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European Technical Assessment

ETA-26/0547 of 10.09.2026

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	SMS-Evo Plus® Spherical and Cylindrical Bearing
Product family to which the construction product belongs	Spherical and cylindrical bearing with special sliding material made of UHMWPE (ultra-high molecular weight polyethylene)
Manufacturer	Schreiber Brücken-Dehntechnik GmbH Am Moosbach 10+12 74535 Mainhardt GERMANY
Manufacturing plant	Schreiber Brücken-Dehntechnik GmbH Am Moosbach 10+12 74535 Mainhardt GEREMANY
This European Technical Assessment contains	32 pages including 14 annexes which form an integral part of this assessment.
This European Technical Assessment is issued in accordance with Article 95(4) of Regulation (EU) 2024/3110, on the basis of	European Assessment Document (EAD) 050004-01-0301 “Spherical and cylindrical bearing with special sliding material made of UHMWPE (ultra-high molecular weight polyethylene)”.

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Specific parts

1 Technical description of the product

1.1 General

SMS-Evo Plus® Spherical and Cylindrical Bearings are a spherical, respectively cylindrical bearings, that permit rotation and displacement movements by a curved sliding surface and a plane sliding surface between bearing plates of steel.

SMS-Evo Plus® Spherical and Cylindrical Bearings are designed in accordance with EN 1337-7. For the purpose of controlling the degree of freedom, they may be combined with sliding elements in accordance with to EN 1337-2, as specified in EN 1337-1, or with restraining rings.

Instead of PTFE, as defined by EN 1337-2, a special sliding material, made of UHMWPE (ultra-high molecular weight polyethylene) named SMS-Evo Plus®, is used for the sliding surfaces of the bearings. The SMS-Evo Plus® is suitable for low and high temperatures outside the scope of EN 1337-2 and shows (as given in the Table 3.1) an improved wear resistance and improved load-bearing capacity in comparison to PTFE according to EN 1337-2. The melting temperature of SMS-Evo Plus® is more than 50°C higher than the maximum operating temperature stated below.

Sliding surfaces with a diameter of the circumscribing circle of special sliding material sheets less than 75 mm or greater than 2010 mm, or with operating bearing temperatures less than –50°C or greater than +80°C, are outside the scope of this European Technical Assessment (ETA). Operating bearing temperatures above +48°C are limited to short periods, e.g. due to climatic temperature changes.

If composite material CM1 according to EN 1337-2 is used in guides, the minimum operating bearing temperature is limited to –35°C and the maximum operating bearing temperature is limited to +48°C.

Note: The operating temperature is considered to be the shade air temperature as given in EN 1991-1-5.

Bearings with an included angle $2\theta > 60°$ for spherical and $2\theta > 75°$ respectively for cylindrical bearings are beyond the scope of this European Technical Assessment (see EN 1337-7, clause 1 and Figure 3 in this ETA).

The subject of the European Technical Assessment is the complete bearing, including if relevant, the necessary guides or restraints.

Concerning product packaging, transport and storage it is the responsibility of the manufacturer to undertake the appropriate measures and to advise his clients on the transport and storage, as he considers necessary in order to reach the declared performances.

The information about installation is provided with the technical documentation from the Manufacturer and it is assumed that the product will be installed according to it or (in absence of such instructions) according to the usual practice of the building professionals.

1.2 Types of bearings

Exemplary types of spherical and cylindrical bearings are shown in Annex 1 and Annex 2.

The respective degrees of freedom are given in EN 1337-1, Table 1.

The SMS-Evo Plus® Spherical and Cylindrical Bearings may also be used upside down, i.e. with flat sliding surfaces positioned at the bottom side (relevant for example in the case of steel bridges).

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1.3 Technical description of the elements of the bearings

1.3.1 General

For aspects not specified in detail in this ETA, EN 1337-7 including references to EN 1337-1, -2 and -5 applies.

1.3.2 Sliding Materials

1.3.2.1 Combinations

The sliding materials in the bearing are combined as shown in Table 1.1. Only one combination is used in a sliding surface.

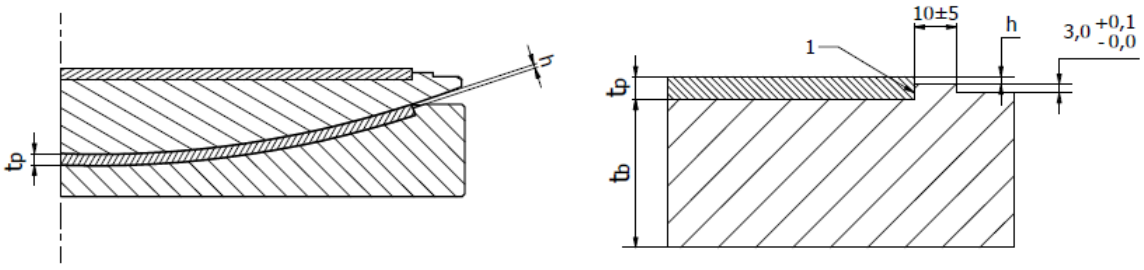
Table 1.1: Combinations of materials for permanent applications as sliding surfaces for spherical and cylindrical bearings with special sliding material SMS-Evo Plus®

Plane surface		Curved surface		Guides	
dimpled SMS-Evo Plus® sheet	austenitic steel	dimpled SMS-Evo Plus® sheet	austenitic steel	undimpled SMS-Evo Plus® sheet	austenitic steel
			hard chromium	CM1 [1)]	

[1)] Instead of the undimpled SMS-Evo Plus® 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.

1.3.2.2 SMS-Evo Plus® sheets

SMS-Evo Plus® is a special sliding material made of a specified UHMWPE (ultra-high molecular weight polyethylene) with melting temperature of more than 50°C higher than the maximum operating temperature of +80°C of SMS-Evo Plus® Spherical and Cylindrical Bearings.
SMS-Evo Plus® is used either as dimpled sheets in primary curved and plane sliding surfaces of the sliding elements of SMS-Evo Plus® Spherical and Cylindrical Bearing, or undimpled sheets in guides, in accordance with Table 1.1.



Key:
1 – sharp edge; *h* – protrusion;
t_p – thickness of the SMS-Evo Plus® sheet;
t_b – thickness of the backing plate

Dimensions are in mm.

Figure 1: Recess, thickness and protrusion of SMS-Evo Plus® sheets

Material composition:

The composition of the material of SMS-Evo Plus® is confidential. Relevant information is given in Table 3.1. Further details are laid down in the technical documentation to this European Technical Assessment, deposited with the Technical Assessment Body Österreichisches Institut für Bautechnik.

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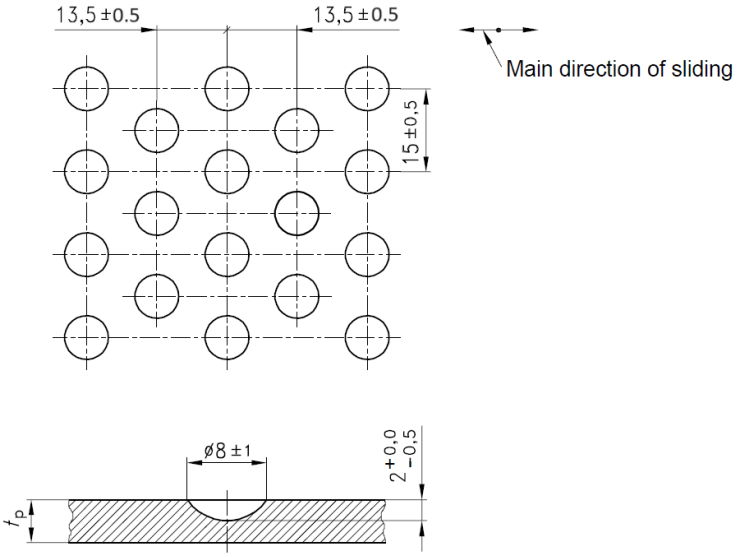
Recess, thickness and protrusion:

SMS-Evo Plus® sheets are recessed into a backing plate as shown in Figure 1. The thickness t_p and protrusion h of the SMS-Evo Plus® sheet in the unloaded condition shall meet the conditions given in Table 1.2. SMS-Evo Plus® sheets used in the primary curved and plane sliding surface are provided with a uniform pattern of dimples to retain the lubricant. The dimensions, shape and arrangement of the dimples in the unloaded and unused condition, and the alignment with respect to the main direction of sliding are in accordance with Figure 2.

