.6299	0.256	0.354	0.354	0.004	0.012	0.024	0.031	0.559	0.028	0.008	14	20	0.020
0.3175	0.7087	0.276	0.394	0.402	0.004	0.012	0.024	0.031	0.638	0.028	0.008	15	20	0.026
0.3968	0.8268	0.315	0.413	0.469	0.004	0.020	0.031	0.035	0.724	0.035	0.012	11	30	0.044
0.4762	0.9843	0.394	0.512	0.591	0.004	0.020	0.031	0.035	0.882	0.035	0.012	10	30	0.071
0.5952	1.1417	0.472	0.591	0.807	0.004	0.020	0.031	0.039	1.039	0.035	0.012	8	30	0.110
0.6746	1.2205	0.531	0.630	0.854	0.004	0.020	0.031	0.039	1.118	0.035	0.012	7	30	0.130
0.8730	1.5748	0.709	0.866	1.067	0.004	0.024	0.039	0.047	1.449	0.055	0.012	8	30	0.278
0.9921	1.7717	0.787	0.984	1.165	0.004	0.024	0.039	0.047	1.646	0.055	0.012	8	30	0.408
1.1905	2.0079	0.945	1.102	1.398	0.004	0.024	0.039	0.047	1.882	0.055	0.012	6	30	0.661
1.3889	2.2441	1.024	1.220	1.642	0.004	0.031	0.047	0.059	2.118	0.055	0.012	7	30	0.750
1.5873	2.5197	1.142	1.339	1.850	0.004	0.031	0.047	0.059	2.394	0.055	0.012	6	30	1.014
1.7857	2.8346	1.260	1.457	2.055	0.004	0.031	0.047	0.059	2.709	0.055	0.012	5	30	1.389
1.9841	3.1496	1.339	1.614	2.331	0.004	0.031	0.047	0.059	3.024	0.055	0.012	7	30	1.918

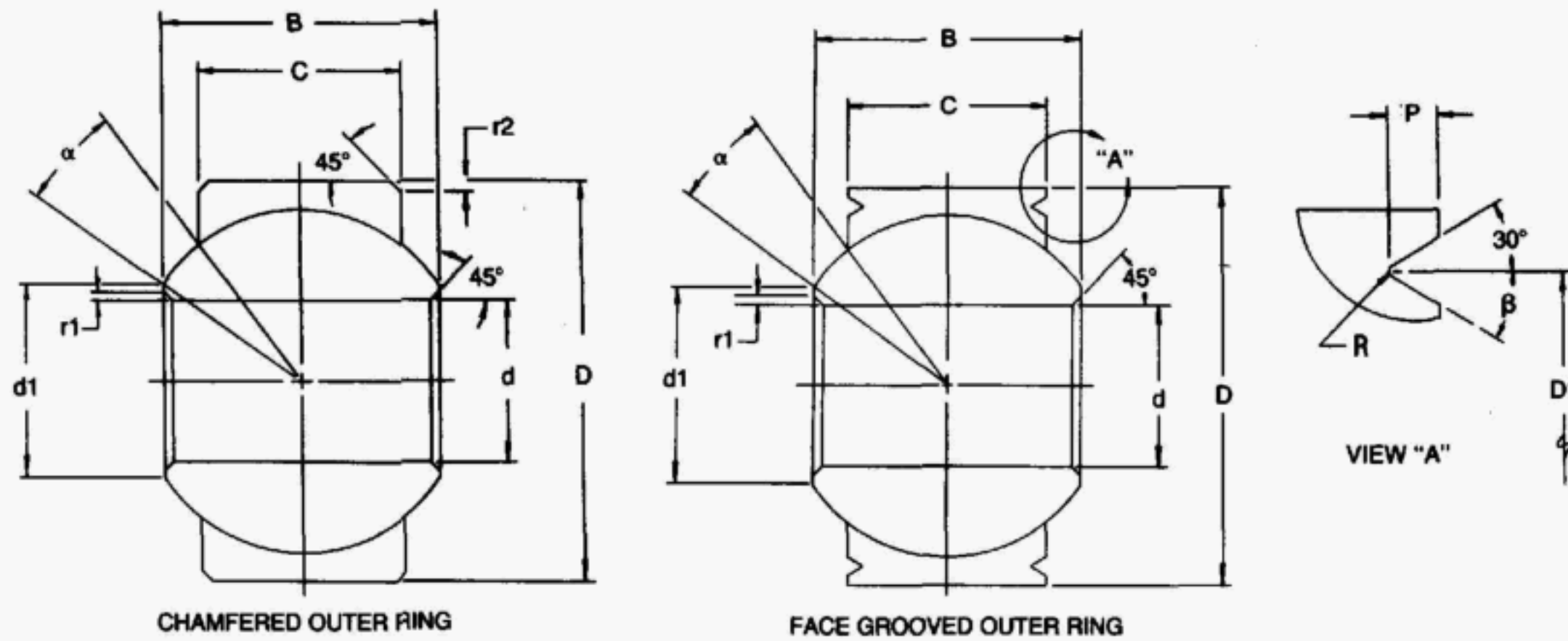
TABLE 2
BOUNDARY DIMENSIONS
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES 2, SWAGED STYLE - WIDE



