Innovative Solutions

FORTEC

Structural bearings

→ POT Bearings
→ Spherical Bearings

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1. Introduction

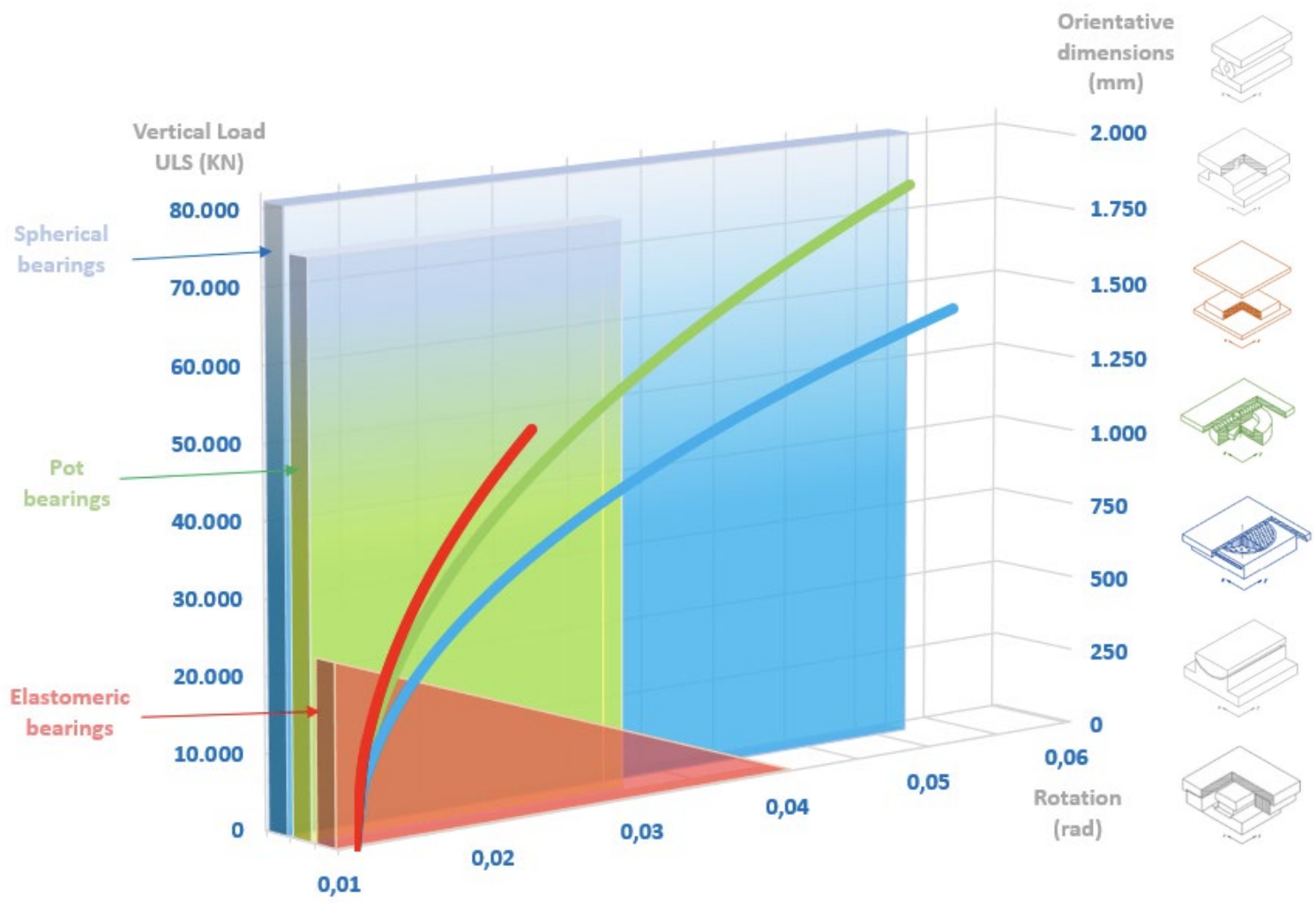
Structural bearings are a key element in any kind of structure as they connect the superstructure with the substructure and transmit vertical and horizontal loads while allowing for limited rotation around any horizontal axis.

By using structural bearings, moments from loads and deformation acting on the structure are suppressed, vertical and horizontal loads are properly and safely transmitted, and movements are allowed as per previsions of the designer. Therefore, structural bearings have an extremely wide range of applications and the selection and correct design and installation is critical for the performance of the structure.

MK4 bearings are widely used in structural and civil engineering applications, and particularly in bridges. They can be designed and manufactured for practically any load in a temperature range between **-35°C and 80°C*** and have actually been tested for vertical loads up to 100.000 kN.

***With the MK4 sliding material MKSM®**

Types of structural bearings



2. New Materials Solutions

2.1 MKSM SLIDING MATERIAL

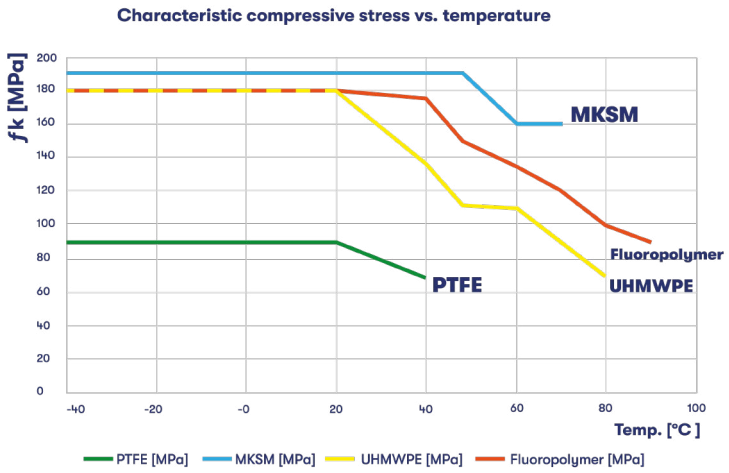
MK4 has developed a new sliding material **MKSM®** for estructural bearings, register patent N° 202230936, which is based on an reinforced alloy of PA66 & UHMWPE and an special additive, it is a new thermoplastic.

