

Structural bearings —

Part 4: Roller bearings

The European Standard EN 1337-4:2004 has the status of a British Standard

ICS 91.010.30

National foreword

This British Standard was published by BSI. It is the UK implementation of EN 1337-4:2004, incorporating corrigendum February 2007. Together with BS EN 1337-6:2004 it supersedes BS 5400-9.1:1983 which will remain current until the publication of the remaining parts of the BS EN 1337 series.

The UK participation in its preparation was entrusted to Technical Committee B/522, Structural bearings.

A list of organizations represented on this committee can be obtained on request to its secretary.

This publication does not purport to include all the necessary provisions of a contract. Users are responsible for its correct application.

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Amendments issued since publication

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Contents

page

Foreword	4
1 Scope	5
2 Normative references	5
3 Terms, definitions and symbols	6
3.1 Terms and definitions	6
3.2 Symbols	6
3.3 Abbreviations	7
4 Functional requirements	8
4.1 General	8
4.2 Load bearing capacity	8
4.3 Rotation capability	9
5 Materials	9
5.1 General	9
5.2 Carbon steel	9
5.3 Stainless steel	9
5.4 Cast steel	9
6 Design	9
6.1 General	9
6.2 Movement	10
6.3 Curved surfaces	10
6.4 Surfaces in contact	10
6.5 Length of rollers	10
6.6 Guidance and security of rollers	10
6.7 Dimensioning of components	10
6.7.1 Dimension of roller	10
6.7.2 Dimensions of roller plates	11
6.7.3 Load distribution to other components	12
6.8 Particular requirements	12
6.8.1 Flat sided rollers	12
6.8.2 Multiple rollers	12
6.8.3 Corrosion in the contact line	12
6.8.4 Alignment of components	12
6.8.5 Alignment of bearings	12
6.9 Design coefficient of friction	12
6.10 Eccentricities	13
6.10.1 Single rollers	13
6.10.2 Eccentricity due to rotation moment of multiple rollers	13
6.10.3 Transverse eccentricity	14
6.10.4 Total eccentricity	14
6.11 Combination with other elements	14
7 Tolerances	14
7.1 Flatness	14
7.2 Surface profile	14
7.3 Surface roughness	14
7.4 Parallelism of contact surfaces	15
7.5 Diameter of multiple rollers	15
8 Conformity evaluation	15
8.1 General	15
8.2 Control of the construction product and its manufacture	15
8.2.1 Factory Production Control (FPC)	15
8.2.2 Initial type testing	15

8.2.3	Routine testing.....	15
8.3	Raw materials and constituents.....	16
9	Installation	16
10	In-service inspection	16
Annex A (normative) Ferrous materials.....		18
Annex B (informative) Factory Production Control		19
B.1	General.....	19
B.1.1	Objectives.....	19
B.1.2	Documentation.....	19
B.1.3	Operations	19
B.2	Verifications and tests.....	20
B.2.1	General comments.....	20
B.2.2	Monitoring of conformity	20
B.2.3	Tests.....	20
B.2.4	Treatment of construction products which do not conform.....	20
B.2.5	Recording of verification and tests (manufacturer's register).....	20
B.2.6	Traceability.....	21
Annex ZA (informative) Clauses of this European Standard addressing the provisions of the EU Construction Products Directive.....		22
ZA.1	Scope and relevant characteristics.....	22
ZA.2	Procedure(s) for attestation of conformity of roller bearings	24
ZA.2.1	System(s) of attestation of conformity	24
ZA.2.2	EC Certificate and declaration of conformity	28
ZA.3	CE marking and labelling	29
Bibliography		31

Foreword

This document (EN 1337-4:2004) has been prepared by Technical Committee CEN /TC 167, "Structural bearings", the secretariat of which is held by UNI.

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 October 2004, and conflicting national standards shall be withdrawn at the latest by January 2006.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative annex ZA, which is an integral part of this document.

The European Standard EN 1337 "Structural bearings" consists of the following 11 parts:

Part 1	General design rules
Part 2	Sliding elements
Part 3	Elastomeric bearings
Part 4	Roller bearings
Part 5	Pot bearings
Part 6	Rocker bearings
Part 7	Spherical and cylindrical PTFE bearings
Part 8	Guide bearings and restrain bearings
Part 9	Protection
Part 10	Inspection and maintenance
Part 11	Transport, storage and installation

Annex A is normative and annex B is informative.

This document includes a Bibliography.

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 United Kingdom.

1 Scope

This part of EN 1337 specifies the requirements for the design and manufacture of single and multiple roller bearings, in which the roller axis is horizontal. In order to accommodate displacements parallel to the roller axis roller bearings can be combined with sliding elements in accordance with EN 1337-2. To permit rotation about the axis perpendicular to the roller axis or about both axes, as for multiple roller bearings, the roller bearings can be combined with bearings from other parts of EN 1337.

This part of EN 1337 does not apply to roller bearings made with materials other than those specified in clause 5.

Bearings which are subjected to rotation greater than 0,05 rad resulting from the characteristic combination of actions are outside the scope of this part of EN 1337.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text, and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 1337-1:2000, *Structural bearings — Part 1: General design rules*.

EN 1337-2:2004, *Structural bearings — Part 2: Sliding elements*.

EN 1337-7; *Structural bearings - Part 7: Spherical and cylindrical PTFE bearings*.

EN 1337-9:1997, *Structural bearings — Part 9: Protection*.

EN 1337-10, *Structural bearings — Part 10: Inspection and maintenance*.

EN 1990; *Eurocode - Basis of structural design*.

ENV 1992-1-1; *Eurocode 2: Design of concrete structures - Part 1: General rules and rules for buildings*.

ENV 1993-1-1; *Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings*.

EN 10025, *Hot rolled products of non-alloy structural steels — Technical delivery conditions*.

EN 10083-1, *Quenched and tempered steels — Part 1: Technical delivery conditions for special steels*.

EN 10083-2, *Quenched and tempered steels — Part 2: Technical delivery condition for unalloyed quality steels*.

EN 10088-2, *Stainless steels — Part 2: Technical delivery conditions for sheet/plate and strip for general purposes*.

EN 10160, *Ultrasonic testing of steel flat product of thickness equal or greater than 6 mm (reflection method)*.