Table 1.2: Thickness t_p and protrusion h of SMS-Evo Plus® sheets

	Plane and curved main sliding surfaces	Guides
Thickness t_p in mm	2,65 x $h \leq t_p \leq$ 10,0; with h in mm	8,0 $\leq t_p \leq$ 10,0
Protrusion h in mm	h = 2,50 + L/3000	h = 3,0 ± 0,2
L is the diameter or diagonal of the circumscribing circle of the projected area of the SMS-Evo Plus® sheet in mm. The tolerance on the protrusion h is ± 0,2 mm for main dimension L less than or equal to 1200 mm, and ± 0,3 mm for L greater than 1200 mm. The tolerance on the thickness t_p is +0,3/-0,0 mm for sheets with main dimension L less than or equal to 1200 mm, and +0,4/-0,0 mm for larger sheets.		

The protrusion h is verified, for the individual SMS-Evo Plus® Spherical and Cylindrical Bearing, at marked measuring points, where the corrosion protection coating shall not exceed 300 µm. There are at least two measuring points, suitably located, for each individual bearing.



Dimensions are in mm.

Figure 2: Pattern of dimples in recessed SMS-Evo Plus® sheets

Sheet arrangement:

Plane SMS-Evo Plus® sheets

Plane SMS-Evo Plus® sheets for flat sliding surfaces of SMS-Evo Plus® Spherical and Cylindrical Bearings are arranged as shown in Annex 3.

Curved SMS-Evo Plus® sheets

Curved SMS-Evo Plus® sheets for spherical and cylindrical sliding of SMS-Evo Plus® Spherical and Cylindrical Bearings are arranged as shown in Annex 4.

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

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SMS-Evo Plus® sheets for guides

Undimpled SMS-Evo Plus® sheets for guides of SMS-Evo Plus® Spherical and Cylindrical Bearings are arranged as shown in Annex 5. General information on guides is given in Annex 8.

Additional provisions

As an alternative to the geometrical rules given above, according to EAD, clause A.4, plane and curved SMS-Evo Plus® sheets may consist of one centric circular sheet with diameter "a" and one or more concentric annuli with a constant width "b". The dimensions "a" and "b" are not smaller than 50 mm. The radial distance between the individual sheets is not less than 10 mm and not greater than twice the thickness of the backing plate, of the sliding material sheet or the mating material, whichever is least.

1.3.2.3 Composite sliding material

Instead of the undimpled SMS-Evo Plus® sheets, but only where self-alignment between the mating parts of the bearing is possible, composite material of type CM1 in accordance with EN 1337-2, clause 5.3.1 can be used in guides.

1.3.2.4 Austenitic steel

Austenitic steel sheets are in accordance with EN 1337-2, clauses 5.4.
The methods of attachment to ferrous backing plates are shown in Annex 6.

1.3.2.5 Hard chromium plated surfaces

Hard chromium plated surfaces are in accordance with EN 1337-2, clause 5.5.
The surface characteristics are specified in EN 1337-2, clauses 5.5.3.

1.3.3 Lubricant

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

1.3.4 Ferrous materials for backing plates

The ferrous materials used for backing plates of the sliding surfaces are in accordance with EN˚1337-2, clause 5.6.

1.3.5 Protection of the sliding surfaces

Skirts are used to protect the sliding surfaces of the sliding elements of SMS-Evo Plus® Spherical and Cylindrical Bearings from contamination. They are also intended to protect hard chromium plated surfaces from air borne particles in industrial environments.

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2 Specification of the intended use(s) in accordance with the applicable European Assessment Document (hereinafter EAD)

SMS-Evo Plus® Spherical and Cylindrical Bearings are intended to be used for the support of bridges or building works in accordance with the scope of EN 1337-1, Clause 1, where the requirements on the individual bearings are critical.

SMS-Evo Plus® Spherical and Cylindrical Bearings with special sliding material made of UHMWPE SMS-Evo Plus® are suitable for all types of structures but especially for non-rigid structures with relatively large and frequent displacements caused by working loads, next for superstructures that induce fast sliding displacements in bearings, e.g. in bridges for high-speed railways, as well as for regions with permanently low and/or high temperatures.

SMS-Evo Plus® Spherical and Cylindrical Bearings are mainly used in concrete, steel and composite structures.

The performance given in clause 3 can only be assumed if SMS-Evo Plus® Spherical and Cylindrical Bearings are used in compliance with the specifications and under boundary conditions set out in the Annexes.

The range of effective bearing temperature of SMS-Evo Plus® Spherical and Cylindrical Bearings covered by this ETA when undimpled SMS-Evo Plus® sheet is used in guides is –50°C and up to +80°C. When composite material of type CM1 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.

Temperatures above +48°C are limited to short periods as due to climate temperature changes.

The verifications and assessment methods on which this European Technical Assessment is based lead to an assumption of a working life of SMS-Evo Plus® Spherical and Cylindrical Bearings of 100 years (see Annex 12), depending on the accumulated sliding path assessed according to clause 3.5 and provided that SMS-Evo Plus® Spherical and Cylindrical Bearings are subjected to appropriate use and maintenance, taking into account the conditions given in EN 1337-1 and EN˚1337-11. The working life of the bearing is reduced to 10 years, if in the bearing's guides composite materials according to EN 1337-2 are used instead of the special sliding material SMS-Evo Plus®. 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 right product in relation to the expected economically reasonable working life of the works.

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

3.1 Performance of the product

Table 3.1: Performance of the product in relation to the essential characteristics

<table>
<tr><th>Essential characteristic</th><th>Assessment method</th><th colspan="2">Performance</th></tr>
<tr><td colspan="4">Basic requirement for construction works 1: Mechanical resistance and stability</td></tr>
<tr><td rowspan="8">Load bearing capacity</td><td rowspan="8">EAD
Clause 2.2.1</td><td colspan="2">Load bearing capacity for long-term loads: see clause 3.2.2</td></tr>
<tr><td>Maximum effective temperature T_{max} [°C]</td><td>Temperature dependant, nominal compressive strength f_k (T) [N/mm²]</td></tr>
<tr><td>35</td><td>180</td></tr>
<tr><td>48</td><td>135</td></tr>
<tr><td>60</td><td>110</td></tr>
<tr><td>70</td><td>90</td></tr>
<tr><td>80</td><td>75</td></tr>
<tr><td colspan="2">Notional elastic modulus:
E_{tp} = 923 N/mm² at p=0,50 f_k=90 N/mm²
Compliance coefficient: $k = \frac{\sigma_{SMS-Evo\ Plus®} - 4{,}3}{95{,}5}$ [-]</td></tr>
<tr><td>Rotation capability</td><td>EAD
Clause 2.2.2</td><td colspan="2">See clause 3.3</td></tr>
<tr><td rowspan="2">Displacement capacity</td><td rowspan="2">EAD
Clause 2.2.3</td><td colspan="2">See clause 3.4</td></tr>
<tr><td colspan="2">Total slide path
• for plane, dimpled and lubricated sheets: 100 000 m
• for curved, dimpled and lubricated sheets: 20 000 m
• for guides, initially lubricated: 20 000 m</td></tr>
<tr><td>Coefficient of friction</td><td>EAD
Clause 2.2.4</td><td colspan="2">See clause 3.5</td></tr>
<tr><td colspan="4">Basic Works Requirement 2: Safety in case of fire</td></tr>
<tr><td>Reaction to Fire</td><td>EAD
Clause 2.2.5</td><td colspan="2">• Metal parts: Performance A1 (decision 96/603/EC)
• Sliding material SMS-Evo Plus®: not assessed
• Spherical and cylindrical bearing: not assessed</td></tr>
<tr><td colspan="4">[1] For guides exposed to permanent loads (e.g. effects of temperature, creep, and shrinkage) the characteristic strength is reduced to 1/3 f_k (T). The characteristic strength for intermediate maximum operating temperatures may be interpolated.
[2] Herein, σ [N/mm²] represents the average pressure acting on the SMS-Evo Plus® sliding sheet under the characteristic combination of actions</td></tr>
</table>

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Table 3.1 (continued)

Essential characteristic	Assessment method	Performance
Aspects of durability		
Protection against contamination of sliding surfaces	EAD Clause 2.2.6.1	*Sliding elements are protected against contamination in accordance with EN 1337-2, clause 7.3 by brushes or rubber skirts.*
Corrosion Resistance	EAD Clause 2.2.6.2	Corrosion protection of structural steel parts by protective coating based on the product specification in accordance with EN ISO 12944-5: • *with hot-dip galvanizing: TSM 4.02 "high";* • *without hot-dip galvanizing: C4.10 "high".* Corrosivity categories according to EN ISO 9223: • *C4 or C5 depending on the intended use*. Protection of austenitic steel sheets used as sliding mate: • *in accordance with EN 1337-2, clause 7.3.*
Ageing Resistance	EAD Clause 2.2.6.3	*Average deviation stated in Annex 13, Table A.13.1*
Resistance against chemical and environmental influences	EAD Clause 2.2.6.4	*Average deviation stated in Annex 13, Table A.13.1*

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3.2 Load bearing capacity

3.2.1 General

The sliding surfaces of SMS-Evo Plus® Spherical and Cylindrical Bearings are dimensioned in accordance with clause 6.8 of EN 1337-2, and for curved sliding surfaces in accordance with clauses 6.2.1 to 6.2.3 of EN 1337-7, adapted to the performance of SMS-Evo Plus® sheets by means of the following:

- possible material combinations are given in Table 1.1. For composite material of type CM1 used in guides, relevant clauses of EN 1337-2 apply;
- the characteristic temperature dependant compressive strength of SMS-Evo Plus® is given in Table 3.1;
- If composite material CM1 in accordance with EN 1337-2, clause 5.3, is used as sliding in guides, the value of the characteristic strength shall be taken from Table 10 given in clause 6.6 of EN 1337-2.

