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Designated according to Article 29 of Regulation (EU) No 305/2011

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# European Technical Assessment

# ETA-17/0808 of 30.11.2017

General part

| | |
|---|---|
| **Technical Assessment Body issuing the European Technical Assessment** | Österreichisches Institut für Bautechnik (OIB)<br>Austrian Institute of Construction Engineering |
| **Trade name of the construction product** | FREYSSINET TETRON SB ISOGLIDE |
| **Product family to which the construction product belongs** | Spherical and cylindrical bearing with special sliding material made of fluoropolymer |
| **Manufacturer** | SOLETANCHE FREYSSINET<br>280 avenue Napoléon Bonaparte<br>92 500 Rueil-Malmaison<br>France |
| **Manufacturing plant** | Factory A |
| **This European Technical Assessment contains** | 19 pages including 3 Annexes which form an integral part of this assessment |
| **This European Technical Assessment is issued in accordance with Regulation (EU) No 305/2011, on the basis of** | European Assessment Document (EAD)<br>EAD 050009-00-0301 “Spherical and cylindrical bearing with special sliding material made of fluoropolymer” |

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Specific parts

## 1 Technical description of the product

FREYSSINET TETRON SB ISOGLIDE is a structural bearing, which permits rotation and displacement movements by a curved and a plane sliding surface between bearing plates of steel. The subject of the ETA is the complete bearing, including, if relevant, the necessary guides or restraints. As an alternative to Figure A.1 in Annex A, the bearing may also be used upside down, i.e. with flat sliding surfaces lying below (meaningful, for example in the case of steel bridges).

FREYSSINET TETRON SB ISOGLIDE is designed according to EN 1337-7 and, for the purpose of controlling the degree of freedom, may be combined with sliding elements according to EN 1337-2 as shown in EN 1337-1. Instead of PTFE according to EN 1337-2, ISOGLIDE, a low friction fluoropolymer made of a specified PTFE (polytetrafluoroethylene), suitable for low and high temperatures outside the scope of EN 1337-2 with improved load-bearing capacity, is used for the sliding surfaces of the bearing.

By this ETA sliding surfaces with a diameter of the circumscribing circle of ISOGLIDE sheets not less than 75 mm up to 1000 mm and with effective bearing temperatures not less than - 50 °C and up to + 90 °C are covered, whereas for the use of steel elements for low temperatures EN 1993-1-10, Table 2.1, is relevant.

FREYSSINET TETRON SB ISOGLIDE bearings with an included angle 2 θ > 60° are beyond the scope of this ETA.

**Materials combination**

The combinations of materials used in the sliding surfaces are given in Table 1. Only one combination is used in a sliding surface. The sliding surface is lubricated in accordance with clause 5.8 of EN 1337-2.

Table 1: Combinations of materials for permanent applications as sliding surfaces for FREYSSINET TETRON SB ISOGLIDE

<table>
<tr><td colspan="2">Plane surface</td><td colspan="2">Curved surface</td><td colspan="2">Guides</td></tr>
<tr><td rowspan="2">dimpled ISOGLIDE sheet</td><td rowspan="2">austenitic steel</td><td rowspan="2">dimpled ISOGLIDE sheet</td><td>austenitic steel</td><td>undimpled ISOGLIDE sheet [1)]</td><td rowspan="2">austenitic steel</td></tr>
<tr><td>hard chromium</td><td>CM1</td></tr>
<tr><td colspan="6">[1)] Instead of the undimpled ISOGLIDE sheets, only where self-alignment between the mating parts of the bearing is possible, composite material of type CM1 in accordance with clause 5.3.1 of EN 1337-2 may be used alternatively.</td></tr>
</table>

ISOGLIDE sheets are confined in accordance with Annex B of the EAD.

Austenitic steel sheets are attached by continuous fillet welding in accordance with clause 7.2.1 of EN 1337-2.

Composite material of type CM1 is attached in accordance with clause 7.2.3 of EN 1337-2.

Where under predicted rotation about a transverse axis, occurring for the un-factorised characteristic actions, the differential deformation of the ISOGLIDE sheet in guides across its smallest dimension would exceed 0.2 mm, a rotation element is included in the backing plate. The material combination of this rotation element is in accordance with the requirements of the mating surfaces of guides given in Table 1 or pot to piston contact surfaces given in EN 1337-5.

**ISOGLIDE sheets**
The composition of the material is confidential, whereas details are laid down in Table 4 of this ETA and relevant information is laid down in technical documentation to this European Technical Assessment, deposited with the Technical Assessment Body Österreichisches Institut für Bautechnik. The geometrical conditions of ISOGLIDE sheets are in conformity with Annex B of the EAD.

The curved ISOGLIDE sheet may be attached to either the convex or the concave backing plate of the curved sliding surface.

**Composite material**
As an alternative to ISOGLIDE sheet, for strips in guides the composite material of type CM1 in accordance with clause 5.3.1 of EN 1337-2 may be used (see Table 1 in this ETA).