Dimensions in millimetres
 Mass in grams, Angles in degrees

d	D	C	B	d_{1min}	r_{1s}	r_{2s}		A_{max}	D_1	P	R	α_{min}	β	Mass ≈
						min	max							
5	16	8.5	11	7.7	0.1	0.5	0.8	0.80	14.2	0.7	0.2	15	20	16
6	16	8.5	11	7.7	0.1	0.5	0.8	0.80	14.2	0.7	0.2	15	20	16
8	18	8	11	10.3	0.1	0.5	0.8	0.80	16.2	0.7	0.2	14	30	17
10	21	10	12.5	12.2	0.1	0.5	0.8	0.90	18.4	0.9	0.3	10	30	27
12	25	13	16	15.5	0.1	0.5	0.8	0.90	23.4	0.9	0.3	10	30	49
15	29	13.5	17	18.9	0.1	0.5	0.8	1.00	26.4	0.9	0.3	9	30	62
17	30	14.5	18	20.1	0.1	0.5	0.8	1.00	27.4	0.9	0.3	9	30	69
20	35	16	20	23.5	0.1	0.5	0.8	1.20	31.8	1.4	0.3	8	30	104
25	54	26	32	35.3	0.1	0.6	1.0	1.20	50.8	1.4	0.3	9	30	445
30	60	28	34	40.9	0.1	0.8	1.2	1.20	56.8	1.4	0.3	8	30	480
35	65	29	36	45.5	0.1	0.8	1.2	1.50	61.8	1.4	0.3	8	30	565
40	68	31	38	47.0	0.1	0.8	1.2	1.50	64.8	1.4	0.3	8	30	600
45	76	33	41	54.1	0.1	0.8	1.2	1.50	72.8	1.4	0.3	8	30	800
50	82	35	44	60.3	0.1	0.8	1.2	1.50	78.8	1.4	0.3	8	30	970
55	96	40	52	63.4	0.1	0.8	1.2	1.50	92.8	1.5	0.3	10	30	1580

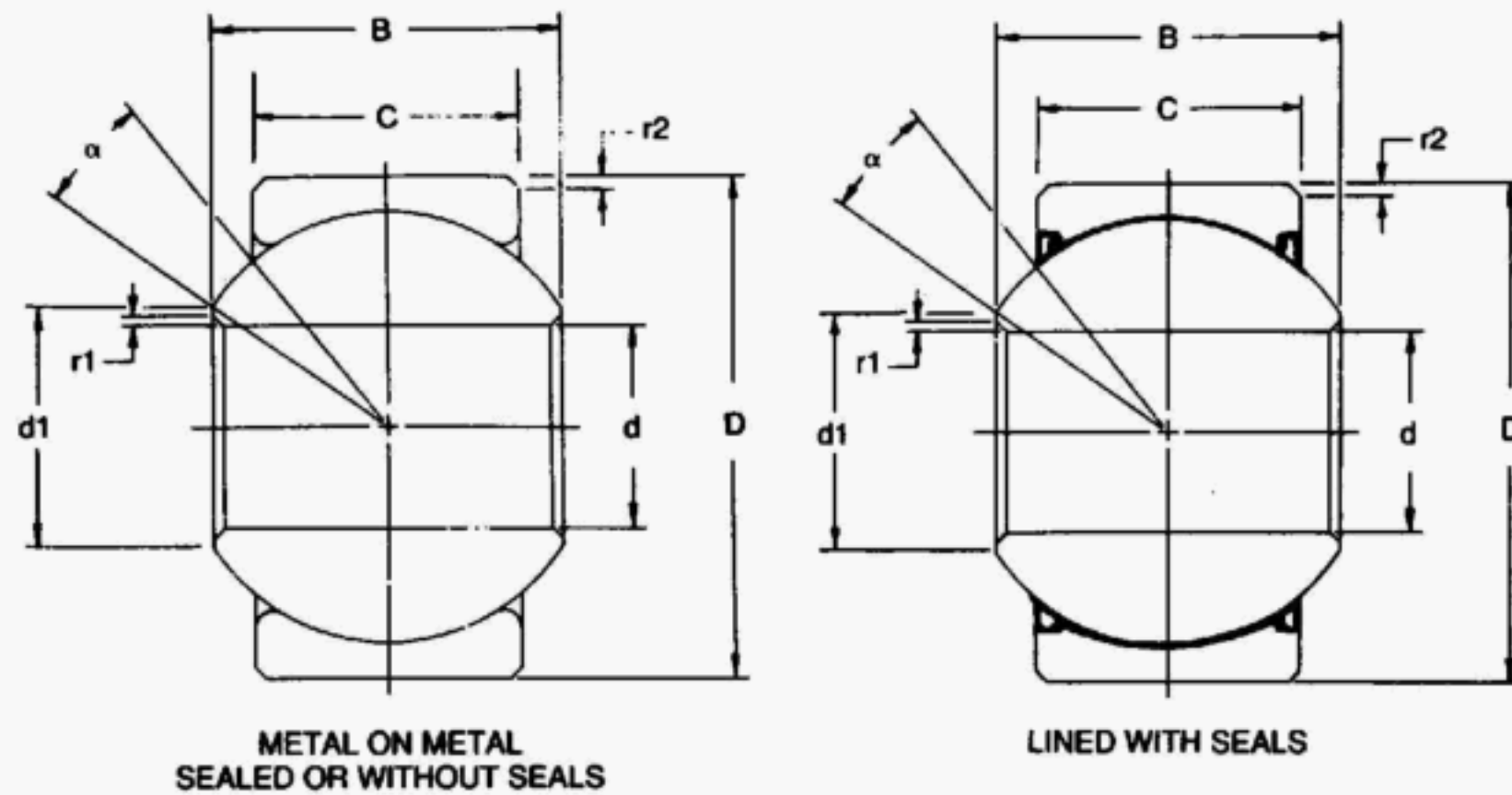
TABLE 2
BOUNDARY DIMENSIONS
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES 2, SWAGED STYLE — WIDE