When calculating the total eccentricity e_t of the axial force N_S, the coefficients of friction of SMS-Evo Plus® sheets given in clause 3.6 are used.

Eccentricities in SMS-Evo Plus® Spherical and Cylindrical Bearings are evaluated according to the methods given in Annex 10.1 and Annex 10.2. If several eccentricities occur in a cross-section under consideration, they need to be added for the calculation of the total eccentricity e_t. The minimum eccentricity to be considered if a bearing cannot rotate about one axis (as for cylindrical bearings), is 1/10 of the side length perpendicular to that axis, according to EN 1337-1, clause 5.5.

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

The backing plates with concave surfaces are fulfilling the dimensional limitations given in Annex 7.1 to Annex 7.3.

3.2.2 Load-bearing capacity for long-term load

3.2.2.1 Axial load

The load bearing capacity for long-term loads $N_{R,max}$ is determined for the individual SMS-EVO PLUS® Spherical and Cylindrical Bearing in relation to the characteristic compressive strength of the sliding surfaces in accordance with Equation (1).

$$N_{R,max} = \min(N_{R,curved}\,; N_{R,flat}) \tag{1}$$

The load bearing capacity for long-term load of a sliding surface is defined as follows:

$$N_R = f_k(T) \times A_r \tag{2}$$

where:

N_R is the load bearing capacity for vertical load

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

A_r is the reduced contact area, see Annex 9.1 and Annex 9.2.

For the purpose of compressive stress evaluation, the curved sliding surface shall be replaced by its projection on a flat surface as shown in Figure 3.

By referring to the maximum dimension of SMS-Evo Plus® sheets covered by this ETA, the maximum characteristic load bearing capacities of SMS-Evo Plus® Spherical and Cylindrical Bearings at the relevant temperatures with respective included angle 2 θ are given in Tables 3.2 and 3.3 respectively.

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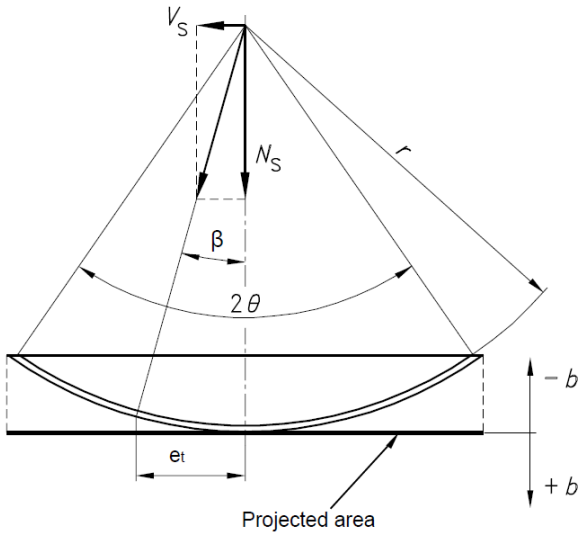


Figure 3: Evaluation scheme for curved sliding surface (example)

Table 3.2: Characteristic load-bearing capacity for long term axial loads of SMS-Evo Plus® Spherical Bearings

maximum effective bearing temperature	$f_k(T)$ [N/mm²]	SMS-Evo Plus® Spherical Bearing - characteristic load bearing capacity $N_{R,max}$ [kN]			
		2 θ = 20°	2 θ = 40°	2 θ = 50°	2 θ = 60°
T ≤ 35°C	180	291 289	285 578	291 861	286 149
T = 48°C	135	218 467	214 183	218 895	214 612
T = 60°C	110	178 010	174 520	178 359	174 869
T = 70°C	90	145 645	142 789	145 930	143 074
T = 80°C	75	121 371	118 991	121 609	119 229

Table 3.3: Characteristic load-bearing capacity for long term axial loads of SMS-Evo Plus® Cylindrical Bearings

maximum effective bearing temperature	$f_k(T)$ [N/mm²]	SMS-Evo Plus® Cylindrical Bearing - characteristic load bearing capacity $N_{R,max}$ [kN]			
		2 θ = 20°	2 θ = 40°	2 θ = 60°	2 θ = 75°
T ≤ 35°C	180	286 720	209 147	295 859	302 141
T = 48°C	135	215 040	217 610	221 894	226 606
T = 60°C	110	175 218	177 312	180 802	184 642
T = 70°C	90	143 360	145 074	147 929	151 071
T = 80°C	75	119 467	120 895	123 274	125 892

Backing Plates

The SMS-Evo Plus® sheets and mating materials shall be supported by metallic plates (backing plates) with flat or curved surfaces.

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The assessment of the backing plates is in accordance with Annex 7.1 to Annex 7.3.

A suitable method for calculating the deformation Δw_1 for backing plates attached to concrete members is given in Annex 11.

For SMS-Evo Plus® Spherical and Cylindrical bearings the calculation of the relative deformation of the backing plate with convex surface shall be omitted and Δw_2 taken as zero in accordance with EN 1337-2, clause 6.9.2.

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-Evo Plus® sheet meets the condition $\sigma_p \geq 0$. The condition $\sigma_p \geq 0$ is satisfied when the total eccentricity e_t falls within the kernel of the projected area.

3.2.2.2 Lateral load

Load bearing capacity of guided spherical and cylindrical bearing in accordance with EN 1337-1, Table 1 (type 3.3, 3.4, 7.2 and 7.3) for long term loads is determined under assumption that the load bearing capacity of the steel components supporting the guide elements is greater than the load bearing capacity of the guide $V_{R,guide}$.

In case spherical or cylindrical bearings are equipped with guides, the load-bearing capacity of guides $V_{R,guide}$ shall be assessed in accordance with EN 1337-2, clause 6.8. If SMS-Evo Plus® is used, the characteristic strengths in accordance with Table 3.1 apply. The load-bearing capacity for lateral load is:

$$V_{R,guide} = f_k(T) \times A \qquad (3)$$

where:

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

- for SMS-Evo Plus® sheets, $f_k(T)$ is given in Table 3.1 of this ETA;
- for composite material of type CM1 used in guides, EN 1337-2, clause 6.6 applies.

A is the sliding surface area of the guide (in accordance with EN 1337-2, clause 6.8.3, eccentricity can be neglected for guides).

Exemplary determined load-bearing capacity for long term loads lateral load of SMS-Evo Plus® Spherical and Cylindrical Bearings are given in Tables 3.4.

Table 3.4: Exemplary characteristic load-bearing capacity for long term lateral load of SMS-Evo Plus® Spherical Bearings

maximum effective bearing temperature	$f_k(T)$ [N/mm²]	A [mm²] $A = d \cdot h$ $h = 2010$ mm, $d = 500$ mm	$V_{R,guide}$ [kN]
T ≤ 35°C	180	1 005 000	180 900
T = 48°C	135	1 005 000	135 675
T = 60°C	110	1 005 000	110 550
T = 70°C	90	1 005 000	90 450
T = 80°C	75	1 005 000	75 375

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In case free spherical bearings are fixed by a steel restraining ring as shown in Figure 4d) of EN 1337-7, the assessment of the steel restraining ring shall be in accordance with rules for pot and piston of pot bearings, given in EN 1337-5, clauses 6.1.3.2 and 6.2.2 to 6.2.4.

The load-bearing capacity of the steel components supporting the guide elements $V_{R,support}$ shall be determined in accordance with EN 1993-1-1 and EN 1993-1-8 such that:

$$V_{R,support} > V_{R,guide} \quad (4)$$

3.3 Rotation capability

The maximum rotation angle of SMS-Evo Plus® Spherical and Cylindrical Bearing is:

$$\alpha_{max} = \alpha_{max,geom.} - \alpha_{inc.rot.} \quad (5)$$

where:

$\alpha_{inc.rot.}$ is the increased rotation in accordance with EN 1337-1, clause 5.4

$\alpha_{max,geom.}$ is the maximum geometrical rotation angle

The maximum rotation angle α_{max} is 0,046 rad.

3.4 Displacement capacity

The total–slide path for SMS-Evo Plus® Spherical and Cylindrical Bearing and the respective sliding partner has been accumulated at a sliding speed of v_a = 15 mm/s (B-phases) and are given in Table 3.1.

