

English Version

**Aerospace series - Bearings, spherical plain in corrosion  
resisting steel without assembly slot - Dimensions and loads**

Série aérospatiale - Rotules lisses en acier résistant à la  
corrosion sans encoche d'assemblage - Dimensions et  
charges

Luft- und Raumfahrt - Gelenklager aus  
korrosionsbeständigem Stahl ohne Einführnut - Maße und  
Belastungen

This European Standard was approved by CEN on 26 October 2005.

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EUROPEAN COMMITTEE FOR STANDARDIZATION  
COMITÉ EUROPÉEN DE NORMALISATION  
EUROPÄISCHES KOMITEE FÜR NORMUNG

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## **Foreword**

This European Standard (EN 2335:2005) has been prepared by the European Association of Aerospace Manufacturers - Standardization (AECMA-STAN).

After enquiries and votes carried out in accordance with the rules of this Association, this Standard has received the approval of the National Associations and the Official Services of the member countries of AECMA, prior to its presentation to CEN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2006, and conflicting national standards shall be withdrawn at the latest by June 2006.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This European Standard supersedes EN 2335:1988.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.



## 1 Scope

This standard specifies the characteristics of spherical plain bearings in corrosion resisting steel, without assembly slot, with or without swaging groove, with or without lubrication holes and grooves, intended for use in fixed or moving parts of aircraft structure and control mechanisms.

They may be used in the temperature range from – 54 °C to 150 °C.

However, as they are lubricated with the following greases (see EN 2337):

- ester type very high pressure grease (code letter A), operating range from – 73 °C to 121 °C or,
- synthetic hydrocarbon type very high pressure grease general purpose (code letter B), operating range from – 54 °C to 177 °C.

Their field of application when lubricated with grease code letter A is limited to 121 °C.

## 2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 1132-1, *Rolling bearings – Tolerances – Part 1: Terms and definitions.*

ISO 8075, *Aerospace – Surface treatment of hardenable stainless steel parts.*

EN 2030, *Steel FE-PM43 – Hardened and tempered – Bars  $D \leq 150$  mm – Aerospace series.* <sup>1)</sup>

EN 2337, *Aerospace series – Spherical plain bearings – Technical specification.*

EN 2424, *Aerospace series – Marking of aerospace products.*

EN 2491, *Aerospace series – Molybdenum disulphide dry lubricants – Coating methods.*

EN 3161, *Aerospace series – Steel FE-PM3801 (X5CrNiCu17-4) – Air melted – Solution treated and precipitation treated – Bar –  $a$  or  $D \geq 200$  mm –  $R_m \geq 930$  MPa.* <sup>2)</sup>

EN 3490, *Aerospace series – Steel FE-PM3901 (X15CrNi17-3) – Air melted – Hardened and tempered – Bar for machining –  $D_e \leq 200$  mm –  $900$  MPa  $\leq R_m \leq 1\,100$  MPa.* <sup>2)</sup>

## 3 Terms and definitions

For the purposes of this standard, the terms and definitions given in ISO 1132-1 apply.

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1) Published as AECMA Standard at the date of publication of this standard

2) Published as AECMA Prestandard at the date of publication of this standard

4 Symbols and abbreviations

The following symbols for tolerances are used:

- $\Delta_{dmp}$  : single plane mean bore diameter deviation
- $\Delta_{ds}$  : deviation of a single bore diameter
- $\Delta_{Dmp}$  : single plane mean outside diameter deviation
- $\Delta_{Ds}$  : deviation of a single outside diameter
- $\alpha$  : angle of tilt of the outer ring with respect to the inner ring, the spherical surface of the outer ring being completely in contact with the inner ring

5 Required characteristics

5.1 Configuration, dimensions and masses

According to Figures 1, 2 and 3 and Table 1. The dimensions are expressed in millimetres and apply after surface treatment.

5.2 Surface roughness

According to Figures 1 and 2. The values are expressed in micrometres and apply before surface treatment.