**Part II**

Dimensions in inches
 Mass in pounds, Angles in degrees

d	D	C	B	d _{1min}	r _{1s}	r _{2s}		A _{max}	D ₁	P	R	α _{min}	β	Mass ≈
						min	max							
0.1969	0.6299	0.335	0.433	0.303	0.004	0.020	0.031	0.031	0.559	0.028	0.008	15	20	0.035
0.2362	0.6299	0.335	0.433	0.303	0.004	0.020	0.031	0.031	0.559	0.028	0.008	15	20	0.035
0.3150	0.7087	0.315	0.433	0.406	0.004	0.020	0.031	0.031	0.638	0.028	0.008	14	30	0.037
0.3937	0.8268	0.394	0.492	0.480	0.004	0.020	0.031	0.035	0.724	0.035	0.012	10	30	0.060
0.4724	0.9843	0.512	0.630	0.610	0.004	0.020	0.031	0.035	0.921	0.035	0.012	10	30	0.108
0.5906	1.1417	0.531	0.669	0.744	0.004	0.020	0.031	0.039	1.039	0.035	0.012	9	30	0.137
0.6693	1.1811	0.571	0.709	0.791	0.004	0.020	0.031	0.039	1.079	0.035	0.012	9	30	0.152
0.7874	1.3780	0.630	0.787	0.925	0.004	0.020	0.031	0.047	1.252	0.055	0.012	8	30	0.229
0.9843	2.1260	1.024	1.260	1.390	0.004	0.024	0.039	0.047	2.000	0.055	0.012	9	30	0.981
1.1811	2.3622	1.102	1.339	1.610	0.004	0.031	0.047	0.047	2.236	0.055	0.012	8	30	1.058
1.3780	2.5591	1.142	1.417	1.791	0.004	0.031	0.047	0.059	2.433	0.055	0.012	8	30	1.246
1.5748	2.6772	1.220	1.496	1.850	0.004	0.031	0.047	0.059	2.551	0.055	0.012	8	30	1.323
1.7717	2.9921	1.299	1.614	2.130	0.004	0.031	0.047	0.059	2.866	0.055	0.012	8	30	1.764
1.9685	3.2283	1.378	1.732	2.374	0.004	0.031	0.047	0.059	3.102	0.055	0.012	8	30	2.138
2.1654	3.7795	1.575	2.047	2.496	0.004	0.031	0.047	0.059	3.654	0.059	0.012	10	30	3.483

