



SLOVENSKI STANDARD
SIST EN 1337-2:2004

01-junij-2004

BUXca Yý U
SIST EN 1337-2:2001

Štrukturalni nosilci - Del 2: Glejajoča elementa

Structural bearings - Part 2: Sliding elements

Lager im Bauwesen - Teil 2: Gleitteile

Appareils d'appui structuraux - Partie 2: Éléments de glissement

ITeH STANDARD PREVIEW
(standards.iteh.ai)

Ta slovenski standard je istoveten z: EN 1337-2:2004

<https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-c5fe5d9fd38d/sist-en-1337-2-2004>

ICS:

91.010.30 V^@ã}ãããã Technical aspects

SIST EN 1337-2:2004 **en**

iTeh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 1337-2:2004

<https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-c5fe5d9fd38d/sist-en-1337-2-2004>

EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 1337-2

March 2004

ICS 91.010.30

Supersedes EN 1337-2:2000

English version

Structural bearings - Part 2: Sliding elements

Appareils d'appui structuraux - Partie 2: Eléments de glissement

Lager im Bauwesen - Teil 2: Gleitteile

This European Standard was approved by CEN on 2 January 2004.

CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration. Up-to-date lists and bibliographical references concerning such national standards may be obtained on application to the Central Secretariat or to any CEN member.

This European Standard exists in three official versions (English, French, German). A version in any other language made by translation under the responsibility of a CEN member into its own language and notified to the Central Secretariat has the same status as the official versions.

CEN members are the national standards bodies of 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.

ITh STANDARD PREVIEW
(standards.iteh.ai)

SIST EN 1337-2:2004
<https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-c5fe5d9fd38d/sist-en-1337-2-2004>



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

Management Centre: rue de Stassart, 36 B-1050 Brussels

Contents

	page
Foreword.....	3
Introduction	4
1 Scope	5
2 Normative references	5
3 Terms and definitions, symbols and abbreviations.....	6
4 Functional requirements	9
5 Material properties.....	11
6 Design requirements	17
7 Manufacturing, assembly and tolerances	28
8 Conformity evaluation	31
9 Installation	34
10 Criteria for in-service inspection.....	34
Annex A (informative) Reduced area for sliding elements.....	35
Annex B (informative) Coefficient of friction for dimpled PTFE sheets.....	37
Annex C (informative) Method for calculating the deformation of backing plates attached to concrete	38
Annex D (normative) Test methods for friction.....	39
Annex E (normative) Hard chromium plated surfaces - Ferroxy test	50
Annex F (normative) Thickness measurement of the anodized surfaces.....	52
Annex G (normative) Lubricant - Oil separation test.....	54
Annex H (normative) Oxidation stability of lubricant	57
Annex J (normative) Austenitic steel sheets adhesive - Lap shear test	63
Annex K (normative) Factory Production Control (FPC).....	66
Annex L (informative) Audit testing.....	69
Bibliography	70

Foreword

This document (EN 1337-2:2004) 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 September 2004, and conflicting national standards shall be withdrawn at the latest by September 2004.

This document supersedes EN 1337-2:2000.

This 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

Annexes A, B, C and L are informative. Annexes D, E, F, G, H, J and K are normative.

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.

iTeh STANDARD PREVIEW
(standards.iteh.ai)

[SIST EN 1337-2:2004](https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-5f549fd38d/sist-en-1337-2-2004)

[https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-](https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-5f549fd38d/sist-en-1337-2-2004)

[5f549fd38d/sist-en-1337-2-2004](https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-5f549fd38d/sist-en-1337-2-2004)

Introduction

This standard considers a minimum operating temperature of -35°C .

An extension down to -40°C will be considered in a future amendment.

Applications beyond the range of temperature given in clause 1 need special consideration not covered by this standard. Characteristics and requirements given in this standard do not apply in such cases.

iTeh STANDARD PREVIEW (standards.iteh.ai)

[SIST EN 1337-2:2004](https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-c5fe5d9fd38d/sist-en-1337-2-2004)

<https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-c5fe5d9fd38d/sist-en-1337-2-2004>

1 Scope

This European Standard specifies the characteristics for the design and manufacture of sliding elements and guides which are not structural bearings but only parts of them for combination with structural bearings as defined in other Parts of this European Standard.

Suitable combinations are shown in Table 1 of EN 1337-1:2000.

Sliding surfaces with a diameter of the circumscribing circle of single or multiple PTFE sheets less than 75 mm or greater than 1500 mm, or with effective bearing temperatures less than -35°C or greater than 48°C are outside the scope of this European Standard.