EN 10204, *Metallic products — Types of inspection documents*.

EN ISO 4287; *Geometrical product specifications (GPS) - Surface texture: Profile method - Terms, definitions and surface texture parameters (ISO 4287:1997)*.

EN ISO 6506-1, *Metallic materials - Brinell hardness test - Part 1: Test method (ISO 6506-1:1999)*.

ISO 3755, *Cast carbon steels for general engineering purposes*.

3 Terms, definitions and symbols

3.1 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply.

3.1.1

roller bearing

bearing formed by an upper and lower plate separated by one or more rollers (see Figure 1)

3.1.2

roller

accurately machined component of a roller bearing with concentric cylindrical surfaces

3.1.3

roller plate

accurately machined flat component which transmits force to and from the roller and provides the surface on which the roller moves

3.1.4

supporting plate

plate intermediate between the roller plate and the structure

3.1.5

multiple roller bearing

bearing comprising more than one roller

3.1.6

rotation element

additional element required with multiple bearings in order to share the applied normal forces between the rollers

3.2 Symbols

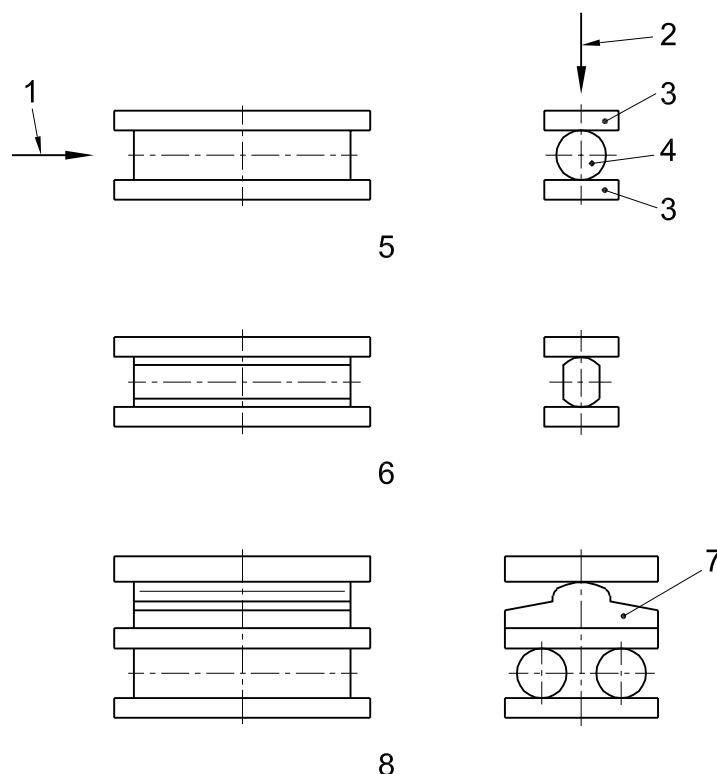
For the purposes of this European Standard, the following symbols apply.

δ	total design angular rotation about the line of contact, in radians (rad)
b	width of Hertzian contact area, in millimetres (mm)
E_d	design modulus of elasticity, in Newtons per square millimetre (N/mm ²)
e_d	total design eccentricity of vertical load, in millimetres (mm)
$e_{1,d}$	total eccentricity due to rolling friction, in millimetres (mm)
$e_{2,d}$	design eccentricity due to rotation, in millimetres (mm)
$e_{3,d}$	design eccentricity due to translation, in millimetres (mm)
D	diameter of the roller at the contact surface, in millimetres (mm)
f_u	ultimate strength of material, in Newtons per square millimetre (N/mm ²)
f_y	yield strength of material, in Newtons per square millimetre (N/mm ²)
N_{Rd}	design resistance of the roller plates in Newtons (N)
N_{Rd}	design resistance per unit length in Newton per millimetre (N/mm)
N_{RK}	characteristic resistance of the roller plates

N_{RK}	characteristic resistance per unit length in Newton per millimetre (N/mm)
N_{Sd}	design axial force, in Newtons (N)
N'_{Sd}	design axial force per unit length in Newton per millimetre (N/mm)
γ_m	partial material safety factor
L	effective length of roller, in millimetres (mm)
M_{Sd}	rotation moment, in Newton millimetres (Nmm)
R	radius of contact surface, in millimetres (mm)
t_p	thickness of roller plate, in millimetres (mm)
μ_d	design coefficient of rolling friction
H	distance between horizontal section to be verified and roller contact area in millimetres (mm)
V_{Sd}	total transverse or shear force in Newtons (N)

3.3 Abbreviations

ULS	Ultimate Limit State
NDP	Nationally Determined Parametres
FPC	Factory Production Control



Key

- 1 Horizontal force
- 2 Normal force
- 3 Roller plate
- 4 Roller
- 5 Single roller bearing
- 6 Flat sided roller bearing
- 7 Rotation element
- 8 Multiple roller bearing

Figure 1 — Types of roller bearing

4 Functional requirements

4.1 General

A roller bearing shall be capable of transferring normal forces between the superstructure and the substructure. It shall permit translation perpendicular to the roller axis and rotation about that axis.

All roller bearings shall incorporate a mechanical restraint system to resist applied horizontal forces along the axis of the roller.

4.2 Load bearing capacity

The load bearing capacity of the roller bearing shall be obtained from the design verification as a function of the geometry and the steel properties.

4.3 Rotation capability

The rotation capability of the roller bearing is an intrinsic characteristic of the system based on its geometry and shall be declared by the manufacturer. Its maximum value shall be 0,05 rad.

5 Materials

5.1 General

Only ferrous materials as specified in the following and in annex A shall be used in the manufacture of rollers and roller plates.

Rollers and roller plates shall be examined for cracks by ultrasonic methods in accordance with the requirements of EN 10160 or by magnetic particle or dye penetrant methods. No components with linear defects revealed by these procedures are acceptable.

The low temperature impact properties of all steel mentioned in the following and in annex A shall comply with the requirements given in annex A. Impact tests shall be conducted as specified in the relevant standards. The minimum energy at -20 °C for the average of 3 samples shall be as given in annex A. Only one of these 3 samples may have a lower value which shall be at least 0,7 x the average specified in annex A.