**Austenitic steel**
Austenitic steel is in accordance with EN 1337-2, clause 5.4.

**Hard chromium plated surfaces**
Hard chromium plated surfaces are in accordance with EN 1337-2, clause 5.5. The substrate is as specified in clause 5.5.2 of EN 1337-2.

**Lubricant**
Silicon grease according to EN 1337-2, clause 5.8, is used as lubricant for sliding surfaces.

**Ferrous materials for backing plates**
The ferrous materials used for backing plates are in accordance with EN 1337-2, clause 5.6.

Examples of FREYSSINET TETRON SB ISOGLIDE are given in Annex A of this ETA.

FREYSSINET TETRON SB ISOGLIDE consists of a backing plate with a convex spherical surface (rotational element) and a backing plate with a concave spherical surface between which a sheet of ISOGLIDE and the mating material form a curved sliding surface (Figure A.2 in Annex A).

FREYSSINET TETRON SB ISOGLIDE is also used in combination with flat sliding elements and guides to form free and guided bearings (Figure A.3 a) to c) in Annex A).

FREYSSINET TETRON SB ISOGLIDE combined with a flat sliding element can be used together with a restraining ring to form fixed and guided bearings (see Figures A.3d and 3e) in Annex A).

FREYSSINET TETRON SB ISOGLIDE may be equipped with lifting devices according to the technical installation manual of the manufacturer and as depicted exemplary in Figure A.4.

Concerning product packaging, transport, storage, maintenance, replacement and repair it is the responsibility of the manufacturer to undertake the appropriate measures and to advise this clients on the transport, storage, maintenance, replacement and repair of the product, as he considers necessary.

## 2 Specification of the intended use(s) in accordance with the applicable EAD

FREYSSINET TETRON SB ISOGLIDE is intended to be used for the support of bridges or building works in accordance with the scope of EN 1337-1 where the requirements on the individual bearings are critical.

FREYSSINET TETRON SB ISOGLIDE is suitable for all types of structures, as well as for regions with continuously low and high temperatures.

The effective bearing temperature of FREYSSINET TETRON SB ISOGLIDE covered by the ETA is not less than - 50 °C and up to + 90 °C. If composite material in accordance with EN 1337-2 is used in guides, the effective bearing temperature is limited down to - 35°C and up to + 48 °C.

Effective bearing temperatures above + 48 °C are limited to short periods (repeated periods of less than 8 hours) as due to climate temperature changes.

FREYSSINET TETRON SB ISOGLIDE is also intended for the use in superstructures where working loads induce fast sliding displacements in bearings.

FREYSSINET TETRON SB ISOGLIDE is mainly used in concrete, steel and composite structures.

The provisions made in this European Technical Assessment are based on an intended working life for the intended use of FREYSSINET TETRON SB ISOGLIDE of 10 years, depending on the accumulated total sliding path in accordance with Clause 3.1.3 in this ETA, and provided that FREYSSINET TETRON SB ISOGLIDE is subjected to appropriate use and maintenance, taking into account the conditions given in EN 1337-1 and EN 1337-11.

It is the responsibility of the manufacturer to ensure that each delivery contains proper information for the use of FREYSSINET TETRON SB ISOGLIDE including general guidance on the basis of the European Technical Assessment.

The indications given on the working life cannot be interpreted as a guarantee given by the producer or the Technical Assessment Body, but are to be regarded only as a means for choosing the appropriate product in relation to the expected, economically reasonable working life of the works.

# 3 Performance of the product and references to the methods used for its assessment

## 3.1 Performance of FREYSSINET TETRON SB ISOGLIDE

Table 2: Essential characteristics and performances of FREYSSINET TETRON SB ISOGLIDE

| Basic requirements for construction works | Essential characteristics | Method of assessment | Performance |
|---|---|---|---|
| BWR 1 | Load bearing capacity | EAD, Clause 2.2.1 | Table 3<br>Clause 3.1.1 |
| | Rotation capability | EAD, Clause 2.2.2 | 0 – 0,05 rad<br>Clause 3.1.2 |
| | Displacement capacity | EAD, Clause 2.2.3<br>EAD, Clause 2.2.6 | Accumulated sliding path of plane and curved sliding elements combined with dimpled lubricated ISOGLIDE -sheets:<br>10 000 m<br><br>Accumulated sliding path of guides:<br>2 000 m<br>Clause 3.1.3 |
| | Durability aspects | EAD, Clause 2.2.4 | Durable<br>Corrosion resistance class C5-M (EN ISO 12944-2), Durability class "H" (EN ISO 12944-1) |
| | Load bearing capacity (of the sliding element) | EAD, Clause 2.2.5 | Clause 3.1.4 |
| | Coefficient of friction (of the sliding element) | EAD, Clause 2.2.6 | Clause 3.1.5 |
| | Durability aspects (of the sliding element) | EAD, Clause 2.2.7 | Clause 3.1.6 |

### 3.1.1 Load bearing capacity

The curved sliding surfaces are designed in accordance with sub clauses 6.2.1 to 6.2.3 of EN 1337-7, adapted to the performance of ISOGLIDE sheets by means of the following:

- The frictional resistance of the sliding surfaces is expressed by means of the coefficients of friction of ISOGLIDE sheets given in clause 3.1.5 in this ETA;
- The characteristic compressive strength of ISOGLIDE is given in Table 5 in this ETA.