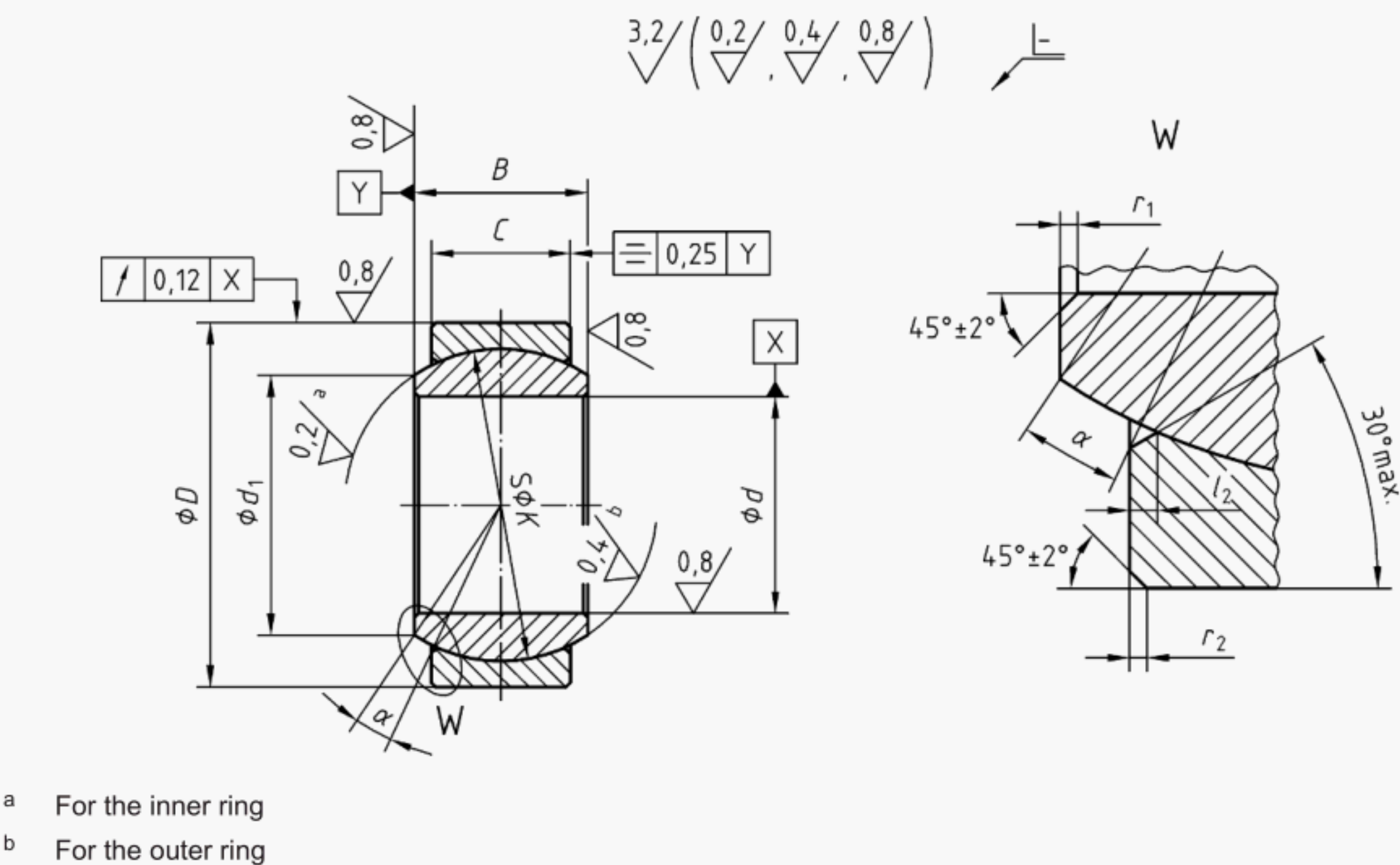