Rollers and roller plates shall not have a surface hardness greater than that specified in annex A.

The hardness of roller and roller plates shall be verified in accordance with EN ISO 6506-1. Both the hardness of the contact surfaces and the variation in hardness across the section shall be verified by tests carried out on the contact surfaces and across the ends.

5.2 Carbon steel

Carbon steel shall be in accordance with the requirements of EN 10025 or EN 10083-1 and EN 10083-2. The minimum yield strength shall be 240 N/mm².

5.3 Stainless steel

Stainless steel shall be in accordance with EN 10088-2. The minimum tensile strength shall be 490 N/mm² for any component.

5.4 Cast steel

Cast steel shall be in accordance with ISO 3755.

6 Design

6.1 General

NOTE 1 The design of roller bearings is based on the assumption that load passes through a Hertzian contact area between two surfaces with dissimilar radii. Design verification with respect to loading, rotation (movement) should be determined in accordance with clause 5 of EN 1337-1:2000.

Performance and durability of bearings designed according to this part of EN 1337 are based on the assumption that requirements established in 6.2 to 6.11 and clause 7, as relevant, are complied with.

The design values of the effects (forces, deformations, movements) from the actions at the supports of the structure shall be calculated from the relevant combination of actions according to EN 1990.

NOTE 2 The decisive design values should be available from a bearing schedule as shown in EN 1990, annex E.1. Until EN 1991 is available the guidance given in annex B of EN 1337-1:2000 can be used. Sliding elements should be designed and manufactured in accordance with EN 1337-2.

γ_m values are defined in Eurocodes EN 1992 to EN 1999. The recommended value is $\gamma_m = 1$.

NOTE 3 When values for partial factors have been selected in Member States, which diverge, for specific works, from the recommended value given in EN 1992 to EN 1999, these values apply in the territory of this member State. Such values are defined in the national annex attached to the relevant Eurocodes.

6.2 Movement

NOTE Roller bearings provide for translation in one direction only. Single rollers permit rotation about the line of contact but multiple rollers require additional elements to accommodate rotation.

Roller bearings for use in curved parts of structures shall have additional sliding elements and/or rotation elements to ensure uniform distribution of load across the roller. The axis of rotation shall be perpendicular to the direction of movement.

6.3 Curved surfaces

The curved surfaces shall be of cylindrical shape.

6.4 Surfaces in contact

Surfaces in contact shall have the same nominal strength and hardness.

6.5 Length of rollers

The length of a roller shall not be less than twice its diameter nor greater than six times its diameter.

6.6 Guidance and security of rollers

Guidance shall be provided to ensure that the axis of rolling is maintained correctly. Location shall be such that true rolling occurs during movement. Where gearing is used as security, the pitch circle diameter of the gear teeth shall be the same as the diameter of the rollers.

6.7 Dimensioning of components

6.7.1 Dimension of roller

NOTE 1 The ability of curved surfaces and plates to withstand deformation under load is dependent upon the hardness of the material of which they are made. There is not a constant relationship between hardness and yield stress of steel but there is between hardness and ultimate strength. Consequently the following expressions are based on the ultimate strength of the material.

The design axial force per unit length of roller contact N_{Sd} shall meet the following condition under the fundamental combination of actions:

$$N_{Sd} \leq N_{Rd} \quad (1)$$

Where $N_{Rd} = \frac{N_{Rk}}{\gamma_m}$ is the design value of resistance per unit length of roller contact.

N_{Rk} is the characteristic value of resistance of the contact surface per unit length.

$$N_{Rk} = 23 \cdot R \cdot \frac{f_u^2}{E_d} \quad (2)$$

γ_m values are defined in Eurocodes EN 1992 to EN 1999. The recommended value is $\gamma_m = 1$.

NOTE 2 When values for partial factors have been selected in Member States, which diverge, for specific works, from the recommended value given in EN 1992 to EN 1999, these values apply in the territory of this member State. Such values are defined in the national annex attached to the relevant Eurocodes.

In determining the values of N_{Sd} the effects of asymmetric loading due to transverse eccentricities and applied moments shall be considered.

6.7.2 Dimensions of roller plates

Roller plates shall be dimensioned in the direction of displacement to allow for movement calculated for the fundamental combination of actions in accordance with 5.1 of EN 1337-1:2000 plus an additional roller design movement of $2 \times t_p$, the thickness of the roller plate, or 20 mm whichever is greater. The length of the plates parallel to the roller axis shall not be less than the length of the roller. In determining the thickness of the roller plates, the following shall be satisfied using the load distribution shown in Figure 2 under the fundamental combination of actions:

$$N_{Sd} \leq N_{Rd} \quad (3)$$

Where $N_{Rd} = \frac{N_{Rk}}{\gamma_m}$ is the design value of resistance in accordance with ENV 1992-1-1 and ENV 1993-1-1.

$$N_{Rk} = f_y (2t_p + b)L \quad (4)$$

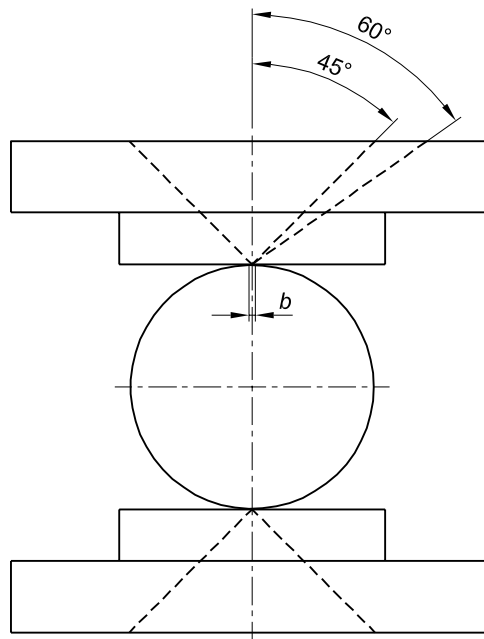


Figure 2 — Load distribution to components

NOTE 1 b can be calculated according to hertzian stress analysis principles or taken as equal to 0.

γ_m values are defined in Eurocodes EN 1992 to EN 1999. The recommended value is $\gamma_m = 1,1$

NOTE 2 When values for partial factors have been selected in member states, which diverge, for specific works, from the recommended value given in EN 1992 to EN 1999, these values apply in the territory of this member state. Such values are defined in the national annex attached to the relevant Eurocodes.