The backing plates with concave surfaces are designed in accordance with clause 6.9 of EN 1337-2 and fulfilling the dimensional limitations given in Figure 7 of EN 1337-7.

For FREYSSINET TETRON SB ISOGLIDE combined with flat sliding elements, clause 3.1.4 in this ETA further applies.

In case free spherical bearings are fixed by a steel restraining ring as shown in Figure A.3d) and e) of Annex A of this ETA, for the design of the steel restraining ring, the design rules for pot and piston of pot bearings given in clause 6 of EN 1337-5 apply.

The load bearing capacity is determined for the single FREYSSINET TETRON SB ISOGLIDE bearing under a fundamental combination of actions in relation to the compressive stress on the sliding surfaces in accordance with Equation (1) in this ETA, see clause 3.1.4.3.
Referring to the maximum dimension of ISOGLIDE sheets covered by this ETA, the maximum load bearing capacity of FREYSSINET TETRON SB ISOGLIDE at the relevant temperature is given in Table 3.

Table 3: Maximum load bearing capacity of FREYSSINET TETRON SB ISOGLIDE under a fundamental combination of action

| Maximum effective bearing temperature | FREYSSINET TETRON SB ISOGLIDE |
|---|---|
| T ≤ 32 °C | 90 882 kN |
| T = 48 °C | 75 735 kN |
| T = 60 °C | 68 161 kN |
| T = 70 °C | 60 588 kN |
| T = 80 °C | 50 490 kN |
| T = 90 °C | 45 441 kN |

Unless otherwise specified, the load bearing capacity given in Table 3 refers to a coefficient of reduction of $\lambda = 0.9$ to consider load eccentricity in Equation (2) in this ETA, and a partial safety factor for sliding materials $\gamma_m = 1.4$ (see in Clause 3.1.4.3 in this ETA).

3.1.2 Rotation capability

Combinations of materials for curved sliding surfaces are given in Table 1 of this ETA.
Coefficients of friction of curved sliding surfaces are given in clause 3.1.5 in this ETA.
For the single, maximum rotation angle, the capacity is given by the geometrical design of the curved sliding surfaces in accordance with the EN 1337-7, clause 6.2.4.

The maximum rotation angle of FREYSSINET TETRON SB ISOGLIDE is 0,05 radians about any horizontal axis. FREYSSINET TETRON SB ISOGLIDE allows free rotation about their vertical axis.

3.1.3 Displacement capacity

Combinations of materials for plane surfaces and guides are given in Table 1 of the ETA.
Coefficients of friction of plane sliding surfaces and guides are given in clause 3.1.5 in this ETA.

The maximum accumulated sliding path of plane sliding elements combined with dimpled and lubricated ISOGLIDE sheets is 10 000 m.
The maximum accumulated sliding path of guides combined with undimpled ISOGLIDE sheets is 2 000 m.
If composite material of type CM1 is used in guides, relevant clauses of EN 1337-2 apply.

For the single, maximum displacement, the capacity is given by the geometrical design of the sliding elements in accordance with clause 6.5.1 of EN 1337-2.

3.1.4 Load bearing capacity (of the sliding element)

A) Sliding surfaces

3.1.4.1 General

The sliding surfaces are designed in accordance with clause 6.8 of EN 1337-2, adapted to the performance of ISOGLIDE sheets by means of the following:

- The frictional resistance of the sliding surfaces is expressed by means of the coefficients of friction given in clause 3.1.5 in this ETA;
- The characteristic compressive strength of ISOGLIDE is given in Table 5 in this ETA.

For composite material of type CM1 used in guides, relevant clauses of EN 1337-2 apply.

Deformation of sliding materials are not used to accommodate rotations except as permitted in clause 6.4 of EN 1337-2.

3.1.4.2 Non separation of sliding surfaces

With the exception of guides, plane and curved sliding surfaces are designed so that under the characteristic combination of actions, the minimum pressure $\sigma_p$ acting on the ISOGLIDE sheet meets the condition $\sigma_p \geq 0$.

3.1.4.3 Compressive stress

Under a fundamental combination of actions, the following condition is met:

$$N_{Sd} \leq \frac{f_k(T)}{\gamma_m} \times A_r \qquad (1)$$

Where:

$N_{Sd}$ is the design value of the axial force due to the design values of action,

$f_k(T)$ is the temperature dependent characteristic compressive strength of sliding material:

- for ISOGLIDE sheets, $f_k(T)$ is given in Table 5 of this ETA,
- for composite material of type CM1 used in guides, clause 6.6 in EN 1337-2 applies;

$\gamma_m$ is a partial safety factor for materials in accordance with EN 1990. If not otherwise specified, the recommended value is $\gamma_m$ = 1,4. The value shall be stated in the technical documentation accompanying the Declaration of Performance.

