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European Technical Assessment

ETA-20/0320
 of 21.05.2020

General part

Technical Assessment Body issuing the European Technical Assessment

Österreichisches Institut für Bautechnik (OIB)
 Austrian Institute of Construction Engineering

Trade name of the construction product

Schreiber SMS® Spherical Bearing

Product family to which the construction product belongs

Spherical and cylindrical bearing with special sliding material made of fluoropolymer

Manufacturer

Schreiber Brücken Dehntechnik GmbH
 Am Moosbach 10+12
 74535 Mainhardt
 Germany

Manufacturing plants

Factory 01, Factory 02

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)
 EAD 050009-00-0301 "Spherical and cylindrical bearing with special sliding material made of fluoropolymer"

Specific parts

1 Technical description of the product

The Schreiber SMS® Spherical Bearing 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).

The Schreiber SMS® Spherical Bearing 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, SMS (SCHREIBER MAGIC SLIDE), 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 SMS 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.

Spherical bearing with an included angle $2\theta > 60^\circ$ 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 Schreiber SMS® Spherical Bearing

Plane surface		Curved surface		Guides	
dimpled SMS sheet	austenitic steel	dimpled SMS sheet	austenitic steel	undimpled SMS sheet ¹⁾	austenitic steel
			hard chromium	CM1	
¹⁾ Instead of the undimpled SMS 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.					

SMS-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 SMS 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.

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

Schreiber SMS® Spherical Bearing are 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.

Schreiber SMS® Spherical Bearing are suitable for all types of structures, as well as for regions with continuously low and high temperatures.

The effective bearing temperature of Schreiber SMS® Spherical Bearing 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. They are also intended for the use in superstructures where working loads induce fast sliding displacements in bearings.

Schreiber SMS® Spherical Bearing are 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 Schreiber SMS® Spherical Bearing of 10 years, depending on the accumulated total sliding path in accordance with Clause 3.1.3 in this ETA, and provided that Schreiber SMS® Spherical Bearing are 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 Schreiber SMS® Spherical Bearing 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 Schreiber SMS® Spherical Bearing

Table 2: Essential characteristics and performances of Schreiber SMS® Spherical Bearing

Basic requirements for construction works	Essential characteristics	Method of assessment	Performance
BWR 1	Load bearing capacity	EAD, Clause 2.2.1	Table 3 Clause 3.1.1
	Rotation capability	EAD, Clause 2.2.2	0 – 0,05 rad Clause 3.1.2
	Displacement capacity	EAD, Clause 2.2.3 EAD, Clause 2.2.6	Accumulated sliding path of plane and curved sliding elements combined with dimpled lubricated SMS-sheets: 10 000 m Accumulated sliding path of guides: 2 000 m Clause 3.1.3
	Durability aspects	EAD, Clause 2.2.4	Durable 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 SMS-sheets by means of the following:

- The frictional resistance of the sliding surfaces is expressed by means of the coefficients of friction of SMS-sheets given in clause 3.1.5 in this ETA;
- The characteristic compressive strength of SMS 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 Schreiber SMS® Spherical Bearing 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 Schreiber SMS® Spherical 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 SMS-sheets covered by this ETA, the maximum load bearing capacity of Schreiber SMS® Spherical Bearing at the relevant temperature is given in Table 3.

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Table 3: Maximum load bearing capacity of Schreiber SMS® Spherical Bearing under a fundamental combination of action

Maximum effective bearing temperature	Schreiber SMS® Spherical Bearing
$T \leq 32 \text{ °C}$	90 882 kN
$T = 48 \text{ °C}$	75 735 kN
$T = 60 \text{ °C}$	68 161 kN
$T = 70 \text{ °C}$	60 588 kN
$T = 80 \text{ °C}$	50 490 kN
$T = 90 \text{ °C}$	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 Schreiber SMS® Spherical Bearing is 0,05 radians about any horizontal axis. Schreiber SMS® Spherical Bearing allow 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 SMS sheets is 10 000 m.

The maximum accumulated sliding path of guides combined with undimpled SMS 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 SMS-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 SMS 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 σ_p acting on the SMS-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:

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

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 SMS 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;

γ_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_r , 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:

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

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 SMS 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) Backing plates

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:

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

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

Where:

k is the stiffness coefficient of dimpled SMS 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 SMS sheet, with $L \leq 1000$ mm according to this ETA;

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

A suitable method for calculating the deformation Δw_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 μ_{max} are used for design of the Schreiber SMS® Spherical Bearing.