Sliding elements for use as temporary devices during construction, for example during launching of the superstructure, are also outside the scope of this European Standard.

In this standard the specification is also given for curved sliding surfaces which are not part of separate sliding elements but which are incorporated in cylindrical or spherical PTFE bearings as per EN 1337.

NOTE The general principles detailed in this European Standard may be applied for sliding elements outside this scope, but their suitability for the intended use should be proven.

ITEH STANDARD PREVIEW
(standards.iteh.ai)

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 1337-7, *Structural bearings - Part 7: Spherical and cylindrical PTFE bearings*

EN 1337-10:2003, *Structural bearings - Part 10: Inspection and maintenance*

EN 1337-11:1997, *Structural bearings - Part 11: Transport, storage and installation*

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

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

EN 10113-1, *Hot-rolled products in weldable fine grain structural steels - Part 1: General delivery conditions*

EN 10137-1, *Plates and wide flats made of high yield strength structural steels in the quenched and tempered or precipitation hardened conditions – Part 1: General delivery conditions*

EN 10204, *Metallic products - Types of inspection documents*

ENV 1992-1-1, *Eurocode 2: Design of concrete structures - Part 1-1: 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 ISO 527-1, *Plastics – Determination of tensile properties – Part 1: General principles (ISO 527-1:1993 including Corr 1:1994)*

EN ISO 527-3, *Plastics – Determination of tensile properties – Part 3: Test conditions for films and sheets (ISO 527-3:1995)*

EN 1337-2:2004 (E)

EN ISO 1183 (all Parts), *Plastics - Methods for determining the density of non-cellular plastics*

EN ISO 2039-1, *Plastics - Determination of hardness - Part 1: Ball indentation method (ISO 2039-1:2001)*

EN ISO 2409, *Paints and varnishes - Cross-cut-test (ISO 2409:1992)*

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

EN ISO 6506 (all Parts), *Metallic materials – Brinell hardness test*

EN ISO 6507-1, *Metallic materials – Vickers hardness test - Part 1: Test method (ISO 6507-1:1997)*

EN ISO 6507-2, *Metallic materials - Vickers hardness test - Part 2: Verification of testing machines (ISO 6507-2:1997)*

ISO 1083, *Spheroidal graphite cast iron - Classification*

ISO 2137, *Petroleum products - Lubricating grease and petrolatum - Determination of cone penetration*

ISO 2176, *Petroleum products - Lubricating grease - Determination of dropping point*

ISO 3016, *Petroleum products - Determination of pour point*

ISO 3522, *Cast aluminium alloys - Chemical composition and mechanical properties*

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

prEN ISO 6158, *Metallic coatings - Electrodeposited coatings of chromium for engineering purposes (ISO/DIS 6158:2002)*

TC1 STANDARD PREVIEW
(standards.iteh.ai)

3 Terms and definitions, symbols and abbreviations

SIST EN 1337-2:2004

3.1 Terms and definitions

<https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-c5fe5d9fd38d/sist-en-1337-2-2004>

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

3.1.1**backing plate**

metallic component which supports sliding materials

3.1.2**coefficient of friction**

ratio of lateral force (resisting force F_x) to the normal force F_z

3.1.3**composite material**

sliding material used in guides

3.1.4**guide**

sliding element which restrains a sliding bearing from moving in one axis

3.1.5**hard chromium surface**

steel backing element plated with a hard chromium layer

3.1.6**lubricant**

special grease used to reduce the friction and wear in the sliding surfaces

3.1.7**mating surface**

hard smooth metallic surface against which the PTFE or composite materials slide

3.1.8**polytetrafluoroethylene (PTFE)**

a thermoplastic material used for its low coefficient of friction

3.1.9**sliding surface**

combination of a pair of flat or curved surfaces of different materials which allow relative displacements

3.1.10**sliding materials**

materials which form sliding surfaces

3.2 Symbols

The most frequently occurring symbols are defined below. Those that are local, and unique to a particular clause, are defined at their first appearance.