TABLE 3
BOUNDARY DIMENSIONS
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES E & G, FRACTURED STYLE



METAL ON METAL
SEALED OR WITHOUT SEALS
Series E

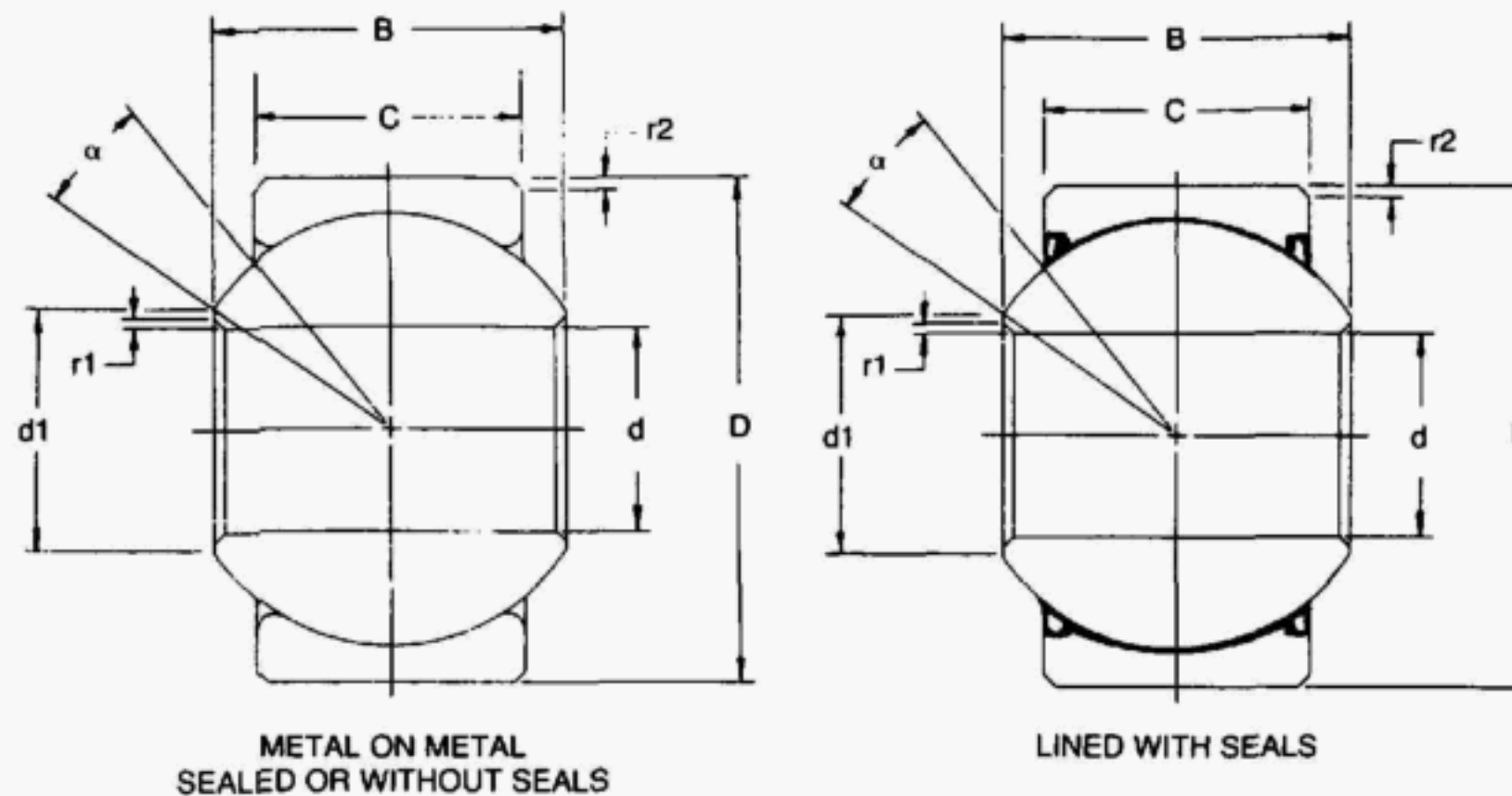
Part I

Dimensions in millimetres
 Angle in degrees

d	D	B	C	d _{1min}	r _{1min} ⁽¹⁾	r _{2min} ⁽²⁾	α ⁽³⁾
* 12	22	10	7	15	0.6	0.6	10*
* 14	26	12	9	18	0.6	0.3	8*
* 15	26	12	9	18	0.6	0.6	8*
16	30	14	10	20	0.6	0.6	10*
17	30	14	10	20	0.6	0.6	10*
20	35	16	12	24	0.6	0.6	9*
24	42	20	16	29	0.6	0.6	7*
25	42	20	16	29	0.6	0.6	7*
30	47	22	18	34	0.6	0.6	6*
35	55	25	20	39	0.6	1.0	6*
40	62	28	22	45	0.6	1.0	7*
45	68	32	25	50	0.6	1.0	7*
50	75	35	28	55	0.6	1.0	6*
55	85	40	32	62	0.6	1.0	7*
60	90	44	36	66	1.0	1.0	6*
70	105	49	40	77	1.0	1.0	6*
80	120	55	45	88	1.0	1.0	6*
90	130	60	50	98	1.0	1.0	5*
100	150	70	55	100	1.0	1.0	7*
110	160	70	55	120	1.0	1.0	6*
120	180	85	70	130	1.0	1.0	6*
140	210	90	70	150	1.0	1.0	7*
160	230	105	80	170	1.0	1.0	8*
180	260	105	80	192	1.1	1.1	6*
200	290	130	100	212	1.1	1.1	7*
220	320	135	100	238	1.1	1.1	8*
240	340	140	100	265	1.1	1.1	8*
260	370	150	110	285	1.1	1.1	7*
280	400	155	120	310	1.1	1.1	6*
300	430	165	120	330	1.1	1.1	7*

- * These sizes available in metal-on-metal only.
 (1) Equal to the maximum shaft fillet radius.
 (2) Equal to the maximum housing fillet radius.
 (3) For bearings without seals, the angle of tilt will be larger and depend on adjacent mounting arrangement.