If composite material of type CM1 in accordance with EN 1337-2, Clause 5.3, is used in guides, the total slide path for this combination is in accordance with EN 1337-2, Table 4.

The single, maximum displacement capacity of SMS-Evo Plus® Spherical and Cylindrical Bearing is given by the project specific geometrical design of the sliding elements. By taking account of the increased movements according to 5.4 in EN 1337-1 it shall be verified under the fundamental combinations of actions that with maximum displacement of the sliding element the mating sliding partner completely covers the SMS-Evo Plus® or CM sheets.

3.5 Coefficient of friction

The following coefficients of friction μ_{max} are used for the design of SMS-Evo Plus® Spherical and Cylindrical 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 maximum coefficient of friction μ_{max} of dimpled and lubricated SMS-Evo Plus® sheets is determined as a function of the average pressure $\sigma_{SMS\text{-}Evo\ Plus}$ [MPa] is given in the Table 3.5.

Table 3.5: Coefficient of friction for sliding elements incorporating dimpled and lubricated SMS-Evo Plus® sheets with austenitic steel or hard chromium as mating partner for total slide path up to 100 000 m

Operating temperatures	Coefficient of friction of main sliding surfaces
where the minimum effective bearing temperature does fall below –35°C, and down to –50 °C	$0{,}03 \le \mu_{max} = \frac{93}{(\sigma_{SMS-Evo\ Plus})^{1{,}82} + 967} \le 0{,}08$
where the minimum effective bearing temperature doesn't fall below –35°C	$0{,}02 \le \mu_{max} = \frac{117}{(\sigma_{SMS-Evo\ Plus})^{2{,}00} + 1317} \le 0{,}08$
where the minimum effective bearing temperature doesn't fall below –5°C	$0{,}01 \le \mu_{max} = \frac{94}{(\sigma_{SMS-Evo\ Plus})^{2{,}10} + 1186} \le 0{,}06$

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For guides incorporating undimpled and initially lubricated SMS-Evo Plus® sheets, the coefficient of friction shall be considered to be independent of contact pressure and is given in the Table 3.6 for different minimum operation temperatures T_{min}.

For guides with composite material of type CM1, see EN 1337-2, section 6.7.

Table 3.6: Coefficient of friction for guides incorporating undimpled and initially lubricated SMS-Evo Plus® sheets with austenitic steel as mating partner for total slide path up to 20 000 m

Operating temperatures	Coefficient of friction in guides
where the minimum effective bearing temperature does fall below –35°C, and down to –50°C:	μ_{max} = 0,087
where the minimum effective bearing temperature doesn't fall below –35°C	μ_{max} = 0,077
where the minimum effective bearing temperature doesn't fall below –5°C:	μ_{max} = 0,055

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, amended by the Commission Decision 2001/596/EC and 2002/592/EC, 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 for products according to this ETA are laid down in in the control plan deposited at the Technical Assessment Body Österreichisches Institut für Bautechnik.

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

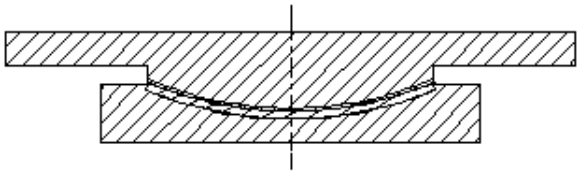
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The original document is signed by:

Thomas Rockenschaub
Managing Director

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Annex 1: SMS-Evo Plus® Spherical Bearing (example)



Fixed by sliding surface (3.2)

Figure A1.1: SMS-Evo Plus® Spherical Bearing

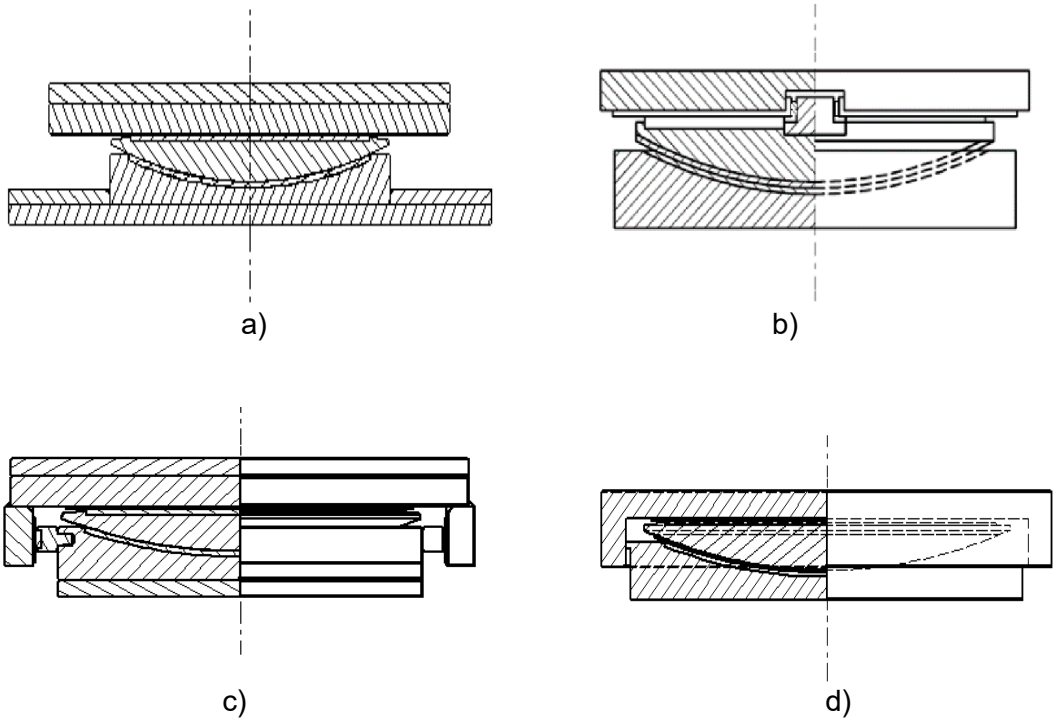


Figure A1.2: SMS-Evo Plus® Spherical Bearing combined with flat sliding elements

Key:

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)

Note: numbers in brackets refer to the examples shown in Figure 1 of EN 1337-1

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Annex 2: SMS-Evo Plus® Cylindrical Bearing (examples)

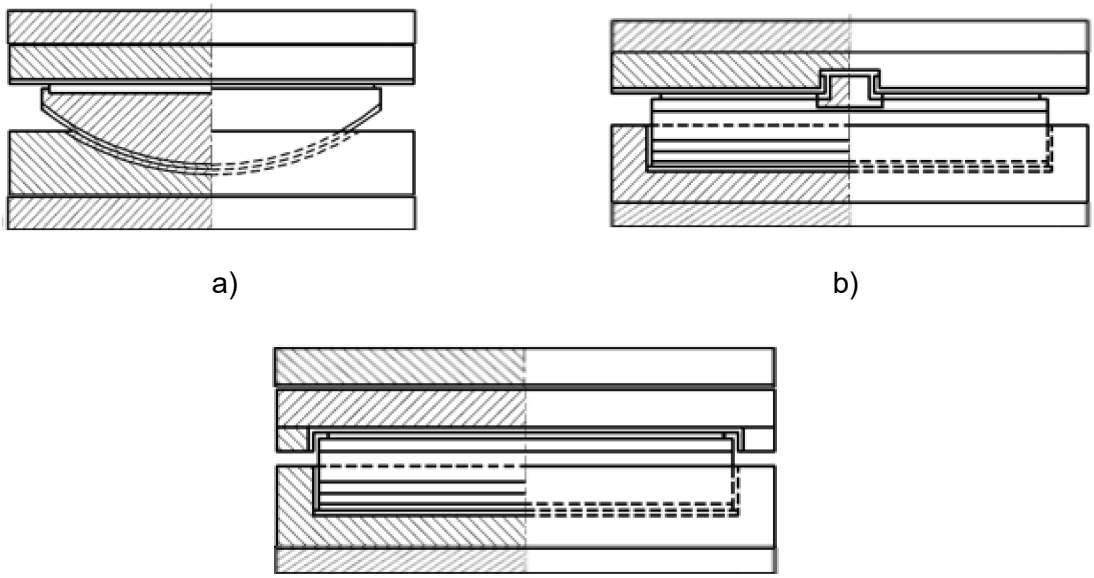


a) b)

Figure A2.1: SMS-Evo Plus® Cylindrical Bearing

Key:

a) Fixed by end stops and sliding surface (7.1)
b) Without end stops for displacements in y direction (7.2)



a) b)

c)

Figure A2.2: SMS-Evo Plus® Cylindrical Bearing combined with flat sliding elements

Key:

a) Free for displacements in any direction (7.4)
b) Guided by an internal guide for displacements in x direction (7.3)
c) Guided by external guides for displacements in x direction