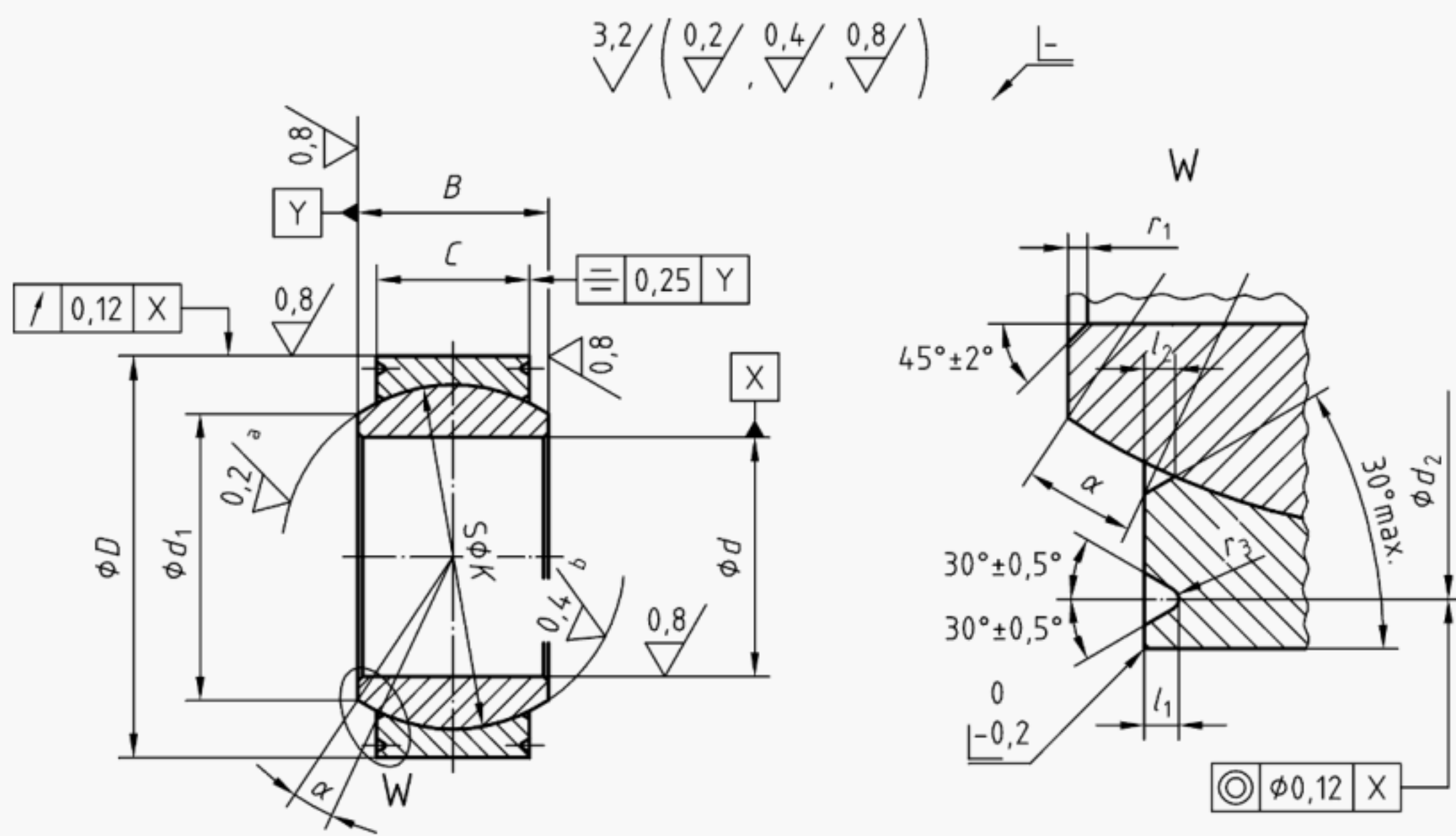