TABLE 3
BOUNDARY DIMENSIONS
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES E & G, FRACTURED STYLE



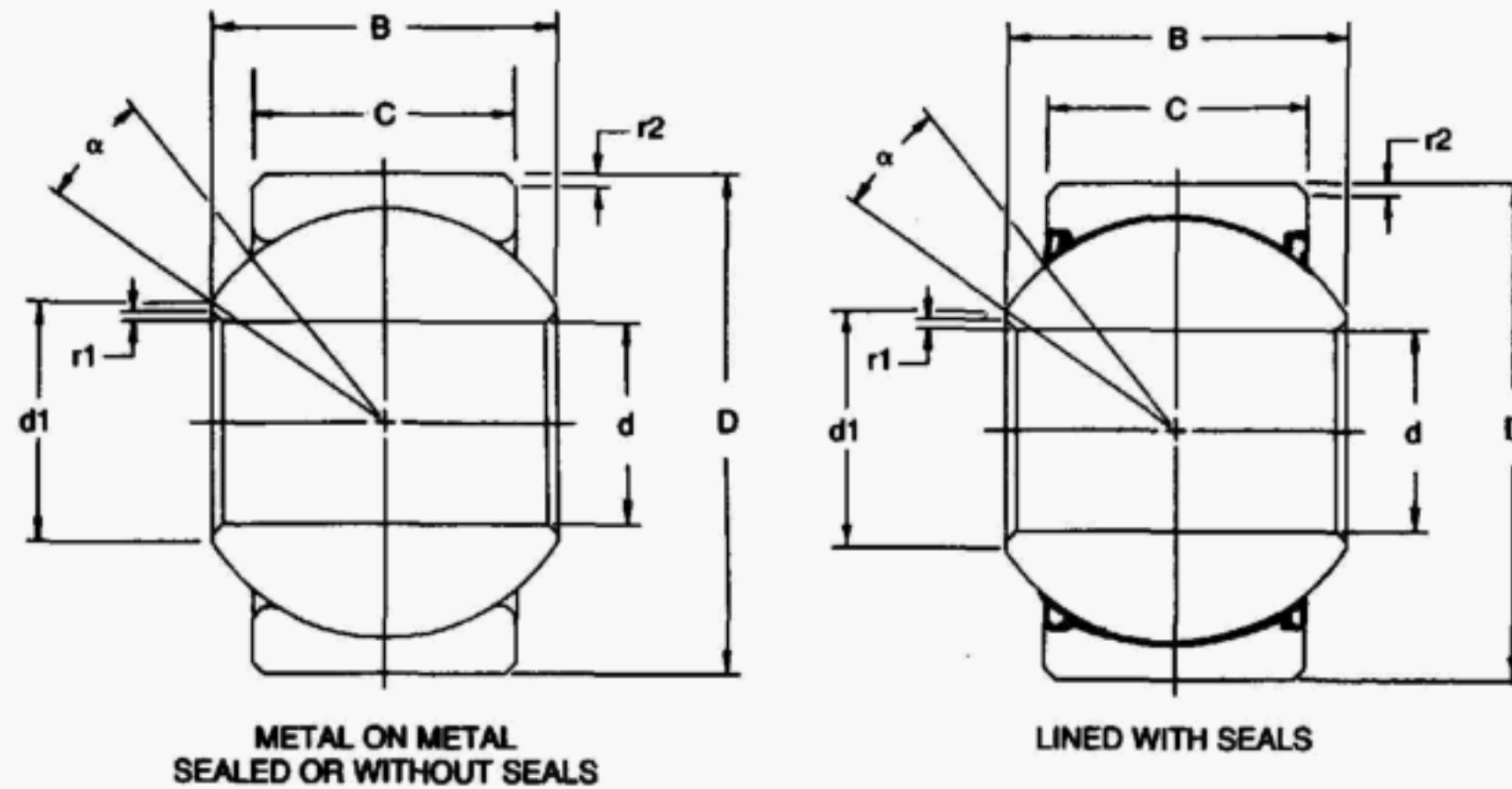
LINED WITH SEALS
Series G

Dimensions in millimetres
 Angle in degrees

d	D	B	C	d _{1min}	r _{1min} ⁽¹⁾	r _{2min} ⁽²⁾	α ⁽³⁾
* 12	26	15	9	16	0.6	0.6	18*
14	30	16	10	19	0.6	0.6	16*
15	30	16	10	19	0.6	0.6	16*
16	35	20	12	21	0.6	0.6	19*
17	35	20	12	21	0.6	0.6	19*
20	42	25	16	24	0.6	0.6	17*
24	47	28	18	29	0.6	0.6	17*
25	47	28	18	29	0.6	0.6	17*
30	55	32	20	34	0.6	1.0	17*
35	62	35	22	39	0.6	1.0	16*
40	68	40	25	44	0.6	1.0	17*
45	75	43	28	50	0.6	1.0	15*
50	90	56	36	57	0.6	1.0	17*
60	105	63	40	67	1.0	1.0	17*
70	120	70	45	77	1.0	1.0	16*
80	130	75	50	87	1.0	1.0	14*
90	150	85	55	99	1.0	1.0	15*
100	160	85	55	110	1.0	1.0	14*
110	190	100	70	122	1.0	1.0	12*
120	210	115	70	132	1.0	1.0	16*
140	230	130	80	151	1.0	1.0	16*
160	260	135	80	176	1.0	1.1	16*
180	290	155	100	196	1.1	1.1	14*
200	320	165	100	220	1.1	1.1	15*
220	340	175	100	243	1.1	1.1	16*
240	370	190	110	263	1.1	1.1	15*
260	400	205	120	285	1.1	1.1	15*
280	430	210	120	310	1.1	1.1	15*

- * These sizes available in metal-on-metal only.
- (1) Equal to the maximum shaft fillet radius.
- (2) Equal to the maximum housing fillet radius.
- (3) For bearings without seals, the angle of tilt will be larger and depend on adjacent mounting arrangement.