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) Coefficient of friction at low temperatures

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

$$0,020 \leq \frac{2,0}{40 + \sigma_{SMS}} \leq 0,036 \quad (4)$$

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

(b) Coefficient of friction at very low temperatures

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

$$0,032 \leq \frac{3,9}{60 + \sigma_{SMS}} \leq 0,052 \quad (5)$$

For guides combined with undimpled and initially lubricated SMS 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 SMS sheets used in zones where the minimum effective bearing temperature doesn't fall below -5 °C, the coefficient of friction μ_{\max} is determined as a function of the average pressure on the sliding surface σ_{SMS} [MPa], as follows:

$$0,011 \leq \frac{1.35}{60 + \sigma_{\text{SMS}}} \leq 0.018 \quad (6)$$

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

NOTE 1: The average pressure σ_{SMS} on dimpled SMS 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 Schreiber SMS® Spherical Bearing 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 SMS 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.

3.2 Performance of the sliding material SMS

Table 4: Essential characteristics of the special sliding material SMS

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 SMS	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 SMS sheets: $E_{tp} = 900 \text{ MPa}$ Stiffness coefficient ¹⁾ : $k = \frac{\sigma_{SMS} [\text{MPa}] - 45}{74,3}$
	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 SMS is expressed as a function of the average pressure σ_{SMS} on the sliding material sheet under the characteristic combination of action			

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Table 5. Characteristic compressive strength of SMS

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 Permanent and Variable Loads	180	150	135	120	100	90
Guides Variable Loads						
Guides Permanent Loads 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 Commission¹, amended by the Commission Decision 2001/596/EC² and 2002/592/EC³, 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 factories twice a year for surveillance of the AVCP.

Issued in Vienna on 21.05.2020
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

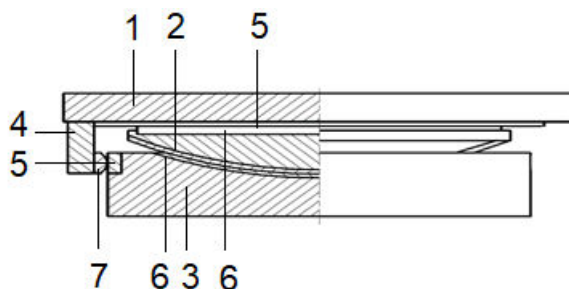
ANNEX A – DESCRIPTION OF THE PRODUCT

Figure A.1: Assembly of a guided and free movable Schreiber SMS® Spherical Bearing

Schreiber SMS® Spherical Bearing (example)

guided spherical bearing
(movable unidirectional)

free spherical bearing
(movable multidirectional)



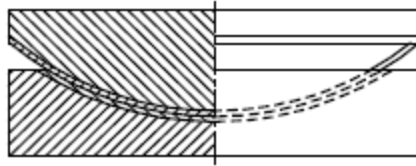
Key

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

Examples of Schreiber SMS® Spherical Bearing are shown in Figures A.2 and A.3.

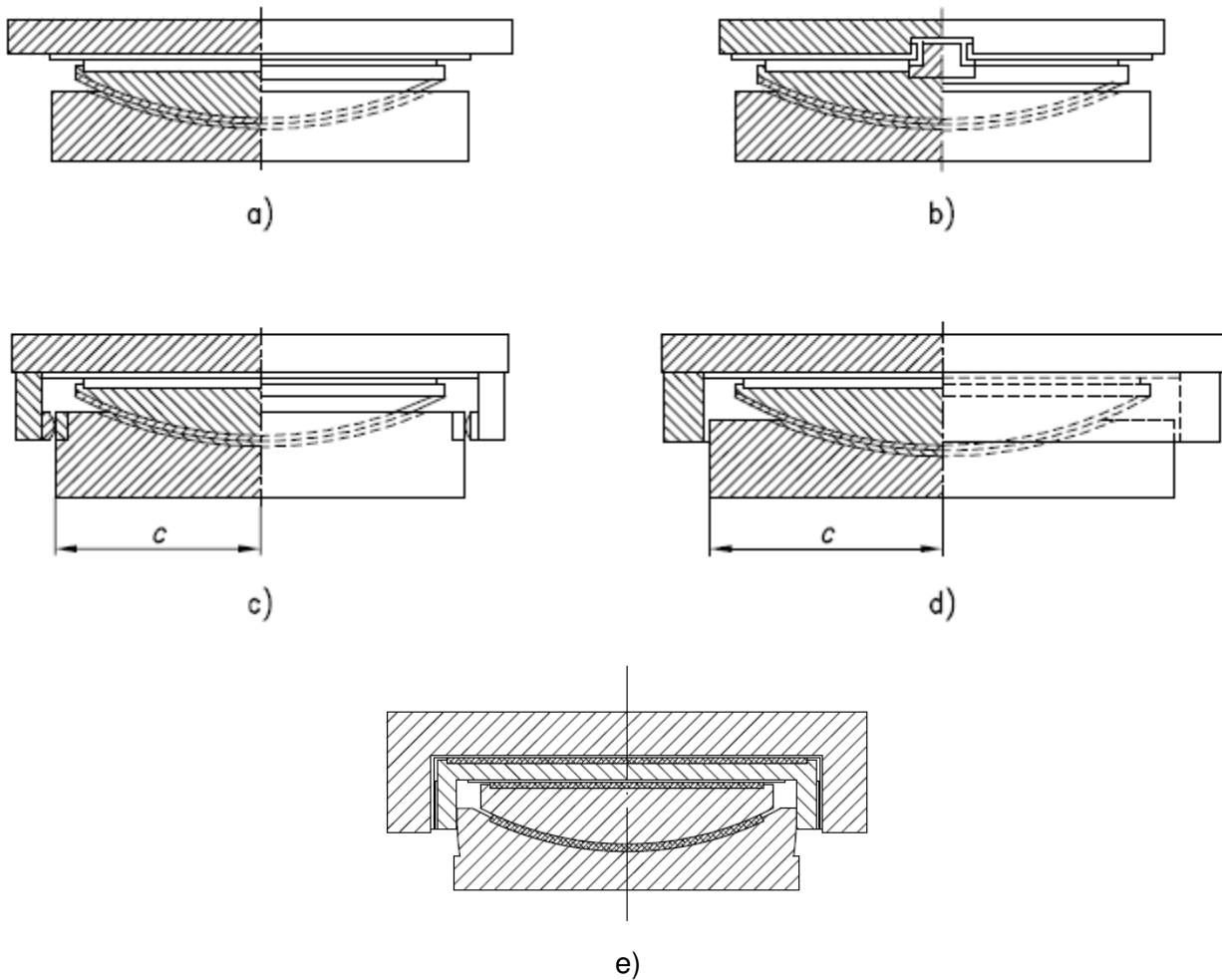
Note: Numbers in brackets in Figures A.2 and A.3 refer to the examples shown in Figure 1 of EN 1337-1.