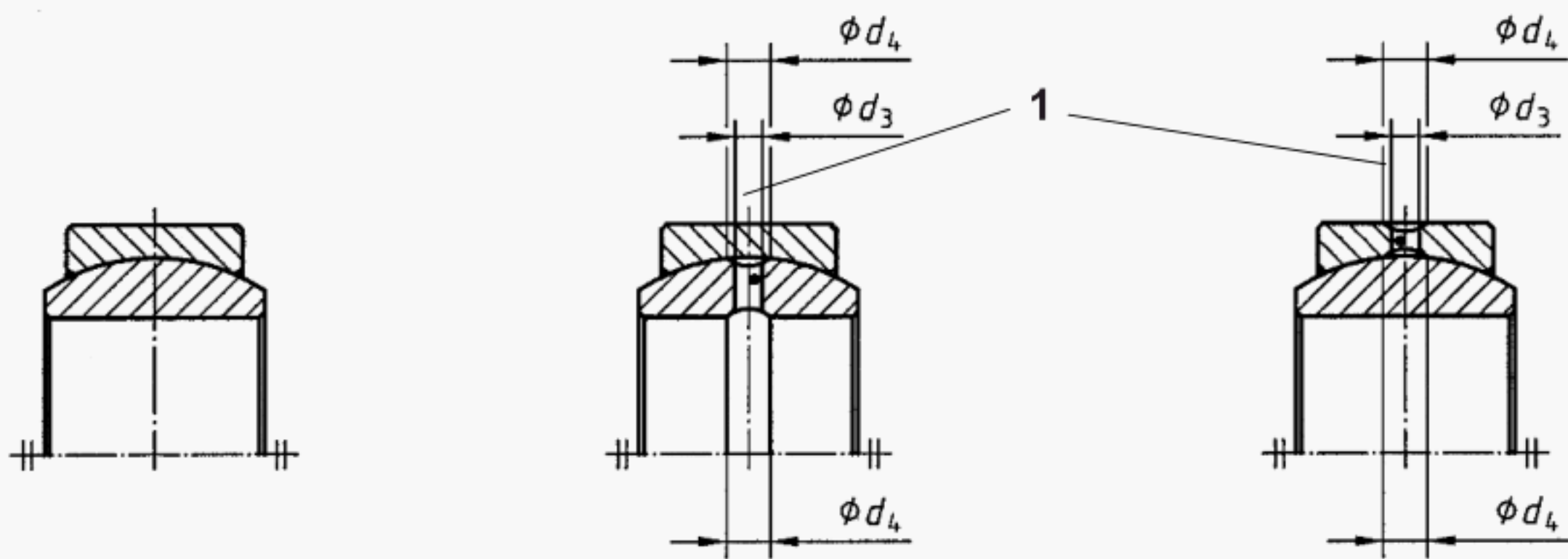
Figure 1 — Bearing without swaging grooves, code letter S