3.2.1 Latin upper cases

A	contact area of sliding surface.....	mm ²
E	modulus of elasticity	GPa
F	action; force	N; kN
G	permanent action	N; kN
L	diameter of the circumscribing circle of single or multiple PTFE sheets (see Figures 3, 4 and 5); length of PTFE or composite materials sheets of guides (see Figure 6)	mm
M	bending moment	N x mm; kN x m
N	axial force; force normal to principal bearing surface	N; kN
R _{y5i}	average surface roughness	µm
S	shape factor	
T	temperature	°C
V	transverse or shear force	N; kN

3.2.2 Latin lower case letters

a	smallest dimension of PTFE sheets;	mm
	minor side of rectangular plates or sheets	mm
b	major side of rectangular plates or sheets	mm
c	clearance between sliding components (difference in width between key and keyway)	mm
d	diameter, diagonal	mm
e	eccentricity	mm
f	nominal compressive strength	MPa
h	protrusion of PTFE sheet from its recess	mm
n	number of cycles	
s	sliding distance	mm
t	thickness, time	mm; s; h
u	perimeter of PTFE sheet	mm
v	sliding speed	mm/s

EN 1337-2:2004 (E)

w	deformation
x	longitudinal axis
y	transverse axis
z	axis normal to the principle bearing surface

3.2.3 Greek letters

α	angle	rad
γ	partial safety factor	
δ	elongation at break	%
Δz	maximum deviation of plane or curved sliding surfaces from theoretical surface	mm
λ	ratio, coefficient	
μ	coefficient of friction	
μ_1	initial coefficient of friction; i.e. the maximum coefficient of friction occurring during the first movement at the start or restart of any test	
μ_T	maximum coefficient of friction during a given temperature phase	
ρ	mass density	kg/m ³
σ	normal pressure	MPa

iTeh STANDARD PREVIEW
(standards.iteh.ai)

3.2.4 Subscripts

	<u>SIST EN 1337-2:2004</u>
	https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-c5fe5d9fd38d/sist-en-1337-2-2004
a	average
b	backing plate
c	concrete
CM	composite materials
d	design
dyn	dynamic
G	permanent action
g	geometrical
k	characteristic
M	material
max	maximum
min	minimum
n	cycle number
p	PTFE
pl	preload
Q	variable action
R	resistance
r	reduced
S	internal forces and moments from actions
s	static
t	tension
T	temperature
8	

u	ultimate
x, y, z	coordinates

3.3 Abbreviations

CM	Composite Material
PTFE	Polytetrafluoroethylene
NDP	Nationally Determined Parameters

4 Functional requirements

NOTE Sliding elements and guides permit movements in plane or curved sliding surfaces with a minimum of friction. Specific verification of frictional resistance is required, as verification of mechanical and physical properties alone is not sufficient to ensure that these components will have the required characteristics. The performance of the sliding elements and guides is deemed to be satisfactory if standardized specimens shown in annex D of specified material combinations meet the requirements of this clause when tested as specified in specific friction tests described in annex D.

4.1 Sliding elements and guides incorporating sliding surfaces with PTFE sheets

4.1.1 Requirements in short term friction tests

The coefficients of friction in each phase of friction testing shall not exceed the values given in Table 1.

Table 1 — Maximum coefficients of friction in short term tests of PTFE sheets in combination with hard chromium plating, austenitic steel or aluminium alloy used for curved or plane sliding surfaces

Test See annex D	Temperature	Hard chromium or austenitic steel				Aluminium alloy			
		$\mu_{s,1}$	$\mu_{dyn,1}$	$\mu_{s,T}$	$\mu_{dyn,T}$	$\mu_{s,1}$	$\mu_{dyn,1}$	$\mu_{s,T}$	$\mu_{dyn,T}$
C	+ 21 °C	0,012	0,005	–	–	0,018	0,008	–	–
D	- 35 °C	0,035	0,025	–	–	0,053	0,038	–	–
E	0 °C	0,018	0,012	–	–	0,027	0,018	–	–
E	- 35 °C	–	–	0,018	0,012	–	–	0,027	0,018
NOTE	$\mu_{s,1}$ is the static coefficient of friction at the first cycle. $\mu_{dyn,1}$ is the dynamic coefficient of friction at the first cycle. $\mu_{s,T}$ is the static coefficient of friction at subsequent cycles. $\mu_{dyn,T}$ is the dynamic coefficient of friction at subsequent cycles. (see also annex D, Figures D.4 and D.6)								

4.1.2 Requirements in long term friction tests

The coefficients of friction of the sliding material combinations shall not exceed the values listed in Tables 2 and 3.

4.2 Guides incorporating composite materials CM1 and CM2

4.2.1 Requirements in short term friction test

The maximum static or dynamic coefficient of friction of the composite materials in combination with austenitic steel shall not exceed 0,15.