TABLE 3
BOUNDARY DIMENSIONS
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES E & G, FRACTURED STYLE



METAL ON METAL
SEALED OR WITHOUT SEALS
Series E

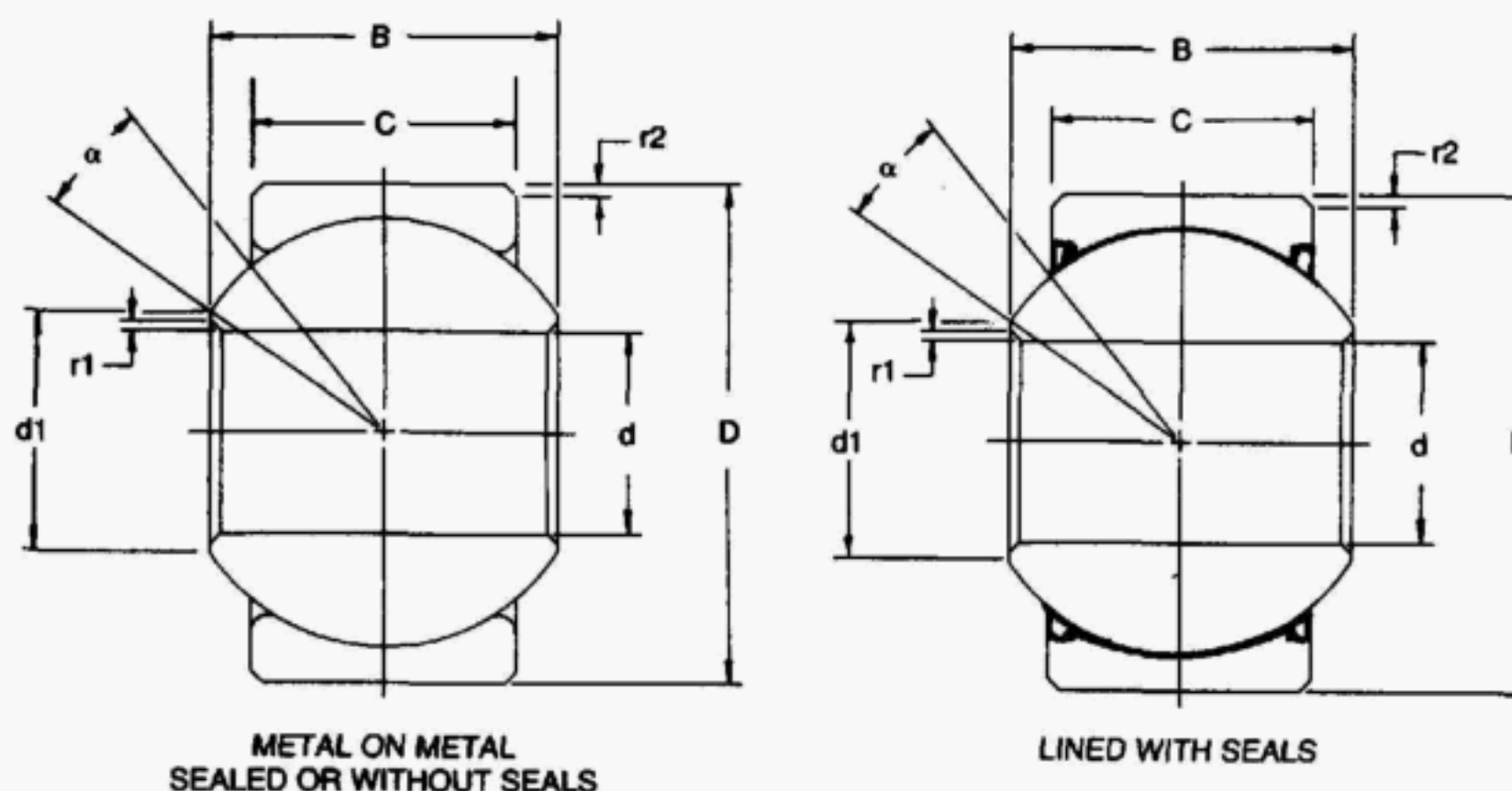
Part II

Dimensions in inches
 Angle in degrees

d	D	B	C	d _{1min}	r _{1min} ⁽¹⁾	r _{2min} ⁽²⁾	α ⁽³⁾
* 0.4724	0.8661	0.394	0.276	0.024	0.024	0.024	10*
* 0.5512	1.0236	0.472	0.354	0.028	0.024	0.012	8*
* 0.5906	1.0236	0.472	0.354	0.028	0.024	0.024	8*
0.6299	1.1811	0.551	0.394	0.031	0.024	0.024	10*
0.6693	1.1811	0.551	0.394	0.031	0.024	0.024	10*
0.7874	1.3780	0.630	0.472	0.038	0.024	0.024	9*
0.9449	1.6535	0.787	0.630	0.046	0.024	0.024	7*
0.9843	1.6535	0.787	0.630	0.046	0.024	0.024	7*
1.1811	1.8504	0.866	0.709	0.054	0.024	0.024	6*
1.3780	2.1654	0.984	0.787	0.061	0.024	0.039	6*
1.5748	2.4409	1.102	0.866	0.071	0.024	0.039	7*
1.7717	2.6772	1.260	0.984	0.079	0.024	0.039	7*
1.9685	2.9528	1.378	1.102	0.087	0.024	0.039	6*
2.1654	3.3465	1.575	1.260	0.098	0.024	0.039	7*
2.3622	3.5433	1.732	1.417	0.104	0.039	0.039	6*
2.7559	4.1339	1.929	1.575	0.121	0.039	0.039	6*
3.1496	4.7244	2.165	1.772	0.139	0.039	0.039	6*
3.5433	5.1181	2.362	1.969	0.154	0.039	0.039	5*
3.9370	5.9055	2.756	2.165	0.157	0.039	0.039	7*
4.3307	6.2992	2.756	2.165	0.189	0.039	0.039	6*
4.7244	7.0866	3.346	2.756	0.205	0.039	0.039	6*
5.5118	8.2677	3.543	2.756	0.236	0.039	0.039	7*
6.2992	9.0551	4.134	3.150	0.268	0.039	0.039	8*
7.0866	10.2362	4.134	3.150	0.302	0.043	0.043	6*
7.8740	11.4173	5.118	3.937	0.334	0.043	0.043	7*
8.6614	12.5984	5.315	3.937	0.375	0.043	0.043	8*
9.4488	13.3858	5.512	3.937	0.417	0.043	0.043	8*
10.2362	14.5669	5.906	4.331	0.449	0.043	0.043	7*
11.0236	15.7480	6.102	4.724	0.488	0.043	0.043	6*
11.8110	16.9291	6.496	4.724	0.520	0.043	0.043	7*

- * These sizes available in metal-on-metal only.
 (1) Equal to the maximum shaft fillet radius.
 (2) Equal to the maximum housing fillet radius.
 (3) For bearings without seals, the angle of tilt will be larger and depend on adjacent mounting arrangement.