Note: numbers in brackets refer to the examples shown in Figure 1 of EN 1337-1

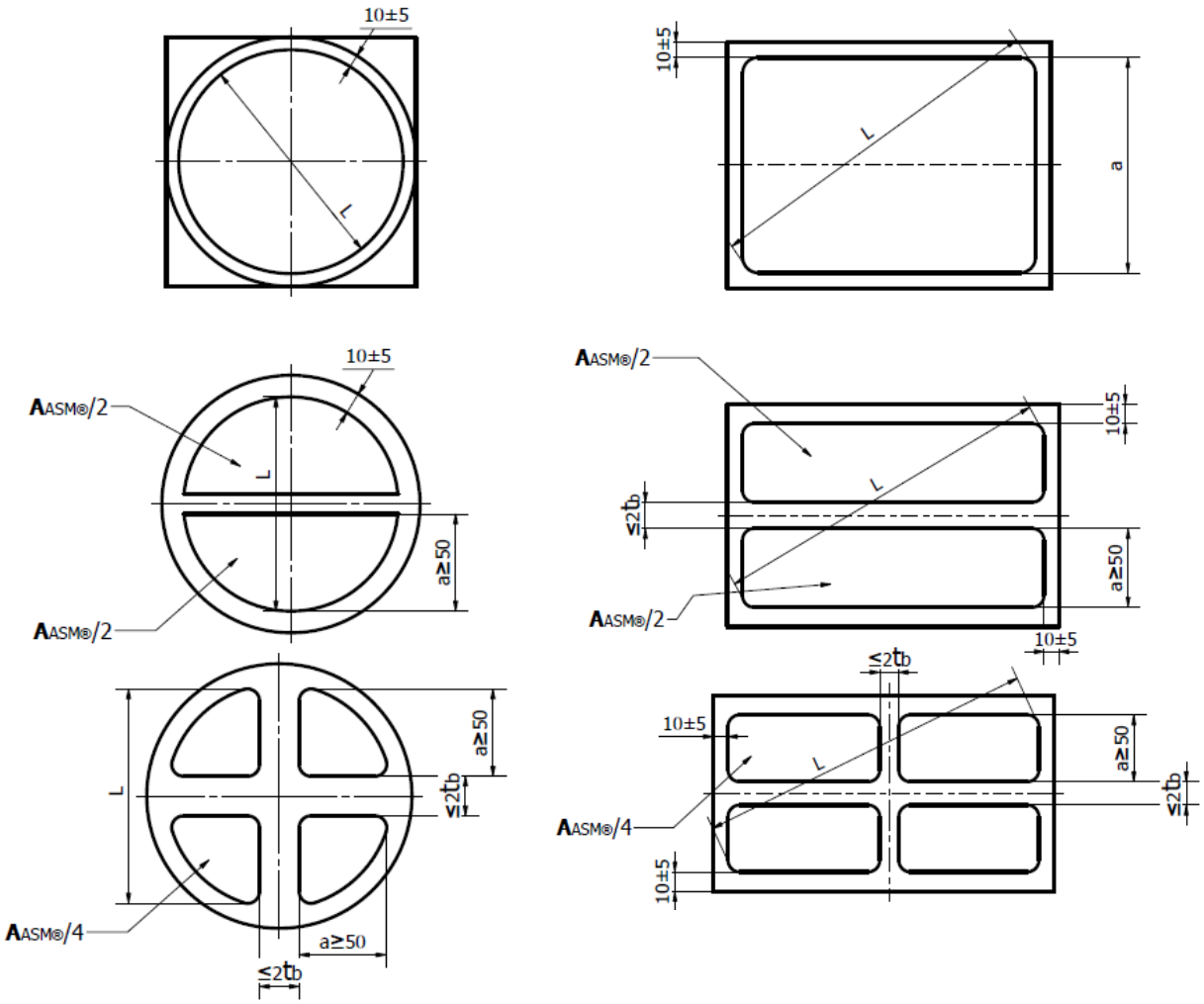
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Annex 3: Arrangement of plane SMS-Evo Plus® sheets

Flat SMS-Evo Plus® sheets for the main sliding surface are either circular or rectangular and may be subdivided into a maximum of four identical parts. Further sub-divisions are beyond the scope of this ETA.

The smallest dimension “a” is not less than 50 mm.

The distance between individual SMS-Evo Plus® sheets does not exceed twice the thickness of the backing plate t_b of the SMS-Evo Plus® sheet or the mating material, whichever is least.



Dimensions are in mm.

Figure A3.1: Examples of recessed plane SMS-Evo Plus® sheets

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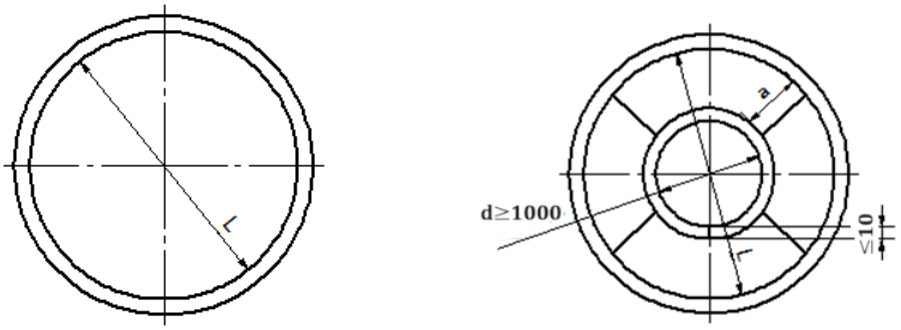
Annex 4: Arrangement of curved SMS-Evo Plus® sheets

Curved SMS-Evo Plus® sheets for spherical sliding surfaces are circular in shape and may be subdivided into a disc and an annulus (see Figure A4.1, right).

In case they are subdivided into a disc and an annulus, the diameter *d* of the disc is:

- not less than 1000 mm or
- not less than 2/3 *L* for sheets with a diameter *d* larger than 1500 mm

The width of the annulus *a* is not less than 50 mm. The annulus may be further divided into equal segments. Both the disc and the annulus shall be retained in recesses, separated by a ring not more than 10 mm wide.



Dimensions are in mm.

Figure A4.1: Configuration of recessed SMS-Evo Plus® sheets for spherical sliding surfaces

As an alternative to the geometrical rules given above, plane and curved surfaces made of SMS-Evo Plus® sheets may consist of one centric circular sheet with diameter "*a*" and one or more concentric annuli with a constant width "*b*". The dimensions " *a*" and " *b*" are not smaller than 50 mm. The radial distance between the individual sheets is not less than 10 mm and not greater than twice the thickness of the backing plate, of the sliding material sheet or the mating material, whichever is least.

Curved SMS-Evo Plus® sheets for cylindrical sliding surfaces are rectangular in shape and may be subdivided into a maximum of two identical parts, according to either configuration shown in the Figure A4.2.

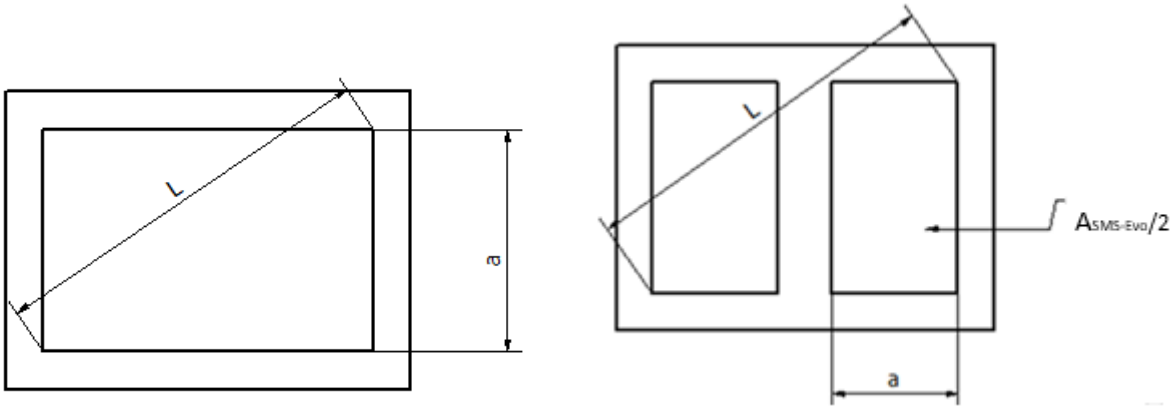


Figure A4.2: Configurations of recessed SMS-Evo Plus® sheets for cylindrical sliding surfaces