EN 1337-2:2004 (E)

Table 2 — The coefficients of friction in long term tests of PTFE sheets in combination with austenitic steel used for plane sliding surfaces

Temperature	Total slide path			
	5 132 m		10 242 m	
	$\mu_{s,T}$	$\mu_{dyn,T}$	$\mu_{s,T}$	$\mu_{dyn,T}$
-35°C	0,030	0,025	0,050	0,040
-20°C	0,025	0,020	0,040	0,030
0°C	0,020	0,015	0,025	0,020
+21°C	0,015	0,010	0,020	0,015

NOTE $\mu_{s,T}$ and $\mu_{dyn,T}$ are the static and dynamic coefficient of friction respectively at the relevant temperatures.

Table 3 — Maximum coefficients of friction in long term tests of PTFE sheets in combination with hard chromium plating, austenitic steel or aluminium alloy used for curved sliding surfaces

Temperature	Total slide path 2 066 m			
	Austenitic steel or hard chromium		Aluminium alloy	
	$\mu_{s,T}$	$\mu_{dyn,T}$	$\mu_{s,T}$	$\mu_{dyn,T}$
-35°C	0,030	0,025	0,045	0,038
-20°C	0,025	0,020	0,038	0,030
0°C	0,020	0,015	0,030	0,022
+21°C	0,015	0,010	0,022	0,015

4.2.2 Requirements in long term friction test

Maximum static or dynamic coefficients of friction shall not exceed the values listed in Table 4.

Table 4 — Maximum static or dynamic coefficients of friction μ_T in long term tests of composite material CM1 and CM2 in combination with austenitic steel used for plane sliding surfaces in guides

Temperature	Total slide path 2 066 m
	μ_T
-35°C	0,200
-20°C	0,150
0°C	0,100
+21°C	0,075

5 Material properties

5.1 General

In the absence of specific standards, material testing shall be in accordance with the procedures given in annexes D to H.

(standards.iteh.ai)

5.2 PTFE sheets

SIST EN 1337-2:2004

5.2.1 Material specification

<https://standards.iteh.ai/catalog/standards/sist/43ad86d3-2052-4bfe-9cfe-c5fe5d9fd38d/sist-en-1337-2-2004>

The raw material for PTFE sheets shall be pure polytetrafluoroethylene free sintered without regenerated or filler materials.

5.2.2 Mechanical and physical properties

The characteristics of PTFE shall be in accordance with Table 5.

Table 5 — Mechanical and physical properties of PTFE

Property	Testing Standard	Requirement
mass density	EN ISO 1183 (all Parts)	$\rho_p = 2140$ to 2200 kg/m ³
tensile strength	EN ISO 527-1 and -3	$f_{ptk} = 29$ to 40 MPa
elongation at break	EN ISO 527-1 and -3	$\delta_p \geq 300$ %
ball hardness	EN ISO 2039-1	H132/60 = 23 to 33 MPa

The test specimens shall be prepared from fully finished sheet but without impressed dimples. They shall be tested at $23^\circ\text{C} \pm 2^\circ\text{C}$.

Mass density shall be determined on three specimens.

EN 1337-2:2004 (E)

Tensile strength test and elongation at break shall be conducted on five specimens type 5 (in accordance with Figure 1 of EN ISO 527-3). The thickness of the specimens shall be $2 \text{ mm} \pm 0,2 \text{ mm}$ and the speed of testing shall be 50 mm/min (speed as defined in EN ISO 527-1).

A total of 10 ball hardness tests shall be conducted using at least three specimens with a minimum of three tests per specimen; the thickness of the specimens shall be at least $4,5 \text{ mm}$.

All specimens shall pass all the tests conducted on them.