6.7.3 Load distribution to other components

For roller bearings the stiffness of the supporting plates is of paramount importance therefore the roller plates shall be so proportioned that loads are adequately distributed to adjacent components. The maximum load dispersion through a component shall be taken as 45° unless a greater angle is justified by calculations which take into account the characteristics of the adjacent components and materials. In no case shall load dispersion be assumed beyond a line drawn at 60° to the vertical axis (see Figure 2).

6.8 Particular requirements

6.8.1 Flat sided rollers

Where movement requirements permit, flat sided rollers may be used. Such rollers shall be symmetrical about the vertical plane passing through the axis of the roller. The minimum width shall not be less than one-third of the diameter nor such that the bearing contact area falls outside the middle third of the rolling surface when the roller is at the extremes of movement determined in accordance with EN 1337-1.

NOTE Flat sided rollers can be mounted at closer centres than circular rollers of the same load capacity resulting in more compact bearings.

6.8.2 Multiple rollers

Where a bearing has more than one roller an additional bearing in accordance with other parts of EN 1337 shall be included to accommodate rotation (see Figure 1). The effects of any rotation moments from this element shall be included when calculating the roller forces by taking into account the corresponding eccentricities. The load per roller shall be calculated at the extreme of the expected movement. In addition where a bearing has more than two rollers the limiting values for design load effects shall be taken as two-thirds of the value given by the expression in 6.7.1.

6.8.3 Corrosion in the contact line

If the materials used for the roller and roller plates are not intrinsically corrosion resistant then other provisions shall be made in the design to prevent corrosion in the area. These measures may take the form of grease boxes, oil baths, flexible seals or other methods which can be shown to be effective or which have been found satisfactory during use. Where dissimilar materials are used in combination the effects of electrolytic corrosion shall be considered.

6.8.4 Alignment of components

Provision shall be made to ensure that bearing components remain correctly aligned with each other and clamped together between manufacture and installation. Temporary transit devices and devices intended to maintain alignment during installation shall not be used to locate the structure.

6.8.5 Alignment of bearings

It is particularly important that the axis of the rolling element is correctly aligned in the structure and accurate alignment marks defining the axes of the roller shall be indelibly scribed on outer surfaces of accessible plates.

6.9 Design coefficient of friction

The design friction coefficient μ_d shall be taken as 0,02 for steel with a hardness ≥ 300 HV and 0,05 for all other steels.

NOTE The coefficient of friction for rolling contact surfaces of rollers used for structural design purposes can be determined by test. Test results should be increased by a factor of 2 to give a design coefficient of friction to allow, for the long-term effects of wear, corrosion protection and accumulation of debris.

6.10 Eccentricities

6.10.1 Single rollers

6.10.1.1 Eccentricity due to rolling friction

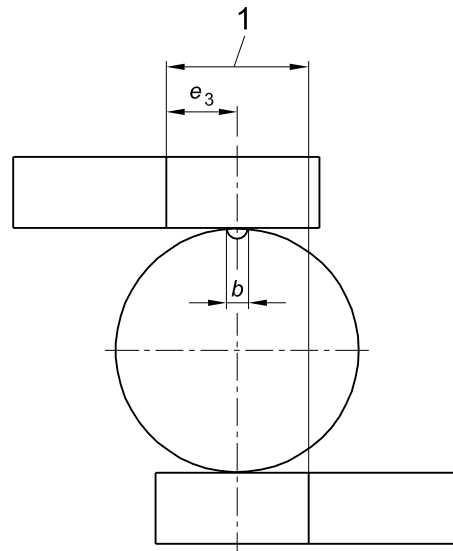
This eccentricity results from the lateral force $V_{Sd} = \mu N_{Sd}$ which has to be taken into account when designing the connection devices of the bearing and fixed point of the bridge.

6.10.1.2 $e_1 = \frac{R}{2} [R + (R + H)]$ Translational eccentricity

Eccentricity, $e_{3,d}$, produced by relative movement (displacement) of top and bottom roller plates is:

$$e_{3,d} = \frac{\text{displacement}}{2} \quad (5)$$

See Figure 3.



Key

1 Displacement

Figure 3 — Translational eccentricity of single roller

6.10.1.3 Rotational eccentricity

Eccentricity caused by the rotational movement of the bridge $e_2 = \frac{R}{2} \theta$

NOTE Other eccentricities can co-exist with those detailed in this clause and designers should be aware of the possibility of their existence. In general their effects are small compared with the above and can be ignored.

6.10.2 Eccentricity due to rotation moment of multiple rollers

Multiple roller bearings have no inherent rotation capacity. Design rotation moment, M_{Sd} , is therefore determined by the characteristics of the additional rotation element designed in accordance with the appropriate part of this part of EN 1337. The design eccentricity resulting from the action of this rotational element shall be calculated in accordance with the relevant part of this part of EN 1337.

EN 1337-4:2004 (E)

Design eccentricity $e_{2,d}$ shall be considered when determining the individual roller design loads and in determining the total design eccentricity on the structure.

$$e_{2,d} = \frac{M_{Sd}}{N_{Sd}} \quad (6)$$

6.10.3 Transverse eccentricity

In the absence of any transverse rotation capability a transverse eccentricity of $L/10$ shall be assumed as specified in 5.5 of EN 1337-1:2000.

6.10.4 Total eccentricity

The total eccentricity to be considered shall be the vectorial sum of the individual foregoing eccentricities.

6.11 Combination with other elements

When a roller bearing is combined with elements from other parts of EN 1337 the characteristics and kinetics of all elements and their interaction, together with the stiffnesses, moments and eccentricities of the adjacent structural components shall be considered.

7 Tolerances

NOTE In Tables 1 and 2, the gauge length is the length of the roller.

7.1 Flatness

The tolerances on flatness of roller plates in the direction of the roller axis shall be in accordance with Table 1.

Table 1 — Flatness tolerance for roller plates

Material	Length of roller contact L (mm)	
	250	> 250
	Tolerance (mm)	Tolerance (mm)
Steel 300 HV	0,1	0,0004 L
Steel > 300 HV	0,075	0,0003 L

7.2 Surface profile

The surface profile tolerance for the length of the curved surface over which contact can occur shall be in accordance with Table 2.