$A_r$ is the reduced contact area of the sliding surface whose centroid is the point through which $N_{Sd}$ acts with the total eccentricity $e_t$, which is caused by both mechanical and geometrical effects, and is calculated on the basis of the theory of plasticity assuming a rectangular stress block.

For guides eccentricity can be neglected.

NOTE: Formulae for the evaluation of the eccentricities of curved surfaces in the most common cases are given in Annex A of EN 1337-7.

The reduced contact area $A_r$ is given by the formula:

$$A_r = \lambda \times A \qquad (2)$$

Where:

A is the contact area of the plane sliding surface or of the projected curved sliding surface.

λ is a coefficient given in Annex B of this ETA.

For ISOGLIDE sheets with minimum dimension "a" ≥ 100 mm (according to Figure 3 of EN 1337-2), the contact areas A and $A_r$ are taken as the gross area without deduction for the area of the dimples. For sheets with "a" < 100 mm the area of the dimples is deducted from the gross area.

B) <u>Backing plates</u>

The load bearing capacity of the backing plates of the sliding surfaces is assessed according to clause 6.9 of EN 1337-2.

3.1.4.4 General

The design of the backing plates follows the provisions given in clause 6.9.1 of EN 1337-2.

3.1.4.5 Deformation assessment

The total deformation $\Delta w_1 + \Delta w_2$ of the backing plates (see Figure 9 of EN 1337-2) is determined in compliance with clause 6.9.2 of EN 1337-2.

The total deformation of the backing plates is assessed using the formula:

$$\Delta w_1 + \Delta w_2 \leq \Delta w_{adm} = h_0 \times \left(0{,}45 - 1{,}708k\sqrt{h_0/L}\right) \leq 1{,}25\text{mm} \quad (3a)$$

$$\text{with } h_r[\text{mm}] = h_0 - \Delta w_1 - \Delta w_2 - \Delta h \geq 1{,}0 + \frac{L[\text{mm}]}{2000} \quad (3b)$$

Where:

k is the stiffness coefficient of dimpled ISOGLIDE sheets defined in clause 3.2.2 in this ETA, with $0 \leq 1.708\ k \leq 1.0$;

L is the diameter of the circumscribing circle of ISOGLIDE sheet, with L ≤ 1000 mm according to this ETA;

$h_0$ is the height of protrusion of the ISOGLIDE sheet in unloaded condition, according to Annex B of the EAD.

A suitable method for calculating the deformation $\Delta w_1$ for common materials is given in Annex C of EN 1337-2.

The thickness of the backing plates is in accordance with clause 6.9.3 of EN 1337-2 in order to fulfil the minimum stiffness for transport and installation.

3.1.5 Coefficient of friction (of sliding elements)

The following coefficients of friction $\mu_{max}$ are used for design of FREYSSINET TETRON SB ISOGLIDE.
These values do not apply in the presence of high dynamic actions which may occur for instance in seismic zones.
The effects of friction are not to be used to relieve the effects of externally applied horizontal loads.
The following coefficients of friction are valid up to a maximum effective bearing temperature of 90° C.

(a) <u>Coefficient of friction at low temperatures</u>

For sliding elements combined with dimpled and lubricated ISOGLIDE sheets used in zones where the minimum effective bearing temperature doesn't fall below -35°C, the coefficient of friction $\mu_{max}$ is determined as a function of the average pressure on the sliding surface $\sigma_{ISOGLIDE}$ [MPa], as follows:

$$0.020 \leq \frac{2.0}{40 + \sigma_{ISOGLIDE}} \leq 0.036 \quad (4)$$

For guides combined with undimpled and initially lubricated ISOGLIDE sheets, the coefficient of friction is $\mu_{max} = 0.05$ independent of the pressure.

(b) <u>Coefficient of friction at very low temperatures</u>

For sliding elements combined with dimpled and lubricated ISOGLIDE sheets used in zones where the minimum effective bearing temperature does fall below -35 °C (down to -50 °C), the coefficient of friction $\mu_{max}$ is determined as a function of the average pressure on the sliding surface $\sigma_{ISOGLIDE}$ [MPa], as follows:

$$0.032 \leq \frac{3.9}{60 + \sigma_{ISOGLIDE}} \leq 0.052 \quad (5)$$

For guides combined with undimpled and initially lubricated ISOGLIDE sheets, the coefficient of friction is $\mu_{max} = 0.06$ independent of the pressure.