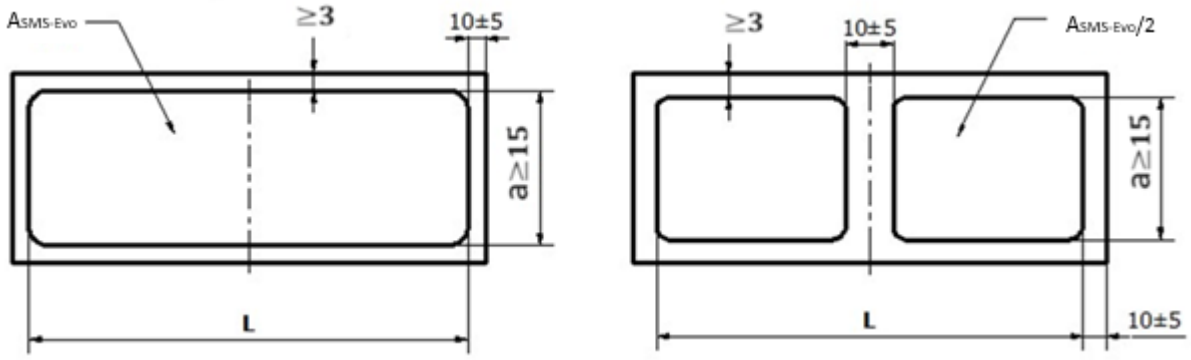
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Annex 5: Arrangement of undimpled SMS-Evo Plus® sheets in guides

The width “a” of undimpled SMS-Evo Plus® sheets for guides is not less than 15 mm and the modified shape factor

$$S = \frac{A_{SMS\text{-}Evo}}{u \cdot h} \cdot \frac{t_p - h}{h}$$

is greater than 4, where $A_{ASM\text{-}Evo}$ is the area of the compressed (undeformed) surface and u is the perimeter of the SMS-Evo Plus® sheet. t_p and h are defined in Figure 1 and Table 1.2, respectively.



Dimensions are in mm.

Figure A5.1: Examples of recessed SMS-Evo Plus® sheets for guides

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Annex 6: Austenitic steel sheets

The minimum thickness of austenitic steel sheets in flat and curved sliding surfaces is in accordance with Table A6.1.

The indication of products performance is based on the assessment under the following conditions:

- The austenitic steel sheet is fully in contact with the backing plate over the area in contact with the SMS-Evo Plus® sheet.
- When attaching the austenitic steel sheet by screwing, counterpunched screwing and riveting, corrosion resistant fasteners compatible with the austenitic steel sheet are used for securing its edges. Fasteners are provided at all corners and along the edges outside the area of contact with the SMS-Evo Plus® sheet, with the maximum spacings listed in Table A6.2.

Table A6.1:Thickness and methods of attachment of austenitic steel sheets

Type of surface	Method of attachment	Thickness (mm)
flat	full surface bonding	1,5
	continuous fillet weld	≥ 1,5
	counterpunched screwing	≥ 1,5
	screwing, riveting	≥ 2,5
spherical	full surface bonding	≥ 2,5
	continuous fillet weld	≥ 2,5
cylindrical	full surface bonding	1,5
	continuous fillet weld on straight edges	≥ 1,5

Table A6.2:Maximum fastener spacing for attachment of austenitic steel sheets by screwing, counterpunched screwing and riveting

Austenitic steel sheet thickness (mm)	Maximum fasteners spacing (mm)
1,5	150
2,0	300
2,5	450
3,0	600

NOTE: for mating surfaces in guides, provisions for flat sliding surfaces apply

Additional provisions regarding type of adhesive, bonding procedure and evenness according to EN 1337-2, clause 7.2.1 also apply.

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Annex 7: Backing plates

The indication of product performance given in this ETA is based on the assessment under the following conditions:

- the SMS-Evo Plus® sheet and the mating sliding materials are supported by metallic plates (backing plates) with plane or curved surfaces;
- surfaces of backing plates in contact with sliding materials or anchor and shimming plates are treated in such a way that the maximum deviation Δz from the theoretical flat surface does not exceed 0,0003 × *d* or 0,2 mm, whichever is greater;
- the maximum deviation *Δz* from the theoretical flat or curved surface within the area of the mating SMS-Evo Plus® sheet does not exceed 0,0003 × *L* or 0,2 mm, whichever is greater.

The assessment of the backing plates accounts for the following:

- verification at ultimate limit state when internal forces and moments from lateral actions are to be considered in addition to the effects from deformation as per hereafter;
- any cross-section reduction (for example due to keyway and the attachment bolts);
- deformations as per hereafter;
- the required stiffness for transport and installation as per hereafter;
- distribution of forces to the adjacent structural members as per hereafter.

Note: if the deformations (see Figure A7.1) exceed the values given below, unacceptably small clearance between the adjacent backing plates and higher wear will occur. As this could endanger the long-term fitness for use of the sliding element, this condition is considered serviceability limit state.

The total deformation $\Delta w_1 + \Delta w_2 \leq \Delta w_{lim}$ of the backing plates is verified in compliance with clause 6.9.2 of EN 1337-2, where Δw_{lim} is adapted to the performance and geometry of the SMS-Evo Plus® sheet in accordance with EAD 050004-01-0301 by:

$$\Delta w_{\mathrm{lim}} = \frac{3}{2}\left[0{,}9 \cdot h_0 - \left(2\,k\sqrt{\frac{(0{,}9 \cdot h_0)^3}{L}}\right) - \left(h_{r,basis} + h_{r,flatTol}\right)\right] \text{[mm]}$$

where:

h_0 , L are defined in Figure 1 and Table 1.1

k is the compliance coefficient of dimpled SMS-Evo Plus® sheets as given in Table 3.1:

$$k = \frac{\sigma_{SMS-Evo\ Plus®} - 4{,}3}{95{,}5}$$

and $\sigma_{SMS-Evo\ Plus®}$ is the average pressure on the sliding surface of SMS-Evo Plus® sheet under the characteristic combination of action.

In order to avoid permanent deformations in the backing plates, the stress induced by this deformation shall not exceed the yield stress of the material. The theoretical model for the verification of the above requirements shall include the effects of all the bearing components which have a significant influence on these deformations, as well as the adjacent structural members and their short and long-term properties.

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For steel and concrete, the design values of material properties in accordance with EN 1993-1-1 and EN 1992-1-1 respectively apply.

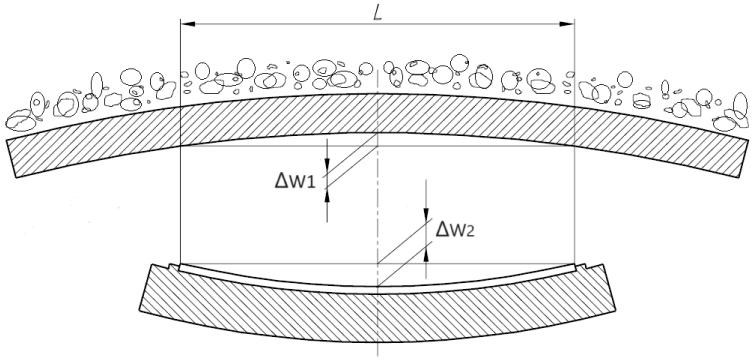


Figure A7.1: Deformation of backing plates

In this model the following assumptions are made:

- central load;
- notional design modulus of elasticity of SMS-Evo Plus® : E_{tp} = 923 MPa;
- the total thickness t_p of SMS-Evo Plus® sheets;
- notional design Poisson's ratio of SMS-Evo Plus® = 0,44;
- in case of adjacent structural members of solid construction: linear reduction of the elastic modulus of concrete or mortar from the edge to the centre of the backing plate from 100 % to 80 %.

A suitable method for calculating deformation Δw_1 for common materials is given in Annex 11.

When using the method given in Annex 11, the elastic limit verification of the backing plates is not required if:

- the condition for the deformation Δw1 + Δw2 is met,
- the concrete strength class is at least C25/30 in accordance with EN 1992-1-1 and
- the steel grade is at least S355 in accordance with EN 10025-1.

The verification is also not required when using lower concrete strength classes and/or steel grades, provided the deformation limit values calculated as above are reduced by a factor of:

- 0,90 when using concrete strength class C20/25;
- 0,67 when using steel S235;
- 0,60 when using both concrete C20/25 and steel S235.

Note: The above is not the only criterion to be considered in determining the relative deformation Δw_1. Particular attention shall be paid to loadings during construction (e.g. when large backing plates are not propped during concrete casting).

For spherical and cylindrical SMS-Evo Plus® bearings the calculation of the relative deformation of the backing plate with convex surface shall be omitted and Δw_2 taken as zero.

Square or rectangular plates shall be considered equivalent to circular plates of diameter d_b = 1,13 a_b where a_b is the side of the square plate or the minor side of the rectangular plate.

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In order to avoid unacceptable deformations during transport and installation, the thickness t_b of the backing plates further fulfils the condition:

$$t_b \geq 0{,}04 \cdot \sqrt{a_b^2 + b_b^2}$$

where:

a_b is the minor side of backing plate

b_b is the major side of backing plate

Backing plates with concave surfaces of SMS-Evo Plus® Spherical and Cylindrical Bearings fulfill in addition the dimensional limitations given in Figure A7.2.