Table 2 — Surface profile tolerance for rollers

Material	Length of roller contact L (mm)	
	250	> 250
	Tolerance (mm)	Tolerance (mm)
Steel 300 HV	0,05	0,05
Steel > 300 HV	0,025	0,025

7.3 Surface roughness

The surface roughness of the roller and roller plate, measured in accordance with EN ISO 4287, shall not exceed the values shown in Table 3.

Table 3 — Surface roughness

Material	Surface roughness (μm)
Steel 300 HV	25,0
Steel > 300 HV	6,3

7.4 Parallelism of contact surfaces

Before installation, the deviation from parallelism between any two pairs of points on the surfaces shall be not more than 0,1 % when the difference in the vertical distance between each pair is expressed as a percentage of the horizontal distance separating them.

7.5 Diameter of multiple rollers

The tolerance on size of multiple rollers with respect to their nominal diameter shall be +0,08 mm/-0,0 mm.

8 Conformity evaluation

8.1 General

The inspections specified in this clause shall be carried out to demonstrate conformity of the product (roller bearings) with this part of EN 1337. In the case of sliding roller bearings, clause 8 of EN 1337-2:2004 also applies.

The given procedure for evaluation of conformity is also valid for non serial production.

8.2 Control of the construction product and its manufacture

8.2.1 Factory Production Control (FPC)

The extent and frequency of factory production control by the manufacturer and of controls during type testing by a third party (if required) shall be conducted in accordance with Table 4. In addition it shall be checked by controlling the inspection certificates as listed in Table 5 that the incoming raw materials and components comply with this part of EN 1337.

NOTE For factory production control see annex B.

8.2.2 Initial type testing

The extent of type-testing shall be conducted in accordance with Table 4.

Type testing shall be performed prior to commencing manufacture. It shall be repeated if changes in the construction product or manufacturing processes occur.

Certificates containing material properties established in clause 5 shall be individually examined during type testing and shall be retained by the manufacturer of the roller bearing and by the third party (if required).

Type testing shall be supplemented with the relevant calculations from clause 6 for the evaluation of the final performance of the roller bearing.

8.2.3 Routine testing

The routine testing shall be carried out continuously by the manufacturer in accordance with Table 4.

8.3 Raw materials and constituents

Compliance with the product requirements specified in clause 5, or examined during type testing, shall be verified by means of inspection certificates in accordance with EN 10204 to the level stated in Table 5.

9 Installation

The bearings shall be installed within a tolerance of $\pm 0,003$ rad of the intended inclination of the contact surfaces to the structure.

10 In-service inspection

In-service inspection shall be in accordance with the requirements of EN 1337-10. Visible defects shall include cracking of roller or roller plates, misalignment of the roller, gap between roller and roller plates in the intended contact area.

In the case of sliding roller bearings, the inspection of the sliding surfaces shall be as for EN 1337-2 and EN 1337-7.

Table 4 — Control and testing of the roller bearing

Type of control		Subject of control	Control in accordance with	Frequency
Factory production control (FPC)	LBC, RC	Dimensions	Manufacturer's drawings	Every bearing
	LBC	Flatness	7.1	
	LBC, RC	Surface profile	7.2	
	LBC	Surface roughness	7.3	
	LBC	Parallelism	7.4	
	LBC	Diameter of multiple rollers	7.5	
	LBC	Hardness of hardened steel	annex A	
	LBC, D	Freedom from cracks	5.1	
	D	Corrosion protection	EN 1337-9	
Type-testing	LBC, RC	Dimensions	Manufacturer's drawings	Once
	LBC	Mechanical characteristics of steel	annex A	
	D	Freedom from cracks	5.1	
	D	Corrosion protection	EN 1337-9	
LBC = relevant to load bearing capacity RC = relevant to rotation capability D = relevant to durability				

Table 5 — Specific testing of raw materials and constituents

Type of inspection certificate in accordance with EN 10204	Subject of control	Control in accordance with	Frequency
3.1.B	Carbon steel	5.2	Every batch
	Stainless steel	5.3	
	Cast steel	5.4	

Annex A
(normative)

Ferrous materials

Table A.1 – Ferrous material classes

Material class	Tensile strength (Minimum) [N/mm ²]	Yield strength (Minimum) [N/mm ²]	Impact / at temperature (Minimum) [J]	Surface hardness (Maximum) [HV 10]	Elongation (Minimum) [%]	Friction coefficient (Maximum)
A	340	240	27 / 0 °C	150	25	0,05
B	490	335	27 / -20 °C	250	21	0,05
C	600	420	27 / -20 °C	450	14	0,02
D	1350	1200	11/-20 °C	480	12	0,02

Annex B (informative)

Factory Production Control

B.1 General

B.1.1 Objectives

The manufacturer should exercise a permanent FPC.

NOTE A quality management system based on the relevant part of the EN ISO 9000 series or equivalent, including specific requirements from this part of EN 1337, can be considered as suitable.

The manufacturer is responsible for organising the effective implementation of the FPC system. Tasks and responsibilities in the production control organisation should be documented and this documentation should be kept up-to-date. In each factory the manufacturer can delegate the action to a person having the necessary authority to:

- a) identify procedures to demonstrate conformity of the construction product at appropriate stages;
- b) identify and record any instance of non-conformity;
- c) identify procedures to correct instances of non-conformity.

B.1.2 Documentation

The manufacturer should draw up and keep up-to-date documents defining the FPC which he applies. The manufacturer's documentation and procedures should be appropriate to the construction product and manufacturing process. All FPC systems should achieve an appropriate level of confidence in the conformity of the construction product. This involves:

- a) preparation of documented procedures and instructions relating to FPC operations, in accordance with the requirements of this part of EN 1337 (see B.1.3);
- b) effective implementation of these procedures and instructions;
- c) recording of these operations and their results;
- d) use of these results to correct any deviations, repair the effects of such deviations, at any resulting instances of non-conformity and, if necessary, revise the FPC to rectify the cause of non-conformity.