(c) Coefficient of friction at moderate low temperatures

For sliding elements combined with dimpled and lubricated ISOGLIDE sheets used in zones where the minimum effective bearing temperature doesn't fall below -5 °C, the coefficient of friction $\mu_{max}$ is determined as a function of the average pressure on the sliding surface $\sigma_{ISOGLIDE}$ [MPa], as follows:

$$0.011 \leq \frac{1.35}{60 + \sigma_{ISOGLIDE}} \leq 0.018 \qquad (6)$$

For guides combined with undimpled and initially lubricated ISOGLIDE sheets, the coefficient of friction is $\mu_{max}$ = 0.028 independent of the pressure.

NOTE 1: The average pressure $\sigma_{ISOGLIDE}$ on dimpled ISOGLIDE sheets is estimated using the gross contact area, i.e. neglecting the deduction of the area of the dimples.

For guides combined with composite material of type CM1, the coefficient of friction at the relevant temperature is given in clause 6.7 of EN 1337-2.

3.1.6 Durability aspects (of the sliding element)

The sliding surfaces of FREYSSINET TETRON SB ISOGLIDE are protected from corrosion and contamination in equivalence to clause 7.3 of EN 1337-2.
Where the austenitic steel sheet is attached by continuous fillet weld, provided the area covered by the austenitic steel sheet is free from rust and rust inducing contaminants, no further treatment of the backing plate behind the austenitic steel sheet is required.
Areas of the backing plate behind the ISOGLIDE sheet are protected by one coat of primer (dry film thickness 20 µm to 100 µm).
Suitable devices, like e.g. rubber skirts, are provided to protect sliding surfaces against contamination. Such protection devices are easily removable for the purpose of inspection.
For hard chromium surfaces special provisions are made in order to protect the surfaces in industrial environments as indicated in EN 1337-2, clause 7.3.

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## 3.2 Performance of the sliding material ISOGLIDE

Table 4: Essential characteristics of the special sliding material ISOGLIDE

| Basic requirements for construction works | Essential characteristics | Method of assessment | Performance |
|---|---|---|---|
| BWR 1 | Material property Young modulus | EAD, Clause 2.2.8 | Laid down in the technical documentation deposited with the Technical Assessment Body |
| | Material property Yield strength | | |
| | Material property Tensile strength | | |
| | Material property Elongation at break | | |
| | Material property Ball hardness | | |
| | Material property Mass density | | |
| | Material property Melting temperature | | |
| | Compressive strength of special sliding material ISOGLIDE | EAD, Clause 2.2.9 | Table 5 in this ETA |
| | Load – deformation behaviour of special sliding material: Stiffness coefficient, modulus of elasticity | EAD, Clause 2.2.10 | Modulus of elasticity of ISOGLIDE sheets: $E_{tp}$ = 900 MPa<br>Stiffness coefficient [1]: $k = \frac{\sigma_{ISOGLIDE}[MPa] - 45}{74,3}$ |
| | Load – deformation behaviour of special sliding material: Protrusion after loading [mm] | | Laid down in the technical documentation deposited with the Technical Assessment Body |
| | Load – deformation behaviour of special sliding material: Ratio tensile strength/yield strength | | |
| | Load – deformation behaviour of special sliding material: Ratio elongation at break/yield deformation | | |
| | High temperature resistance of the special sliding material | EAD, Clause 2.2.11 | Resistant |
| | Resistance of the special sliding material against chemical and environmental influences | EAD, Clause 2.2.12 | Resistant |

[1] The stiffness coefficient k of ISOGLIDE is expressed as a function of the average pressure $\sigma_{ISOGLIDE}$ on the sliding material sheet under the characteristic combination of action

Table 5. Characteristic compressive strength of ISOGLIDE

| Effective bearing temperature T | ≤ 35°C | 48°C | 60°C | 70°C | 80°C | 90°C |
|---|---|---|---|---|---|---|
| Sliding surface | characteristic compressive strength $f_k(T)$, in MPa | | | | | |
| Main sliding surface<br>Permanent and Variable Loads<br>Guides<br>Variable Loads | 180 | 150 | 135 | 120 | 100 | 90 |
| Guides<br>Permanent Loads<br>Effects of temperature, shrinkage and creep | 60 | 50 | 45 | 40 | 33 | 30 |

## 4 Assessment and verification of constancy of performance (hereinafter AVCP) system applied, with reference to its legal base

According to the decision 95/467/EC of the European Commission[1], amended by the Commission Decision 2001/596/EC[2] and 2002/592/EC[3], the system(s) of assessment and verification of constancy of performance (see Annex V of Regulation (EU) No 305/2011) is 1.

## 5 Technical details necessary for the implementation of the AVCP system, as provided for in the applicable EAD

Technical details necessary for the implementation of the AVCP system are laid down in the control plan deposited with the Technical Assessment Body Österreichisches Institut für Bautechnik.

The notified production control certification body shall visit the factory twice a year for surveillance of the AVCP.