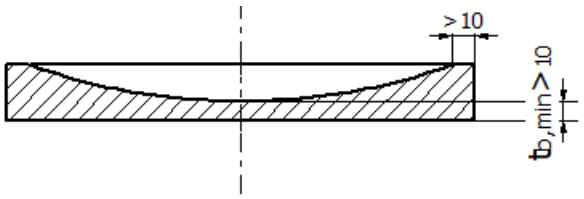


Figure A7.2: Dimensional limitations of a backing plate with curved surfaces

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Annex 8: Guides

Guides may be used for resisting lateral forces due to variable and permanent actions. Depending on the bearing construction, the guides may be arranged externally or centrally. The sliding materials are fixed on keys and keyways in the backing plates.

The clearance c between mating sliding components in unused condition meet the following condition:

$$c \leq 1{,}0 \text{ mm} + \frac{L[mm]}{1000}$$

Typical examples of the attachment of keys and guides are shown in Figures 7 and 8 of EN 1337-2.

In the design of the connection at ultimate limit state in accordance with EN 1993-1-1, the effects of horizontal force, its induced moment and the friction forces shall be considered.

Where for the characteristic combination of actions under predicted rotation about a transverse axis the differential deformation of the SMS-Evo Plus® sheet in guides across its smallest dimension would exceed 0,2 mm, a rotation element (e.g., linear rocker) is included in the backing plate. The material combination of this rotational element is designed in accordance with requirements of the mating surfaces of guides given in Table 1.1 or pot to piston contact surfaces in EN 1337-5.

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Annex 9: Reduced area for rectangular and circular sliding surfaces

This Annex gives the values of the coefficient λ to be used according to Clause 3.2.2.1 for the calculation of the reduced area A_r of flat and curved sliding surfaces:

$A_r = \lambda \cdot A$

where A is contact area of the flat sliding surface or projection area of the curved sliding surface

Plane sliding surfaces

for rectangular sliding surfaces (see Figure A9.1, left)

$A = a \times b$

$\lambda = (b - 2\,e)$

for circular sliding surfaces (see Figure A9.1, right)

$$A = \pi \cdot \frac{L^2}{4}$$

The coefficient λ is given in Table A9.1, first column, or alternatively can be calculated by using the approximate formula

$$\lambda = 1 - 0{,}75\,\pi \cdot \frac{e}{L}$$

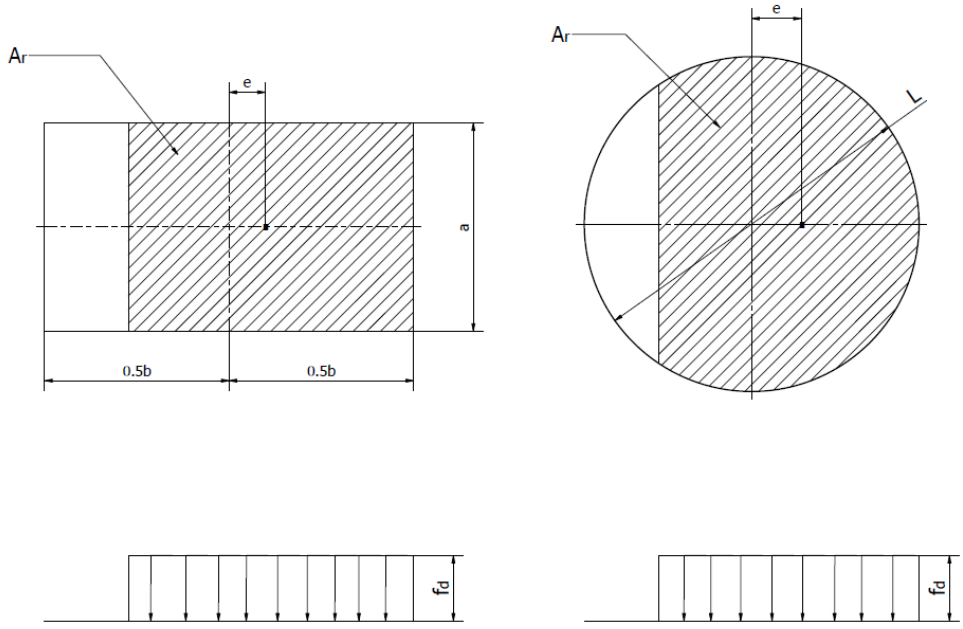


Figure A9.1: Reduced contact area A_r for a) rectangular and b) circular plane sliding surfaces (e = eccentricity in the considered direction)

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Curved sliding surfaces

The coefficient λ is given in Table A9.1 for both spherical and cylindrical surfaces.

Table A9.1: coefficient $\lambda = A_r / A$ for flat and curved sliding surfaces

e / *L*	sliding surface								
	flat	spherical				cylindrical			
		included angle θ				included angle θ			
		30°	25°	20°	10°	37,5°	30°	20°	10°
0,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000	1,000
0,005	0,990	0,991	0,991	0,990	0,990	0,992	0,992	0,991	0,990
0,010	0,979	0,982	0,981	0,980	0,979	0,984	0,983	0,981	0,980
0,020	0,957	0,962	0,961	0,960	0,958	0,968	0,965	0,962	0,961
0,030	0,934	0,942	0,940	0,938	0,936	0,951	0,947	0,943	0,941
0,040	0,912	0,922	0,919	0,916	0,913	0,934	0,929	0,924	0,921
0,050	0,888	0,901	0,898	0,894	0,890	0,917	0,911	0,905	0,901
0,060	0,865	0,880	0,876	0,872	0,867	0,900	0,893	0,886	0,881
0,070	0,841	0,858	0,853	0,849	0,844	0,882	0,874	0,866	0,862
0,080	0,818	0,836	0,831	0,826	0,820	0,864	0,855	0,847	0,842
0,090	0,793	0,814	0,808	0,803	0,796	0,846	0,837	0,827	0,822
0,100	0,769	0,792	0,786	0,780	0,773	0,828	0,818	0,808	0,802
0,110	0,745	0,770	0,763	0,757	0,749	0,809	0,799	0,788	0,782
0,120	0,722	0,747	0,740	0,733	0,724	0,790	0,779	0,768	0,762
0,125	0,709	0,736	0,729	0,722	0,712	0,780	0,769	0,758	0,752
0,130	0,697	0,725	0,717	0,710	0,700	0,771	0,760	0,749	0,742
0,140	0,673	0,702	0,693	0,686	0,676	0,752	0,740	0,729	0,722
0,150	0,649	0,680	0,670	0,663	0,653	0,733	0,721	0,709	0,702
0,160	0,625	0,657	0,647	0,639	0,628	0,713	0,701	0,689	0,682
0,170	0,601	0,635	0,624	0,616	0,604	0,693	0,681	0,669	0,662
0,180	0,577	0,612	0,601	0,592	0,581	0,673	0,661	0,649	0,642
0,190	0,552	0,590	0,578	0,569	0,557	0,653	0,641	0,629	0,622
0,200	0,529	0,567	0,556	0,546	0,533	0,633	0,621	0,609	0,602
0,210	0,506	0,545	0,533	0,523	0,510	0,612	0,600	0,589	0,582
0,215	0,500	0,541	0,529	0,518		0,602	0,590	0,579	0,572
0,220	0,482	0,523	0,511	0,500		0,592	0,580	0,569	0,562
0,230	0,458	0,501				0,571	0,559	0,548	0,542
0,240	0,435					0,550	0,539	0,528	0,522
0,250	0,412					0,529	0,518	0,508	0,502
Note: intermediate values may be obtained by linear interpolation									

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Annex 10: Method for calculation of the eccentricities

Frictional forces, forces from applied horizontal loads and the rotated condition of the bearing produce an eccentricity of the axial force N_S. This Annex gives methods for calculating the significant eccentricities that are used in the verification of the SMS-Evo Plus® sheets, the adjacent structural members and anchoring devices. Depending on the design features of the particular bearing, additional eccentricities may exist. When several eccentricities occur in a cross-section under consideration, they need to be added.

Curved sliding surfaces

In the presence of rotational movements, in both cylindrical and spherical bearings, an internal moment occurs due to the frictional resistance.

Regardless of whether the bearing has one or two surfaces, the associated eccentricity e_1 is:

$$e_1 = \mu_{max} \cdot r$$

where:

μ_{max} is the coefficient of friction of curved SMS-Evo Plus® sheets given in clause 3.5

r is the radius of curvature of the spherical or cylindrical sliding surface

Sliding surfaces with external guides and restraining rings

For the spherical bearings of the type shown in Figures A1.2 c) and A1.2 d) in Annex 1, rotational movements produce an eccentricity e_2 which affects only the adjacent structural members (i.e. plinth, beam, etc.) and the anchoring devices:

$$e_2 = \frac{V_d}{N_S} \cdot \mu_{max} \cdot c$$

For bearings with lateral guides of the type shown in Figure A1.2 c), the coefficient of friction μ_{max} is given in clause 3.5. For free bearings fixed by a restraining ring of type shown in Figure A1.2 d), μ_{max} should be taken as 0,2 in accordance with EN 1337-5, 6.1.3.2.