B.1.3 Operations

FPC includes the following operations:

- a) specification and verification of raw materials and constituents;
- b) controls and tests to be carried out during manufacture of the construction product according to a frequency laid down;
- c) verifications and tests to be carried out on finished construction products according to a frequency which may be laid down in the technical specifications and adapted to the product and its conditions of manufacture.

NOTE 1 The operations under (b) centre as much on the intermediate states of the construction product as on manufacturing machines and their adjustment, and equipment etc. These controls and tests and their frequency are chosen based on type of construction product and composition, the manufacturing process and its complexity, the sensitivity of product features to variations in manufacturing parameters etc.

NOTE 2 With regard to operations under (c), where there is no control of finished construction products at the time that they are placed on the market, the manufacturer should ensure that packaging and reasonable conditions of storage do not damage construction products and that the construction product remains in conformity with the technical specification.

NOTE 3 The appropriate calibrations should be carried out on defined measuring and test instruments.

B.2 Verifications and tests

B.2.1 General comments

The manufacturer should have or have available the installations, equipment and personnel which enable him to carry out the necessary verifications and tests. He can, as his agent, meet this requirement by concluding a sub-contract agreement with one or more organisations or persons having the necessary skills and equipment.

The manufacturer should calibrate or verify and maintain the control, measuring or test equipment in good operating condition, whether or not it belongs to him, with a view to demonstrating conformity with the specification or the test reference system to which the specification refers.

B.2.2 Monitoring of conformity

If necessary, monitoring is carried out of the conformity of intermediate states of the product and at the main stages of its production.

This monitoring of conformity focuses where necessary on the construction product throughout the process of manufacture, so that only products having passed the scheduled intermediate controls and tests are despatched.

B.2.3 Tests

Tests should be in accordance with the test plan (Tables 4 and 5) and be carried out in accordance with the methods indicated in this part of EN 1337.

NOTE Initial type tests on the product may not be carried out by the manufacturer himself but should be carried out and validated by an approved body.

The manufacturer should establish and maintain records which provide evidence that the construction product has been tested. These records should show clearly whether the construction product has satisfied the defined acceptance criteria. Where the construction product fails to satisfy the acceptance measures, the provision for non-conforming product should apply.

B.2.4 Treatment of construction products which do not conform

If control or tests show that the construction product does not meet the requirements, then necessary corrective should immediately be taken. Construction products or batches not conforming should be isolated and properly identified. Once the fault has been corrected, the test or verification in question should be repeated.

If construction products have been delivered before the results are available, a procedure and record should be maintained for notifying customers.

B.2.5 Recording of verification and tests (manufacturer's register)

The results of factory production controls should be properly recorded in the manufacturer's register. The construction product description, date of manufacture, test method adopted, test results and acceptance criteria should be entered in the register under the signature of the person responsible for control who carried out the verification.

With regard to any control result not meeting the requirements of this part of EN 1337, the corrective measures taken to rectify the situation (e.g. a further test carried out, modification of manufacturing process, scrapping or rectifying of the product) should be indicated in the register.

In the case of third party surveillance the records should be made available to the third party for examination.

B.2.6 Traceability

It is the manufacturer's, or his agent's responsibility to keep full records of individual construction products or product batches, including their related manufacturing details and characteristics and to keep records of to whom these construction products or batches were first sold. Individual construction products or batches of products and their related manufacturing details should be completely identifiable and traceable. In certain cases, for example bulk products, a rigorous traceability is not possible.

Annex ZA (informative)

Clauses of this European Standard addressing the provisions of the EU Construction Products Directive

ZA.1 Scope and relevant characteristics

This part of EN 1337 has been prepared under a mandate¹⁾ given to CEN by the European Commission and the European Free Trade Association.

The clauses of this part of EN 1337 shown in this annex meet the requirements of the mandate given under the EU Construction Products Directive (89/106/EEC).

Compliance with these clauses confers a presumption of fitness of the roller bearings covered by this annex for the intended uses indicated herein; reference shall be made to the information accompanying the CE marking.

WARNING: Other requirements and other EU Directives, not affecting the fitness for intended use, can be applicable to the roller bearings falling within the scope of this European Standard.

NOTE In addition to any specific clauses relating to dangerous substances contained in this part of EN 1337, there may be other requirements applicable to the products falling within its scope (e.g. transposed European legislation and national laws, regulations and administrative provisions). In order to meet the provisions of the EU Construction Products Directive, these requirements need also to be complied with, when and where they apply.
Note : an informative database of European and national provisions on dangerous substances is available at the Construction web site on EUROPA (CREATE, accessed through <http://europa.eu.int/comm/enterprise/construction/internal/dangsub/dangmain.htm>)

¹⁾ M/104 "Structural bearings" as amended by M/122 (anti-seismic devices are covered by CEN/TC 340).

Table ZA.1.1 - Relevant clauses for roller bearings for buildings and civil engineering works

Products: Roller bearings (Figure 1) as covered by the scope of this part of EN 1337			
Intended use: In buildings and civil engineering works			
Essential characteristics	Requirement clauses in this and other European Standard(s)	Levels and/or classes	Notes
Load bearing capacity	EN 1337-4:2004 Clauses - 4.1 - 4.2 - 6	None	Design value, in kN
Rotation capability	EN 1337-4:2004 Clauses - 4.1 - 4.3 - 6	None	Design value, in radians
Coefficient of friction of the rolling element	EN 1337-4:2004 Clause - 6.9	None	Design value (See annex A)
Durability – Against repeated loading Against low and high temperature Against corrosion	EN 1337-4:2004 Clauses - 5 - annex A - 5 - annex A 6.8.3 EN 1337-9	None	

Table ZA.1.2 - Relevant clauses for roller bearings with flat sliding elements for buildings and civil engineering works