TABLE 3
BOUNDARY DIMENSIONS
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES E & G, FRACTURED STYLE



LINED WITH SEALS
Series G

Dimensions in inches
 Angle in degrees

d	D	B	C	d _{1min}	r _{1smin} ⁽¹⁾	r _{2smin} ⁽²⁾	α ⁽³⁾
* 0.4724	1.0236	0.591	0.354	0.630	0.024	0.024	18*
0.5512	1.1811	0.630	0.394	0.748	0.024	0.024	16*
0.5906	1.1811	0.630	0.394	0.748	0.024	0.024	16*
0.6299	1.3780	0.787	0.472	0.827	0.024	0.024	19*
0.6693	1.3780	0.787	0.472	0.827	0.024	0.024	19*
0.7874	1.6535	0.984	0.630	0.945	0.024	0.024	17*
0.9449	1.8504	1.102	0.709	1.142	0.024	0.024	17*
0.9843	1.8504	1.102	0.709	1.142	0.024	0.024	17*
1.1811	2.1654	1.260	0.787	1.339	0.024	0.039	17*
1.3780	2.4409	1.378	0.866	1.535	0.024	0.039	16*
1.5748	2.6772	1.575	0.984	1.732	0.024	0.039	17*
1.7717	2.9528	1.693	1.102	1.969	0.024	0.039	15*
1.9685	3.5433	2.205	1.417	2.244	0.024	0.039	17*
2.3622	4.1339	2.480	1.575	2.638	0.039	0.039	17*
2.7559	4.7244	2.756	1.772	3.031	0.039	0.039	16*
3.1496	5.1181	2.953	1.969	3.425	0.039	0.039	14*
3.5433	5.9055	3.346	2.165	3.898	0.039	0.039	15*
3.9370	6.2992	3.346	2.165	4.331	0.039	0.039	14*
4.3307	7.4803	3.937	2.756	4.803	0.039	0.039	12*
4.7244	8.2677	4.528	2.756	5.197	0.039	0.039	16*
5.5118	9.0551	5.118	3.150	5.945	0.039	0.039	16*
6.2992	10.2362	5.315	3.150	6.929	0.039	0.043	16*
7.0866	11.4173	6.102	3.937	7.717	0.043	0.043	14*
7.8740	12.5984	6.496	3.937	8.661	0.043	0.043	15*
8.6614	13.3858	6.890	3.937	9.567	0.043	0.043	16*
9.4488	14.5669	7.480	4.331	10.354	0.043	0.043	15*
10.2362	15.7480	8.071	4.724	11.220	0.043	0.043	15*
11.0236	16.9291	8.268	4.724	12.205	0.043	0.043	15*

* These sizes available in metal-on-metal only.

(1) Equal to the maximum shaft fillet radius.

(2) Equal to the maximum housing fillet radius.

(3) For bearings without seals, the angle of tilt will be larger and depend on adjacent mounting arrangement.

6. TOLERANCES

TABLE 4
TOLERANCES
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES 1 & 2, SWAGED STYLE

Part I

INNER RING Dimensions in millimetres
 Tolerances in micrometres

d		Δd_2		Δd_{mp}		ΔB_2	
Over	Incl	High	Low	High	Low	High	Low
—	10	+2	-10	0	-8	0	-60
10	18	+3	-11	0	-8	0	-60
18	30	+3	-13	0	-10	0	-60
30	50	+3	-15	0	-12	0	-60
50	80	+3	-15	0	-12	0	-60

OUTER RING Dimensions in millimetres
 Tolerances in micrometres

D		ΔD_2		ΔD_{mp}		ΔC_2	
Over	Incl	High	Low	High	Low	High	Low
—	18	+5	-13	0	-8	+100	-100
18	30	+6	-15	0	-9	+100	-100
30	50	+8	-19	0	-11	+100	-100
50	80	+10	-23	0	-13	+100	-100
80	120	+13	-28	0	-15	+100	-100

FACE GROOVE FEATURES Dimensions in millimetres
 Tolerances in micrometres

d		Allowable Deviation from D_1		Allowable Deviation from P		Allowable Deviation from R	
Over	Incl	High	Low	High	Low	High	Low
ALL SIZES		+100	0	0	-200	+100	0

CHAMFER Dimensions in millimetres
 Tolerances in micrometres

d		Allowable Deviation from r_1	
Over	Incl	High	Low
—	10	+300	0
10	18	+300	0
18	30	+300	0
30	50	+300	0
50	80	+300	0

Tolerances for groove inner angle,
 $\beta = \pm 0.5^\circ$ unless otherwise specified.

TABLE 4
TOLERANCES
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES 1 & 2, SWAGED STYLE

Part II

INNER RING Dimensions in inches
Tolerances in 0.0001 inches

d		Δd_s		Δd_{mp}		ΔB_s	
Over	Incl	High	Low	High	Low	High	Low
—	0.3937	+0.7874	-3.9370	0	-3.1496	0	-23.622
0.3937	0.7087	+1.1811	-4.3307	0	-3.1496	0	-23.622
0.7087	1.1811	+1.1811	-5.1181	0	-3.9370	0	-23.622
1.1811	1.9685	+1.1811	-5.9055	0	-4.7244	0	-23.622
1.9685	3.1496	+1.1811	-5.9055	0	-4.7244	0	-23.622

OUTER RING Dimensions in inches
Tolerances in 0.0001 inches

D		ΔD_s		ΔD_{mp}		ΔC_s	
Over	Incl	High	Low	High	Low	High	Low
—	0.7087	+1.9685	-5.1181	0	-3.1496	+39.370	-39.370
0.7087	1.1811	+2.3622	-5.9055	0	-3.5433	+39.370	-39.370
1.1811	1.9685	+3.1496	-7.4803	0	-4.3307	+39.370	-39.370
1.9685	3.1496	+3.9370	-9.0551	0	-5.1181	+39.370	-39.370
3.1496	4.7244	+5.1181	-11.0236	0	-5.9055	+39.370	-39.370

FACE GROOVE FEATURES Dimensions in inches
Tolerances in 0.0001 inches

d		Allowable Deviation from D_1		Allowable Deviation from P		Allowable Deviation from R	
Over	Incl	High	Low	High	Low	High	Low
ALL SIZES		+39.370	0	0	-78.740	+39.370	0

CHAMFER Dimensions in inches
Tolerances in 0.0001 inches

d		Allowable Deviation from r_1	
Over	Incl	High	Low
—	0.394	+118.110	0
0.394	0.709	+118.110	0
0.709	1.181	+118.110	0
1.181	1.969	+118.110	0
1.969	3.150	+118.110	0

Tolerances for groove inner angle,
 $\beta = \pm 0.5^\circ$ unless otherwise specified.