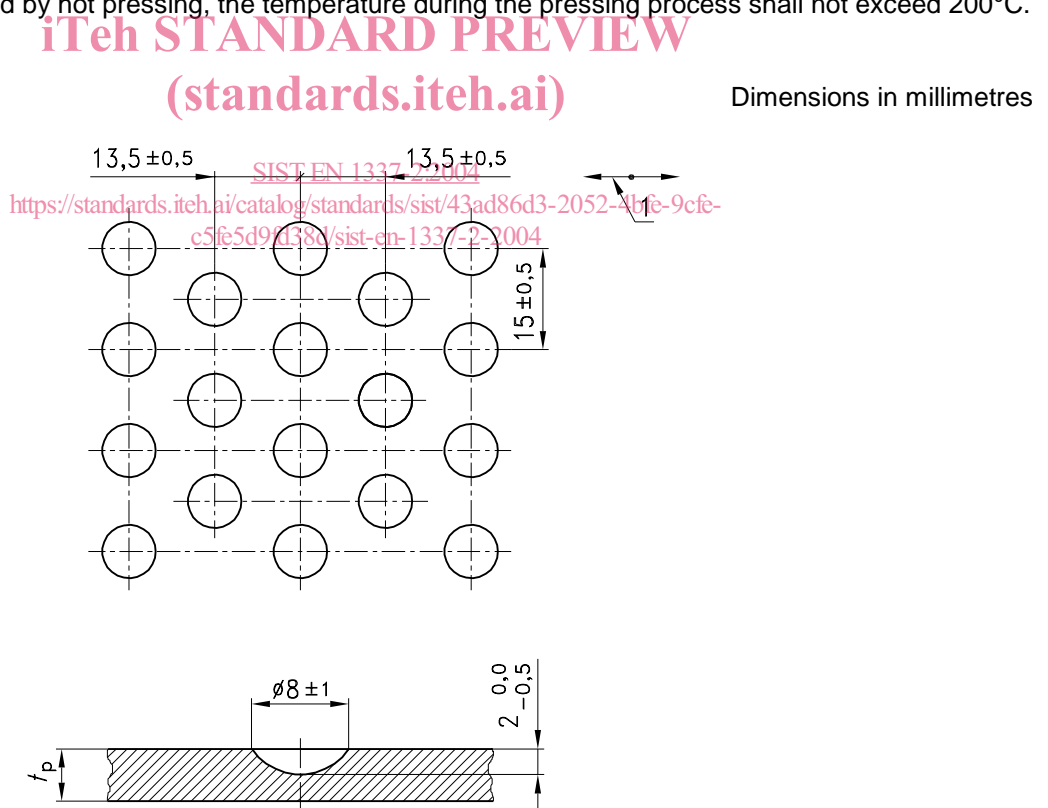
5.2.3 Geometrical properties**5.2.3.1 Tolerance on thickness**

The admissible tolerance on thickness of single PTFE sheets or associated multiple sheets is ${}^+0,3_0 \text{ mm}$ for sheets with a diameter L less than 1200 mm and ${}^+0,4_0 \text{ mm}$ for larger sheets.

5.2.3.2 Dimple pattern

Dimples and dimple pattern shall be in accordance with Figure 1.

Where dimples are produced by hot pressing, the temperature during the pressing process shall not exceed 200°C .

**Key**

- 1 Main direction of sliding

Figure 1 — Pattern of dimples in recessed PTFE sheets

5.2.4 Suitability as sliding material

PTFE shall be tested in accordance with annex D and shall meet the requirements of 4.1.1 and 4.1.2.

Lubricant shall be in accordance with 5.8.

The mating surfaces for the short term friction test shall be austenitic steel or hard chromium and for the long term friction test austenitic steel in accordance with 5.4 and 5.5.

5.3 Composite materials

5.3.1 Composite material CM1

This is a composite material consisting of three layers: a bronze backing strip and a sintered interlocking porous matrix, impregnated and overlaid with a PTFE / lead mixture.

The material shall conform to the characteristics listed in Table 6.

In addition, the condition of the material and its surface finish shall be checked visually.

Table 6 — Characteristics of CM1

Bronze backing	material: CuSn 6			
	composition by mass	Sn	5 to 7,50	%
		P	≤ 0,35	%
		Pb	≤ 0,10	%
		Fe	≤ 0,10	%
		Zn + Ni	≤ 0,50	%
		others	≤ 0,30	%
	remainder Cu			
thickness		(2,1 ± 0,15)	mm	
hardness HB - EN ISO 6506 (all Parts)		80 to 160		
Bronze interlayer	material: CuSn 10			
	composition by mass	Sn	10 to 12	%
		Pb	≤ 1,00	%
		P	0,25 to 0,4	%
		Si	≤ 0,17	%
		Fe	≤ 0,15	%
		Ni	≤ 0,15	%
		others	≤ 0,50	%
saturation with PTFE - Pb		≥ 25	%	
thickness		0,25 ^{+0,15} _{0,0}	mm	
Composite material surface layer	material: PTFE+Pb			
	composition by mass	Pb 49 to 62%, remainder PTFE		
	thickness		0,01 ^{+0,02} _{0,0}	mm
total thickness		2,48 ± 0,015	mm	
	overlay adhesion - EN ISO 2409		minimum GT 2	