Issued in Vienna on 30.11.2017
by Österreichisches Institut für Bautechnik

The original document is signed by:

Rainer Mikulits
Managing Director

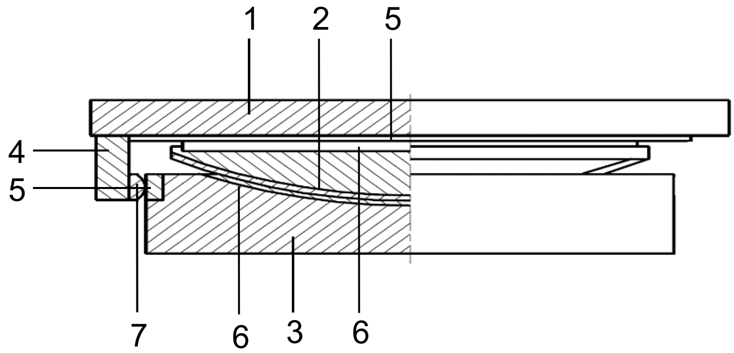
1 Official Journal of the European Communities L 268/29 of 10.11.1995
2 Official Journal of the European Communities L 209/33 of 2.8.2001
3 Official Journal of the European Communities L 192/57 of 20.7.2002

# ANNEX A – DESCRIPTION OF THE PRODUCT

Figure A.1: Assembly of a guided and free movable FREYSSINET TETRON SB ISOGLIDE bearing

FREYSSINET TETRON SB ISOGLIDE (example)

guided spherical bearing (movable unidirectional) | free spherical bearing (movable multidirectional)




**Key**

1 Sliding plate
2 Rotational element (convex plate)
3 Bottom plate (concave backing plate)
4 Guide
5 Austenitic steel sheet
6 ISOGLIDE sheet
7 Rocker strip

Examples of FREYSSINET TETRON SB ISOGLIDE are shown in Figures A.2 and A.3.

Note: Numbers in brackets in Figures A.2 and A.3 refer to the examples shown in Figure 1 of EN 1337-1.

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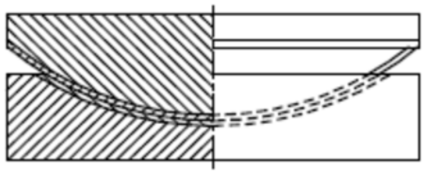
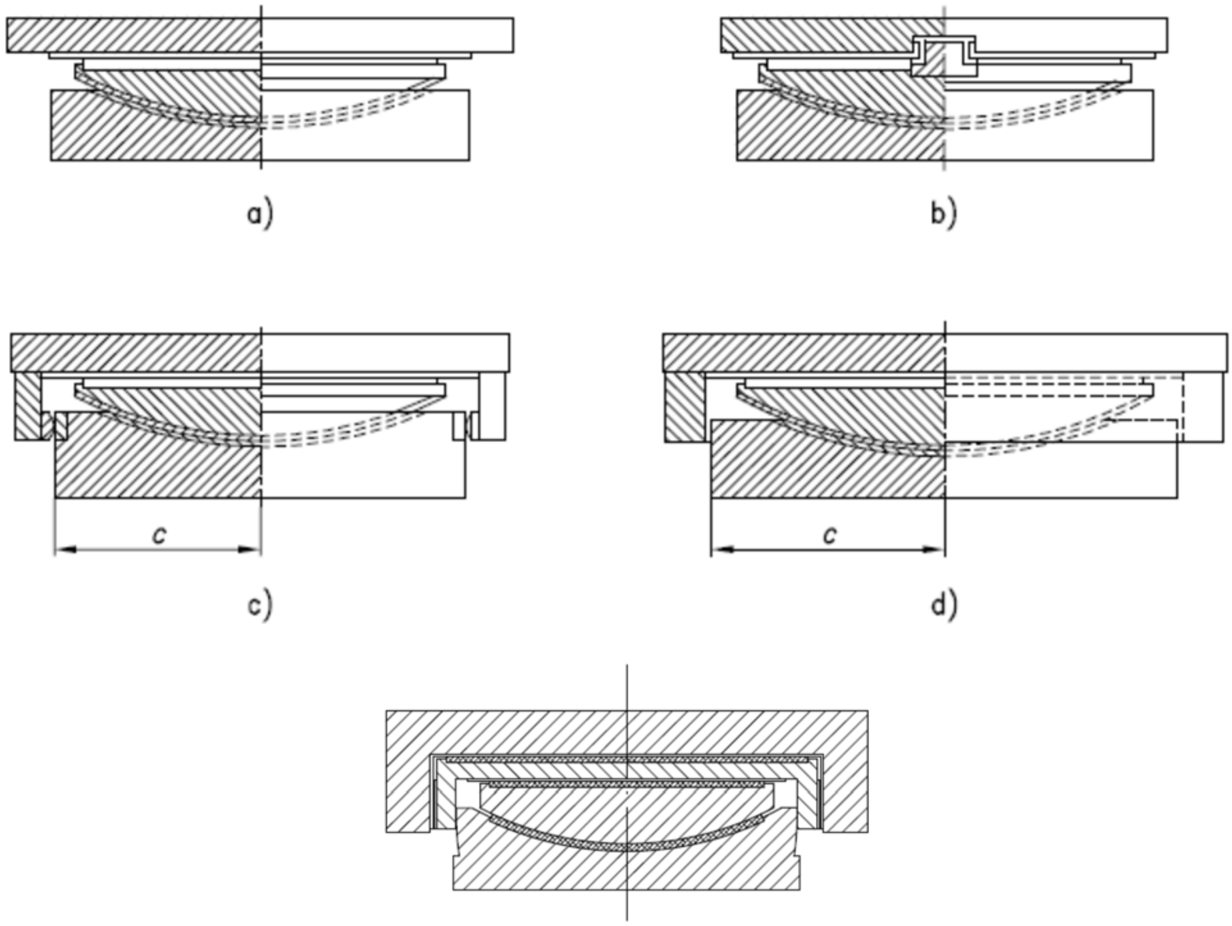
Figure A.2: FREYSSINET TETRON SB ISOGLIDE