TABLE 5
TOLERANCES
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES E & G, FRACTURED STYLE

Part I
Inner Ring

Dimensions in millimetres
Tolerances in micrometres

d		Δd_{ms}		ΔB_r	
over	up to (incl)	high	low	high	low
—	10	0	−8	0	−120
10	18	0	−8	0	−120
18	30	0	−10	0	−120
30	50	0	−12	0	−120
50	80	0	−15	0	−150
80	120	0	−20	0	−200
120	150	0	−25	0	−250
150	180	0	−25	0	−250
180	250	0	−30	0	−300
250	315	0	−35	0	−350
315	400	0	−40	0	−400
400	500	0	−45	0	−450
500	630	0	−50	0	−500
630	800	0	−75	0	−750
800	1000	0	−100	0	−1000
1000	1250	0	−125	0	−1250
1250	1600	0	−160	0	−1600
1600	2000	0	−200	0	−2000

Outer Ring

Dimensions in millimetres
Tolerances in micrometres

D		ΔD_{ms}^*		ΔC_r	
over	up to (incl)	high	low	high	low
10	18	0	−8	0	−240
18	30	0	−9	0	−240
30	50	0	−11	0	−240
50	80	0	−13	0	−300
80	120	0	−15	0	−400
120	150	0	−18	0	−500
150	180	0	−25	0	−500
180	250	0	−30	0	−600
250	315	0	−35	0	−700
315	400	0	−40	0	−800
400	500	0	−45	0	−900
500	630	0	−50	0	−1000
630	800	0	−75	0	−1100
800	1000	0	−100	0	−1200
1000	1250	0	−125	0	−1300
1250	1600	0	−160	0	−1600
1600	2000	0	−200	0	−2000
2000	2500	0	−250	0	−2500
2500	3150	0	−320	0	−3200

*Outer diameter allowable deviation dimensions are before fracture or any coatings.

TABLE 5
TOLERANCES
SPHERICAL PLAIN RADIAL BEARINGS
METRIC DESIGN
SERIES E & G, FRACTURED STYLE

Part II
Inner Ring

Dimensions in inches
Tolerances in 0.0001 inches

d		Δd_{mp}		ΔB_s	
over	up to (incl)	high	low	high	low
—	0.3937	0	−3.1496	0	−47.2441
0.3937	0.7087	0	−3.1496	0	−47.2441
0.7087	1.1811	0	−3.9370	0	−47.2441
1.1811	1.9685	0	−4.7244	0	−47.2441
1.9685	3.1496	0	−5.9055	0	−59.0551
3.1496	4.7244	0	−7.8740	0	−78.7402
4.7244	5.9055	0	−9.8425	0	−98.4252
5.9055	7.0866	0	−9.8425	0	−98.4252
7.0866	9.8425	0	−11.8110	0	−118.1102
9.8425	12.4016	0	−13.7795	0	−137.7953
12.4016	15.7480	0	−15.7480	0	−157.4803
15.7480	19.6850	0	−17.7165	0	−177.1654
19.6850	24.8031	0	−19.6850	0	−196.8504
24.8031	31.4961	0	−29.5276	0	−295.2756
31.4961	39.3701	0	−39.3701	0	−393.7008
39.3701	49.2126	0	−49.2126	0	−492.1260
49.2126	62.9921	0	−62.9921	0	−629.9213
62.9921	78.7402	0	−78.7402	0	−787.4016

Outer Ring

Dimensions in inches
Tolerances in 0.0001 inches

D		ΔD_{mp}^*		ΔC_s	
over	up to (incl)	high	low	high	low
0.3937	0.7087	0	−3.1496	0	−94.4882
0.7087	1.1811	0	−3.5433	0	−94.4882
1.1811	1.9685	0	−4.3307	0	−94.4882
1.9685	3.1496	0	−5.1181	0	−118.1102
3.1496	4.7244	0	−5.9055	0	−157.4803
4.7244	5.9055	0	−7.0866	0	−196.8504
5.9055	7.0866	0	−9.8425	0	−196.8504
7.0866	9.8425	0	−11.8110	0	−236.2205
9.8425	12.4016	0	−13.7795	0	−275.5906
12.4016	15.7480	0	−15.7480	0	−314.9606
15.7480	19.6850	0	−17.7165	0	−354.3307
19.6850	24.8031	0	−19.6850	0	−393.7008
24.8031	31.4961	0	−29.5276	0	−433.0709
31.4961	39.3701	0	−39.3701	0	−472.4409
39.3701	49.2126	0	−49.2126	0	−511.8110
49.2126	62.9921	0	−62.9921	0	−629.9213
62.9921	78.7402	0	−78.7402	0	−787.4016
78.7402	98.4252	0	−98.4252	0	−984.2520
98.4252	124.0157	0	−125.9843	0	−1259.8425

*Outer diameter allowable deviation dimensions are before fracture or any coatings.

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