Products:	Roller bearings (Figure 1) with flat sliding elements as covered by the scope of this part of EN 1337		
Intended use:	In buildings and civil engineering works		
Essential characteristics	Requirement clauses in this and other European Standard(s)	Levels and/or classes	Notes
Load bearing capacity	EN 1337-4:2004 Clauses - 4.1 - 4.2 - 6	None	Design value in kN
Rotation capacity	EN 1337-4:2004 Clauses - 4.1 - 4.3 - 6	None	Design value in radians
Coefficient of friction of the rolling element	EN 1337-4:2004 Clause - 6.9	None	Design value (See annex A)
Durability – Against repeated loading Against low and high temperature Against corrosion	EN 1337-4:2004 Clauses - 5 - annex A - 5 annex A - 6.8.3 EN 1337-9:1997, clause 4	None	
Load bearing capacity (of sliding element)	EN 1337-2:2004 clauses - 5 - 6.8.3 - 6.9	None	Design value in kN
Coefficient of friction (of sliding element)	EN 1337-2:2004 clauses - 4 - 5 - 6 - 7	None	Tabulated value (Table 11)
Durability aspects (of sliding element)	EN 1337-2:2004, clause 7 EN 1337-9:1997, clause 4	None	

The requirement on a certain characteristic is not applicable to those Member States (MSs) where there are no regulatory requirements on that characteristic for the intended use of the product. In this case, manufacturers placing their products on the market of these MSs are not obliged to determine nor declare the performance of their products with regard to this characteristic and the option "No performance determined" (NPD) in the information accompanying the CE marking (see clause ZA.3) may be used. The NPD option may not be used, however, where the characteristic is subject to a threshold level.

ZA.2 Procedure(s) for attestation of conformity of roller bearings

ZA.2.1 System(s) of attestation of conformity

The system(s) of attestation of conformity of roller bearings indicated in Table ZA.1.1 and Table ZA.1.2 in accordance with the Decision of the Commission Decision 95/467/EC of 24/10/1995 are the following:

Table ZA.2 - System(s) of attestation of conformity

Table EAE – System(s) of attestation of conformity			
Product(s)	Intended use(s)	Level(s) or class(es)	Attestation of conformity system(s)
Roller bearings	In buildings and civil engineering works where requirements on individual bearings are critical ^a	None	1
	In buildings and civil engineering works where requirements on individual bearings are not critical ^b		3
System 1: See annex III.2.(i), without audit testing of samples			
System 3: See annex III.2.(ii), second possibility			
^a Critical in the sense that those requirements may, in case of failure of the bearing, put the works or parts thereof in states beyond those regarded as serviceability and ultimate limit states.			
^b Not critical in the sense that those requirements may not, in case of failure of the bearing and under normal circumstances, put the works or parts thereof in states beyond those regarded as serviceability and ultimate limit states.			

The attestation of conformity of the roller bearings in Table ZA.1.1 shall be based on the evaluation of conformity sub-clauses of clause 8 of EN 1337-4:2004 indicated in Tables ZA.3.1 to ZA.3.2.

Table ZA.3.1 - Assignment of evaluation of conformity tasks for roller bearings intended to be subject to critical requirements

Tasks		Contents of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Table ZA.1.1 and Table ZA.1.2 where relevant	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.1 (factory production control) - annex B (factory production control)
	Further testing of samples taken at the factory, where relevant	All characteristics of Table ZA.1.1 and Table ZA.1.2 where relevant	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.3 (routine testing)
Tasks for the notified body	Initial type testing	All characteristics of Table ZA.1.1 and Table ZA.1.2 where relevant	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.2 (initial type testing)
	Initial inspection of factory and of FPC	Parameters related to all characteristics of Table ZA.1.1 and Table ZA.1.2 where relevant	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.1 (factory production control) - 8.2.3 (routine testing) - annex B (factory production control)
	Continuous surveillance, assessment and approval of FPC	Parameters related to all characteristics of Table ZA.1.1 and Table ZA.1.2 where relevant	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.1 (factory production control) - 8.2.3 (routine testing) - annex B (factory production control)

Table ZA.3.2 - Assignment of evaluation of conformity tasks for roller bearings intended to be subject to non critical requirements

Tasks		Contents of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Table ZA.1.1 and Table ZA.1.2 where relevant	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.1 (factory production control) - annex B (factory production control)
Tasks for the notified body	Initial type testing	All characteristics of Table ZA.1.1 and Table ZA.1.2 where relevant	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.2 (initial type testing)

The attestation of conformity of the sliding roller bearings in Table ZA.1.2 shall be based on the evaluation of conformity sub-clauses of clause 8 of EN 1337-4:2004 indicated in Tables ZA.3.3 to ZA.3.4.

Table ZA.3.3 - Assignment of evaluation of conformity tasks for sliding roller bearings intended to be subject to critical requirements

Tasks		Contents of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Table ZA.1.2	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.1 (factory production control) - annex B EN 1337-2:2004 clauses - 8.2.1 (general) - 8.2.3 (FPC) - 8.3 (raw materials and constituents) - 8.4 (sampling)
	Further testing of samples taken at the factory, where relevant	All characteristics of Table ZA.1.1	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.3 (routine testing)
Tasks for the notified body	Initial type testing	All characteristics of Table ZA.1.2	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.2 (initial type testing) EN 1337-2:2004 clauses - 8.2.1 (general) - 8.2.3 (FPC) - 8.3 (raw materials and constituents) - 8.4 (sampling)
	Initial inspection of factory and of FPC	Parameters related to all characteristics of Table ZA.1.2	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.1 (factory production control) - 8.2.3 (routine testing) - annex B EN 1337-2:2004 clauses - 8.2.1 (general) - 8.2.3 (FPC) - 8.3 (raw materials and constituents) - 8.4 (sampling)
	Continuous surveillance, assessment and approval of FPC	Parameters related to all characteristics of Table ZA.1.2	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.1 (factory production control) - 8.2.3 (routine testing) - annex B EN 1337-2:2004 clauses - 8.2.1 (general) - 8.2.3 (FPC) - 8.3 (raw materials and constituents) - 8.4 (sampling)

Table ZA.3.4 - Assignment of evaluation of conformity tasks for sliding roller bearings intended to be subject to non critical requirements

Tasks		Contents of the task	Evaluation of conformity clauses to apply
Tasks for the manufacturer	Factory production control (FPC)	Parameters related to all characteristics of Table ZA.1.1	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.1 (factory production control) - annex B EN 1337-2:2004 clauses - 8.2.1 (general) - 8.2.3 (FPC) - 8.3 (raw materials and constituents) - 8.4 (sampling)
Tasks for the notified body	Initial type testing	All characteristics of Table ZA.1.1	EN 1337-4:2004 clauses - 8.1 (conformity evaluation – general) - 8.2.2 (initial type testing) EN 1337-2:2004 clauses - 8.2.1 (general) - 8.2.3 (FPC) - 8.3 (raw materials and constituents) - 8.4 (sampling)

ZA.2.2 EC Certificate and declaration of conformity

When compliance with the conditions of this annex is achieved:

a) For bearings under system 1, the certification body shall draw up a certificate of conformity (EC Certificate of conformity), which entitles the manufacturer to affix the CE marking. The certificate shall include:

- name, address and identification number of the certification body;
- name and address of the manufacturer, or his authorised representative established in the EEA and place of production;
- description of the product (type, identification, use,...);
- provisions to which the product conforms (e.g. annex ZA of this EN);
- particular conditions applicable to the use of the product (e.g. provisions for the use of a bearing under certain conditions, etc);
- the number of the certificate;
- conditions and period of validity of the certificate, where applicable;
- name of, and position held by, the person empowered to sign the certificate.