Fixed by sliding surface (3.2)

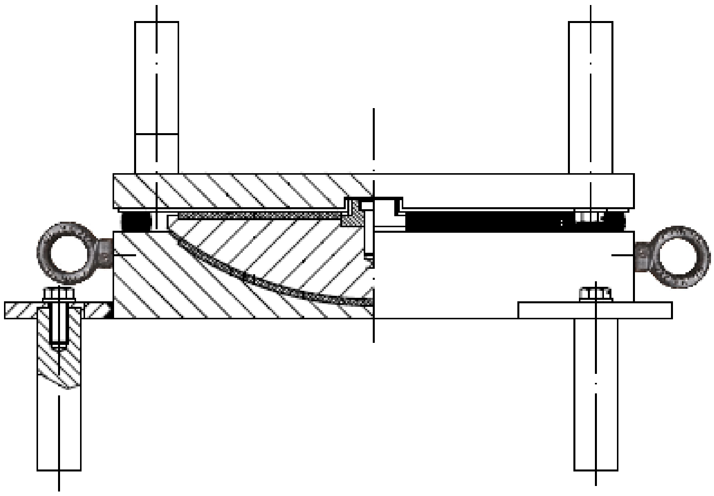
Figure A.3: FREYSSINET TETRON SB ISOGLIDE combined with flat sliding elements




e)

a) Free for displacements in any direction (3.5)
b) Guided by an internal guide for displacements in one direction (3.4)
c) Guided by external guides for displacements in one direction (3.3)
d) Fixed by a restraining ring (3.1)
e) Guided by external guides for displacements along one direction, and steel ring

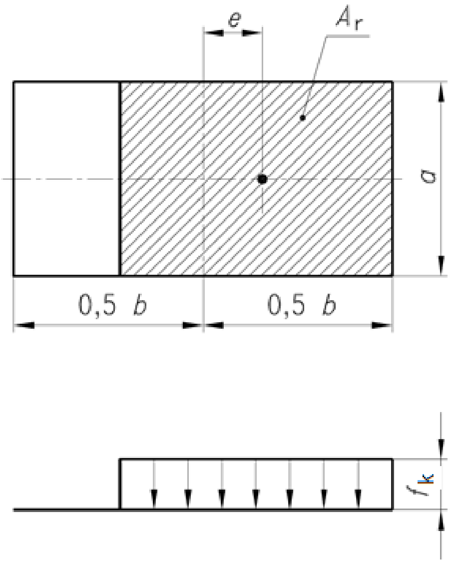
Figure A.4: FREYSSINET TETRON SB ISOGLIDE equipped with lifting devices (example)



## ANNEX B – REDUCED AREA FOR SLIDING ELEMENTS

Thereafter the values of the coefficient λ used in 3.1.4.3 of this ETA for the calculation of the reduced area $A_r$ of the sliding surfaces of FREYSSINET TETRON SB ISOGLIDE are stated.
e = total eccentricity
θ = semi-included angle of the curved surface

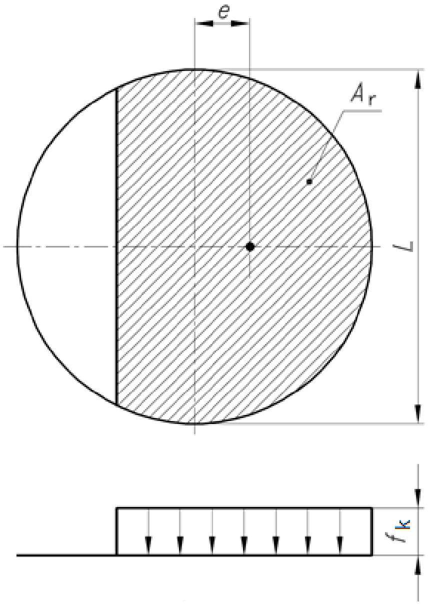
Figure B.1 - Reduced contact area $A_r$ for rectangular sliding surfaces




$A = a \times b$ (B.1)

$A_r = A - 2\,e \times a = a\,(b - 2\,e)$ (B.2)

Figure B.2 - Reduced contact area $A_r$ for circular sliding surfaces




$A = \pi \times L^2/4$ (B.3)

$Ar = \lambda \times A$ (B.4)

Parameter λ for either curved or plane surfaces is given in Tables B.1 and B.2 of this ETA, respectively.