Figure A.2: Schreiber SMS® Spherical Bearing



Fixed by sliding surface (3.2)

Figure A.3: Schreiber SMS® Spherical Bearing combined with flat sliding elements



- 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

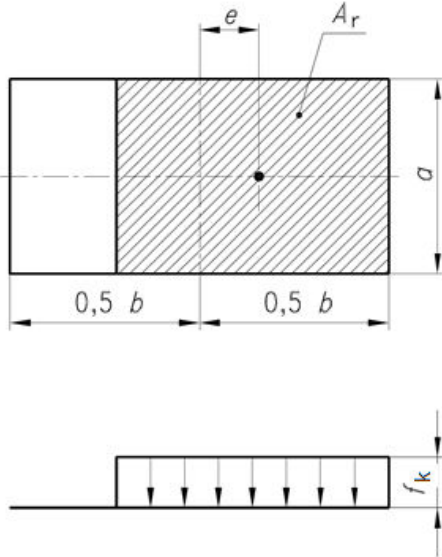
ANNEX B – REDUCED AREA FOR SLIDING ELEMENTS

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 Schreiber SMS® Spherical Bearing are stated.

e = total eccentricity

θ = semi-included angle of the curved surface

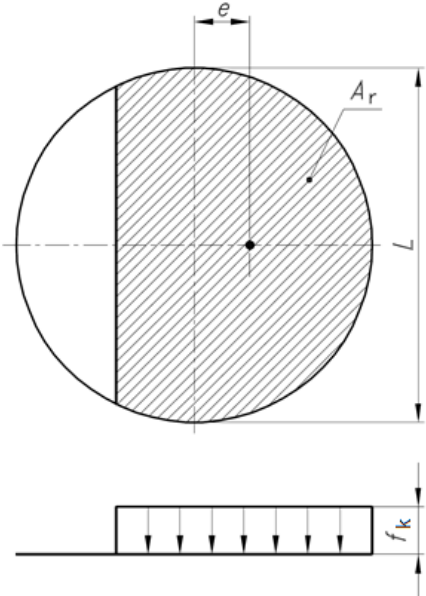
Figure B.1 - Reduced contact area A_r for rectangular sliding surfaces



$$A = a \times b \tag{B.1}$$

$$A_r = A - 2 e \times a = a (b - 2 e) \tag{B.2}$$

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



$$A = \pi \times L^2/4 \tag{B.3}$$

$$A_r = \lambda \times A \tag{B.4}$$

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)

$e/L \backslash \theta$	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.

ANMERKUNG Zwischenwerte dürfen durch lineare Interpolation ermittelt werden.

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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

ANMERKUNG Zwischenwerte dürfen durch lineare Interpolation ermittelt werden

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

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

ANNEX C – REFERENCE DOCUMENTS

EAD 05009-00-0301	European Assessment Document (EAD), EAD 05009-00-0301 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 tough- ness 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