- a For the inner ring
- b For the outer ring

Figure 2 — Bearing with swaging grooves, code letter R



Code letter E:

Bearing without lubrication holes and groove

Code letter F:

Bearing with lubrication holes on inner ring and:

- a lubrication groove on the bore of the inner ring
- a distribution groove on spherical surface of the inner or outer ring

Code letter G:

Bearing with lubrication holes on the outer ring and:

- a lubrication groove on the outer surface of outer ring
- a distribution groove on spherical surface of the inner or outer ring

Key

1 Three holes  $\phi d_3$  at  $120^\circ$

NOTE The configuration with or without lubrication hole and lubrication groove applies to bearings either code letter R or code letter S.

Figure 3

Table 1

<i>d</i>		<i>B</i>	<i>C</i>	<i>D</i>	Tolerances μm				<i>d</i> <sub>1</sub>	<i>d</i> <sub>2</sub>	<i>d</i> <sub>3</sub>	<i>d</i> <sub>4</sub>	<i>k</i>	<i>l</i> <sub>1</sub>	<i>l</i> <sub>2</sub>	<i>r</i> <sub>1</sub>	<i>r</i> <sub>2</sub>	<i>r</i> <sub>3</sub>	α°	Mass			
Code	Nom.	<sup>0</sup> − 0,06	± 0,1		Δ <sub>dmp</sub>	Δ <sub>ds</sub>	Δ <sub>Dmp</sub>	Δ <sub>Ds</sub>	min.	+ 0,1 0	± 0,2	± 0,2	≈	<sup>0</sup> − 0,2	max.			+ 0,1 0	min. <sup>d</sup>	g ≈			
04	4	5	3	12	<sup>0</sup> − 8	<sup>+ 2</sup> − 10	<sup>0</sup> − 8	<sup>+ 5</sup> − 13	6	c	b		8	c	0,5		0,3 to 0,6	c	16	3			
05	5	6	4	14					8				10						13	5			
06	6								10				13						15	8			
08	8	8	5	16					13				16						12	12			
10	10	9	6	19					15				20,2						18	0,7		11	17
12	12	10	7	22		<sup>0</sup> − 9	<sup>+ 6</sup> − 15	18	24,2	22	0,6 to 1	8	32										
15	15	12	9	26				<sup>+ 3</sup> − 11		24				1,5	2,8	25	0,7	0,9	0,5 to 0,8	0,2	10	49	
15 <sup>a</sup>																							20
17	17	14	10	30		<sup>0</sup> − 10	<sup>+ 3</sup> − 13	<sup>0</sup> − 11	<sup>+ 8</sup> − 19	20	28	2	2,9	29	0,7	0,9	0,8		0,9 to 1,3	0,3	6	160	
17 <sup>a</sup>										24	33												2,5
20	20	16	12	35	24					33,2	36	41	47	53	60	66	1,4	1	0,6 to 1	1,4 to 1,8	7	460	
20 <sup>a</sup>					29					38,8													2,5
25	25	20	16	42	34					44,4	36	41	47	53	60	66	1,4	1	0,6 to 1	1,4 to 1,8	7	460	
25 <sup>a</sup>					39,4					43,8													2,5
30	30	22	18	47	39					51,8	36	41	47	53	60	66	1,4	1	0,6 to 1	1,4 to 1,8	7	460	
30 <sup>a</sup>					44,4					43,8													2,5
35	35	25	20	55	45					58,8	36	41	47	53	60	66	1,4	1	0,6 to 1	1,4 to 1,8	7	460	
40	40	28	22	62	50					64,8													36
45	45	32	25	68	55					71,8	36	41	47	53	60	66	1,4	1	0,6 to 1	1,4 to 1,8	7	460	
50	50	35	28	75	66	71,8	36	41	47	53													60
60	60	44	36	90	<sup>0</sup> − 15	<sup>+ 4</sup> − 19					<sup>0</sup> − 15	<sup>+ 13</sup> − 28	66	86,8	3	4,5	80					6	
					<sup>0</sup> − 15	<sup>+ 4</sup> − 19	<sup>0</sup> − 15	<sup>+ 13</sup> − 28	66	86,8	3	4,5	80						6	1 100			
<sup>a</sup> Code number 1 to be added to the end of identity block.																							
<sup>b</sup> Without lubrication holes and groove.																							
<sup>c</sup> Without swaging groove.																							
<sup>d</sup> Maximum values for the user.																							

5.3 Clearances and loads

See Table 2.

Table 2

<i>d</i>  Code number	Internal clearances				Permissible static loads	
	µm				kN	
	axial		radial max.		radial	axial <sup>a</sup>
	normal code letter N	reduced code letter P	normal code letter N	normal code letter P	<i>C<sub>s</sub></i>	<i>C<sub>a</sub></i>
04	35 to 75	5 to 35	20	10	7,2	0,45
05					12,6	0,8
06					16	1
08					21	1,8
10					31	2,5
12					40,5	3,5
15					70	5,3
17	40 to 80	5 to 40	25	12	91,4	6,7
20					130	9,8
25	50 to 100	5 to 50	30	15	216,7	18
30					277,5	25
35					359,9	31
40					428,8	38
45	60 to 120	5 to 60	35	20	558,4	50
50					760,1	64
60					1056	104,00
<sup>a</sup> These values apply to bearings without swaging groove. For bearings with swaging grooves, the push-out loads may be smaller than these values.						

5.4 Materials

Inner ring: according to EN 2030, 55 HRC to 62 HRC

Outer ring: according to EN 3490 or EN 3161, 28 HRC to 37 HRC before swaging

5.5 Surface treatment

5.5.1 Outer ring

Dry-film lubricant on the spherical surface (antiscoring treatment) applied according to EN 2491.