Table B.1: – Coefficient λ for curved circular surfaces (see EN 1337-7, Table B.1)

| e/L \ θ | 30° | 25° | 20° | 10° |
|---|---|---|---|---|
| 0,00 | 1,000 | 1,000 | 1,000 | 1,000 |
| 0,01 | 0,982 | 0,981 | 0,980 | 0,979 |
| 0,02 | 0,962 | 0,961 | 0,960 | 0,958 |
| 0,03 | 0,942 | 0,940 | 0,938 | 0,936 |
| 0,04 | 0,922 | 0,919 | 0,916 | 0,913 |
| 0,05 | 0,901 | 0,898 | 0,894 | 0,890 |
| 0,06 | 0,880 | 0,876 | 0,872 | 0,867 |
| 0,07 | 0,858 | 0,853 | 0,849 | 0,844 |
| 0,08 | 0,836 | 0,831 | 0,826 | 0,820 |
| 0,09 | 0,814 | 0,808 | 0,803 | 0,796 |
| 0,10 | 0,792 | 0,786 | 0,780 | 0,773 |
| 0,11 | 0,770 | 0,763 | 0,757 | 0,749 |
| 0,12 | 0,747 | 0,740 | 0,733 | 0,724 |
| 0,13 | 0,725 | 0,717 | 0,710 | 0,700 |
| 0,14 | 0,702 | 0,693 | 0,686 | 0,676 |
| 0,15 | 0,680 | 0,670 | 0,663 | 0,653 |
| 0,16 | 0,657 | 0,647 | 0,639 | 0,628 |
| 0,17 | 0,635 | 0,624 | 0,616 | 0,604 |
| 0,18 | 0,612 | 0,601 | 0,592 | 0,581 |
| 0,19 | 0,590 | 0,578 | 0,569 | 0,557 |
| 0,20 | 0,567 | 0,556 | 0,546 | 0,533 |
| 0,21 | 0,545 | 0,533 | 0,523 | 0,510 |
| 0,22 | 0,523 | 0,511 | 0,500 | |
| 0,23 | 0,501 | | | |
| 0,24 | | | | |
| 0,25 | | | | |

NOTE Intermediate values may be obtained by linear interpolation.

Table B.2: – Coefficient λ for plane circular surfaces (see EN 1337-2, Table A.1)

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| e / L | 0,005 | 0,010 | 0,020 | 0,030 | 0,040 | 0,050 | 0,060 |
| λ | 0,990 | 0,979 | 0,957 | 0,934 | 0,912 | 0,888 | 0,865 |
| e / L | 0,070 | 0,080 | 0,090 | 0,100 | 0,110 | 0,120 | 0,125 |
| λ | 0,841 | 0,818 | 0,793 | 0,769 | 0,745 | 0,722 | 0,709 |
| e / L | 0,130 | 0,140 | 0,150 | 0,160 | 0,170 | 0,180 | 0,190 |
| λ | 0,697 | 0,673 | 0,649 | 0,625 | 0,601 | 0,577 | 0,552 |
| e / L | 0,200 | 0,210 | 0,212 | 0,220 | 0,230 | 0,240 | 0,250 |
| λ | 0,529 | 0,506 | 0,500 | 0,482 | 0,458 | 0,435 | 0,412 |

Note: Intermediate values can be obtained by linear interpolation

As an alternative to the exact values given in Table B.3, the following approximate formula can be used for flat circular surfaces:

$$\lambda = 1 - 0{,}75\,\pi\, e / L \quad \text{(B.5)}$$

# ANNEX C – REFERENCE DOCUMENTS

EAD European Assessment Document (EAD), EAD 050009-00-0301 Spherical and cylindrical bearing with special sliding material made of fluoropolymer;

| | |
|---|---|
| EN 1337-1:2000 | Structural bearings - Part 1: General design rules |
| EN 1337-2:2004 | Structural bearings - Part 2: Sliding elements |
| EN 1337-5:2005 | Structural bearings - Part 5: Pot bearings |
| EN 1337-7:2004 | Structural bearings - Part 7: Spherical and cylindrical PTFE bearings |
| EN 1337-11:1997 | Structural bearings - Part 11: Transport, storage and installation |
| EN 1990:2002+AC:2008+AC:2010 | Eurocode - Basis of structural design |
| EN 1993-1-10:2005+AC:2009 | Eurocode 3: Design of steel structures - Part 1-10: Material toughness and through-thickness properties |
| EN ISO 12944-1:1998 | Paints and varnishes - Corrosion protection of steel structures by protective coating systems - Part 1: General introduction |
| EN ISO 12944-2:1998 | Paints and varnishes - Corrosion protection of steel structures by protective coating systems - Part 2: Classification of environments |