Rotation

In all the types of bearings with two sliding surfaces as shown in Figures A1.2 a) b), c), d) and A2.2 a), b), c), a rotation angle α produces an eccentricity e_3 of the vertical load on the curved surface equal to:

$$e_3 = \alpha \cdot (r + b)$$

where:

r is the radius of curvature of the spherical or cylindrical sliding surface

b represents the distance between the cross-section under consideration and the sliding surface, as shown in Figure 3.

At any rate, this eccentricity e_3 acts always in the opposite direction to eccentricity e_2. The occurrence of e_3 depends on whether the curved SMS-Evo Plus® sheet is either attached to the convex or concave backing plate and whether the value α is greater or lesser than the friction coefficient μ_{max} of the curved sliding surface, as well as on whether the bearing clearance is performing its function effectively in the case of guided bearings. In the type of bearings equipped with only one sliding surface as the ones shown in Figures A1.1 and A2.1, the eccentricity e_3 occurs only in the curved SMS-Evo Plus® sheet and, furthermore, only when the SMS-Evo Plus® sheet is attached to the convex backing plate.

Because of the uncertainty concerning the actual values of α and μ_{max} as well as the effect bearing clearance can entail, e_3 shall in any case be taken into account.

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Lateral forces

Lateral forces result from horizontal actions and the friction resistance of the other bearings in the structure.

In bearings where lateral forces are transmitted by guides or restraining rings, the eccentricity in the curved sliding surface is equal to zero.

In bearings of the fixed type with only one sliding surface as in Figures A1.1 and A2.1 and in the spherical bearing with a central guide as in Figure A1.2 b), an eccentricity e_4 results from the horizontal load V_s given by (see Figure 3):

$$e_4 = \frac{V_d}{N_S} \cdot (r + b)$$

In all cases where the lines of application of lateral action and reaction are not coincident, the resulting couple causes an eccentricity that shall be additionally taken into account.

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Annex 11: Method for calculating the deformation of backing plates attached to concrete

For circular steel plates attached to concrete structural members of concrete strength class C20/25 according to EN 206-1 or greater, and mortar layers of equivalent strength, the maximum relative deformation Δw over the diameter L of the SMS-Evo Plus® sheet is given by the equation:

$$\Delta w = \frac{0{,}55}{L} \cdot k_c \cdot \alpha_c \cdot k_b \cdot \alpha_b$$

with

$$k_c = 1{,}1 + \left(1{,}7 - 0{,}85 \cdot \frac{d_b}{L}\right) \cdot \left(2 - \frac{d_b}{L_0}\right) \qquad if \quad L_0 \le d_b \le 2\,L_0$$

$$k_c = 1{,}1 \qquad if \quad d_b > 2\,L_0$$

$$\alpha_c = \frac{N_{Qd}}{E_{cd}} + \frac{N_{Gd}}{E_{crd}}$$

$$k_b = 0{,}30 + 0{,}55 \cdot \frac{d_b}{L}$$

$$\alpha_b = \left(\frac{L}{L + 2\,t_b}\right)^2 \cdot \left(\frac{3\,L_0}{d_b}\right)^{0{,}4}$$

where

d_b is the diameter of the backing plate

t_b is the thickness of the backing plate;
for backing plates with a concave surface the calculation may be based on the equivalent constant thickness $t'_b = t_{b,min} + 0{,}6\,(t_{b,max} - t_{b,min})$

L is the diameter of SMS-Evo Plus® sheet

L_0 is the reference diameter (L_0 = 300 mm)

N_{Qd} is the design axial force due to variable actions

N_{Gd} is the design axial force due to permanent actions

E_{cd} is the design secant modulus of elasticity of concrete

E_{crd} is the design reduced modulus of elasticity of concrete, for the determination of creep when acted upon by permanent design actions N_{Gd} ($E_{crd} \approx 1/3\ E_{cd}$)

The above approximate procedure may also be applied to square plates and rectangular plates, considered equivalent to circular plates of diameter

$d_b = 1{,}13\ a_b$

where a_b is the side of the square plate or the minor side of the rectangular plate.

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Annex 12: Working life

The intended working life of 100 years of SMS-Evo Plus® Spherical and Cylindrical Bearings (see clause 2) corresponds to Working Life Category 5 according to EN 1990, Table 2.1 for buildings and for bridges, see Table A12.1. Its estimation is based on the maximum design value of accumulated slide path per year $S_{Ay,d}$ for buildings and for bridges and the corresponding mating partner in sliding surfaces given in Table A12.2.

Table A12.1: Working Life Category of structural bearings in accordance with EN 1990

Design Working Life Category	Years
1	10
2	10 to 25
3	15 to 30
4	50
5	100

Table A12.2: Mating partner of SMS-Evo Plus® sheets in sliding surfaces depending on the type of structure

Type of structure	Design accumulated slide path per year $S_{Ay,d}$	Mating partner in sliding surfaces		
		plane	curved	guides
Buildings	≤ 200 m/year	austenitic steel	all materials according to Table 1.1	austenitic steel
Bridges	≤ 1000 m/year	austenitic steel		austenitic steel

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Annex 13: Durability aspects

Table A.13.1: Ageing resistance of SMS-Evo Plus® sheets assessed in accordance with EAD, clause 2.2.6.3

Average deviation (%) of aged of SMS-Evo Plus® from virgin of SMS-Evo Plus® after exposure to T_{max} = 80°C for 168 hours	
Tensile modulus	+0,2
Stress at yield	-1,2
Stress at break	-2,1
Strain at break	-4,7
Ball indentation hardness	-1,4

Table A.13.2: Resistance of SMS-Evo Plus® sheets against chemical and environmental influences assessed in accordance with EAD, clause 2.2.6.4

Average deviation (%) of aged of SMS-Evo Plus® from virgin of SMS-Evo Plus®, after separate exposure of test specimens for **60 days at + 23ºC ± 2 ºC** to the below mentioned media			
	Mass	Volume	Strain at break
Distilled water	+0,01	-0,01	+2,8
Sodium chloride	-0,08	-0,05	+3,1
Chromium chloride	-0,04	-0,06	+3,4
Ferric chloride	-0,02	-0,04	+0,9
Zinc chloride	-0,02	-0,05	+2,5

Average deviation (%) of aged of SMS-Evo Plus® from virgin of SMS-Evo Plus®, after separate exposure of test specimens to **Silicone grease** [(a)] for the below described duration and temperature				
Temperature (°C ±2)	Duration (days)	Mass	Volume	Strain at break
23	60	+0,23	+0,19	+1,9
70	14	+0,51	+0,49	-3,4
80	90	+0,41	+0,34	-4,0
90	21	+0,57	+0,44	-2,8

[(a)] in accordance with EN 1337-2, clause 5.8

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Annex 14: Reference documents

EAD 050004-01-0301	Spherical and cylindrical bearing with special sliding material made of UHMWPE (ultra-high molecular weight polyethylene)
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 1337-9:1997	Structural bearings - Part 9: Protection
EN 1337-11:1997	Structural bearings - Part 11: Transport, storage and installation
EN 1990:2002+A1:2005	Eurocode - Basis of structural design
EN 1991-1-5:2003	Eurocode 1: Actions on structures - Part 1-5: General actions - Thermal actions
EN 1992-1-1:2004	Eurocode 2: Design of concrete structures - Part 1-1: General rules and rules for buildings
EN 1993-1-1:2005	Eurocode 3: Design of steel structures - Part 1-1: General rules and rules for buildings
EN 10025-1:2004	Hot rolled products of structural steels - Part 1: General technical delivery conditions
EN ISO 527-1:2019	Plastics - Determination of tensile properties - Part 1: General principles
EN ISO 527-3:2018	Plastics - Determination of tensile properties - Part 3: Test conditions for films and sheets
EN ISO 2039-1:2003	Plastics - Determination of hardness - Part 1: Ball indentation method
EN ISO 1183-1:2019	Plastics - Methods for determining the density of non-cellular plastics - Part 1: Immersion method, liquid pycnometer method and titration method
EN ISO 11357-3:2018	Plastics - Differential scanning calorimetry (DSC) - Part 3: Determination of temperature and enthalpy of melting and crystallization
EN ISO 12944-1:2017	Paints and varnishes - Corrosion protection of steel structures by protective paint systems - Part 1: General introduction
EN ISO 12944-2:2017	Paint and varnishes - Corrosion protection of steel structures by protective paint systems - Part 2: Classification of environments (ISO 12944-2:2018)