5.5.2 Inner ring

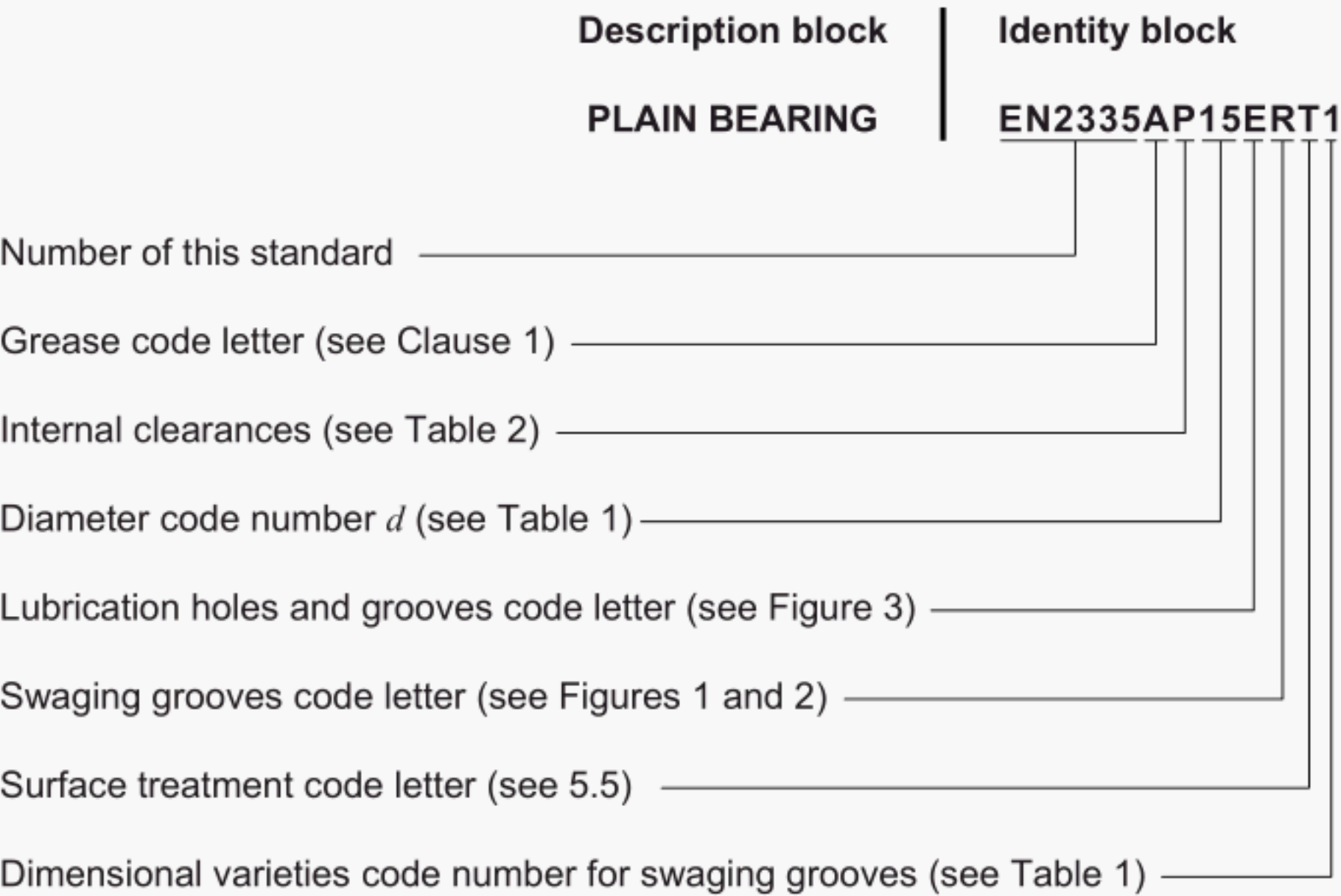
Passivation according to ISO 8075: code letter T

Without surface treatment (passivation): without code letter



6 Designation

EXAMPLE



NOTE If necessary, the code I9005 shall be placed between the description block and the identity block.

7 Marking

EN 2424, style A

The marking position is at the manufacturer's option.

8 Technical specification

See EN 2337