In addition, the manufacturer shall draw up a declaration of conformity (EC Declaration of conformity) including the following:

- name and address of the manufacturer, or his authorised representative established in the EEA;
- name and address of the certification body;
- description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;
- provisions to which the product conforms (i.e. annex ZA of this EN);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc.);
- number of the accompanying EC Certificate of conformity;
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

The above mentioned declaration and certificate shall be presented in the official language or languages of the Member State in which the product is to be used.

b) For bearings under system 3, the manufacturer or his agent established in the EEA shall prepare and retain a declaration of conformity (EC Declaration of conformity), which entitles the manufacturer to affix the CE marking. The certificate shall include:

- name and address of the manufacturer, or his authorised representative established in the EEA, and place of production;
- description of the product (type, identification, use,...), and a copy of the information accompanying the CE marking;
- provisions to which the product conforms (i.e. annex ZA of this EN);
- particular conditions applicable to the use of the product (e.g. provisions for use under certain conditions, etc);
- name and address of notified laboratory(ies);
- name of, and position held by, the person empowered to sign the declaration on behalf of the manufacturer or his authorised representative.

The declaration shall be presented in the official language or languages of the Member State in which the product is to be used.

ZA.3 CE marking and labelling

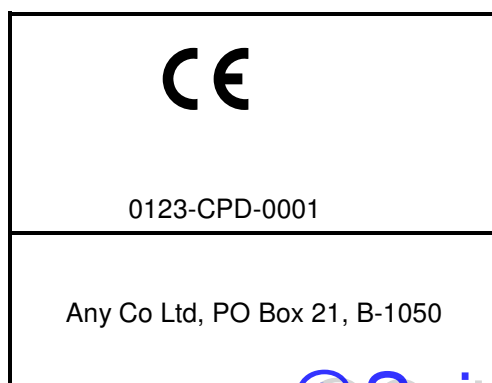
The manufacturer or his authorised representative established within the EEA is responsible for the affixing of the CE marking. The CE marking symbol to affix shall be in accordance with the Directive 93/68/EC and shall be shown on the bearings (or when not possible it may be on the accompanying label, the packaging or on the accompanying commercial documents e.g. a delivery note).

The following information shall accompany the CE marking symbol:

- identification number of the certification body (only for products under system 1);
- name or identifying mark and registered address of the producer;
- the last two digits of the year in which the marking is affixed;
- number of the EC Certificate of conformity or factory production control certificate (if relevant);
- reference to this part of EN 1337;
- description of the product: generic name, material, dimensions,.. and intended use;
- information on those relevant essential characteristics listed in Tables ZA.1.1 and ZA.1.2 which are to be declared presented as:
 - declared values and, where relevant, level or class (including "conforming" for pass/fail requirements, where necessary) to declare for each essential characteristic as indicated in "Notes" in Tables ZA.1.1 and ZA.1.2, and;
 - as an alternative, standard designation(s) alone or in combination with declared values as above and;
 - "No performance determined" for characteristics where this is relevant.

The "No performance determined" (NPD) option may not be used where the characteristic is subject to a threshold level. Otherwise, the NPD option may be used when and where the characteristic, for a given intended use, is not subject to regulatory requirements in the Member State of destination.


Figures ZA.1 and ZA.2 give examples of the information to be given on the product, label, packaging and/or commercial documents.



CE conformity marking, consisting of the «CE»-symbol given in Directive 93/68/EEC.

*Identification number of the certification body(when relevant)
Name or identifying mark and registered address of the manufacturer*

Figure ZA.1 - Example of CE marking information on the bearing

	
0123-CPD-0001	
Any Co Ltd, PO Box 21, B-1050	
03	
0123-CPD-0456	
EN 1337-4:2004	
BEARING N°	
Roller bearing for minimum operating temperature of xxxx °C ² , for uses in buildings and civil engineering works where requirements on individual bearings are <u>critical</u>	
BEARING ³	
Characteristic load bearing capacity (kN) Characteristic rotation capability (rad) Characteristic movement capability (mm) Durability, conforming	

CE conformity marking, consisting of the «CE»-symbol given in Directive 93/68/EEC.

*Identification number of the certification body(when relevant)
Name or identifying mark and registered address of the manufacturer*

The last two digits of the year in which the marking was affixed

Number of the EC certificate of conformity

No. of European Standard

Identification of product and intended use

and

Information on mandated characteristics

Figure ZA.2 - Example CE marking information on the accompanying documents

In addition to any specific information relating to dangerous substances shown above, the product should also be accompanied, when and where required and in the appropriate form, by documentation listing any other legislation on dangerous substances for which compliance is claimed, together with any information required by that legislation.

Note: European legislation without national derogations need not be mentioned

² This information shall be declared by the manufacturer.

³ In the absence of Nationally Determined Parameters (NDP), e.g. partial safety factors, the manufacturer shall provide the accumulated slide path capability (if required) and the grade of the steel used for the components, as well as the geometrical characteristics of the bearing.

Bibliography

- [1] EN ISO 9000:2000, *Quality management systems – Fundamentals and vocabulary (ISO 9000:2000)*.
- [2] EN ISO 9001:2000, *Quality management systems – Requirements (ISO 9001:2000)*.
- [3] EN ISO 9004:2000, *Quality management systems – Guidelines for performance improvements (ISO 9004:2000)*.

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