The properties of **MKSM** are clearly superior of PTFE, PA or UHMWPE, because it gives the best combination of the mechanical and thermal properties required for structural bearings.

The UHMWPE has the characteristics of good self-lubrication, small wear, prominent impact resistance performance but poor other mechanical properties. The resistance capacity drops considerably with the increase in temperature, thus it can enter the plastic regime with loads design, appearing the phenomenon of creep (plasticity) in the short term.

The PA66 is a high-toughness material and has the superior performance such as creep resistance and plastic deformation resistance, by other side it has higher wear and friction coeficient value.

The **MKSM** material combines the advantage of the best thermoplastic polymers, very high wear resistance, heat distortion temperature higher than 80°C, expansion coecient
0,8 x10-4cm/cm°C. In the next table appear a comparative of a few properties of these three materials:



MKSM is the best solution for structural bearings guaranteeing:

- ✔ **Highest compression** strength compare with the other materials - **190 MPa**
- ✔ **Reduced friction** - lower than PTFE or UHMWPE
- ✔ **High sliding path** (seven times bigger than the requested in UNE-1337-2) - **> 70000 m**

Materials	Density [g/cm³]	Elastic module [N/mm²]	Total Slide Path [m]
PTFE	2,35	1.800	10.000
PA66	1,15	3.000	-
UHMWPE	0,94	700	50.000
MKSM	1,09	2.000	>70.000

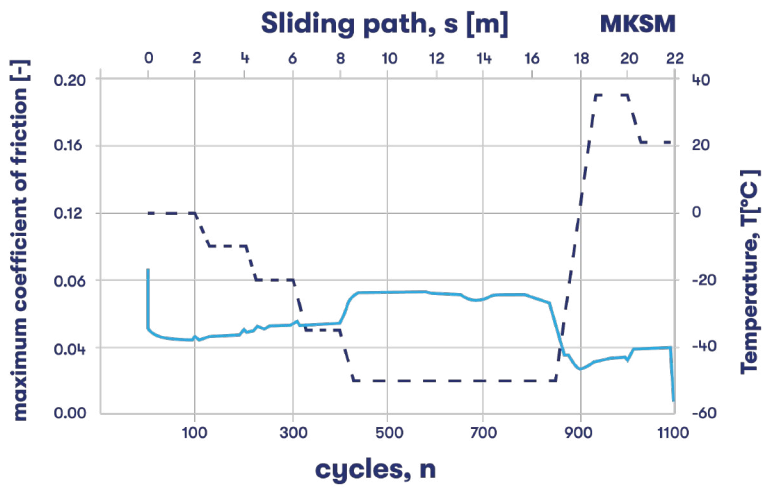


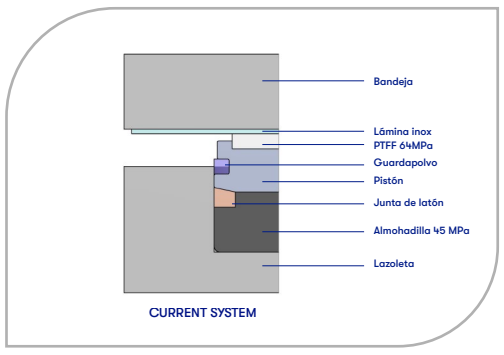
FIGURE: Maximum coefficient of friction in temperature - Sliding path 70374 to 70396 m

Extensive tests were performed according with UNE 1337-2 and the corresponding EAD.

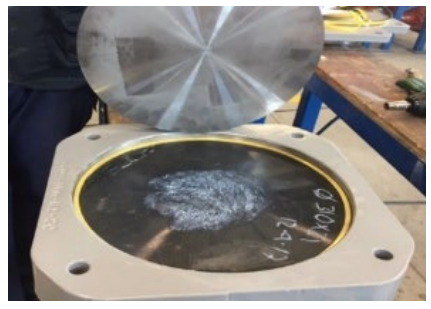
2.2 MKSD SEALING DEVICE

New SEALING Device **MKSD®**, with register patent N° P202130212 (**MKSD**), is manufactured with MK4 - developed alloy (POM with an special additive). **MKSD** improves the tightness of the sealing, managing to allowing for increased pressure in the elastic pad, preventing it from flowing through the gap between piston / pot. The advantages are either an increase of compression loads in the design or for fixed design, reducing the dimensions of the pot bearing lower weight and lower cost. SEALING Device **MKSD** also ensures a **long service life** due to the especially developed material with very low wear over time. In this way, the friction between the **MKSD** and the pot is lower, reducing wear.

SEALING Device **MKSD** ensures permanent tightness thanks to smart design of the pad and the piston, where a permanent expansion force is applied to the wall of the pot avoiding the extrusion of the pad.



MKSD Sealing Design

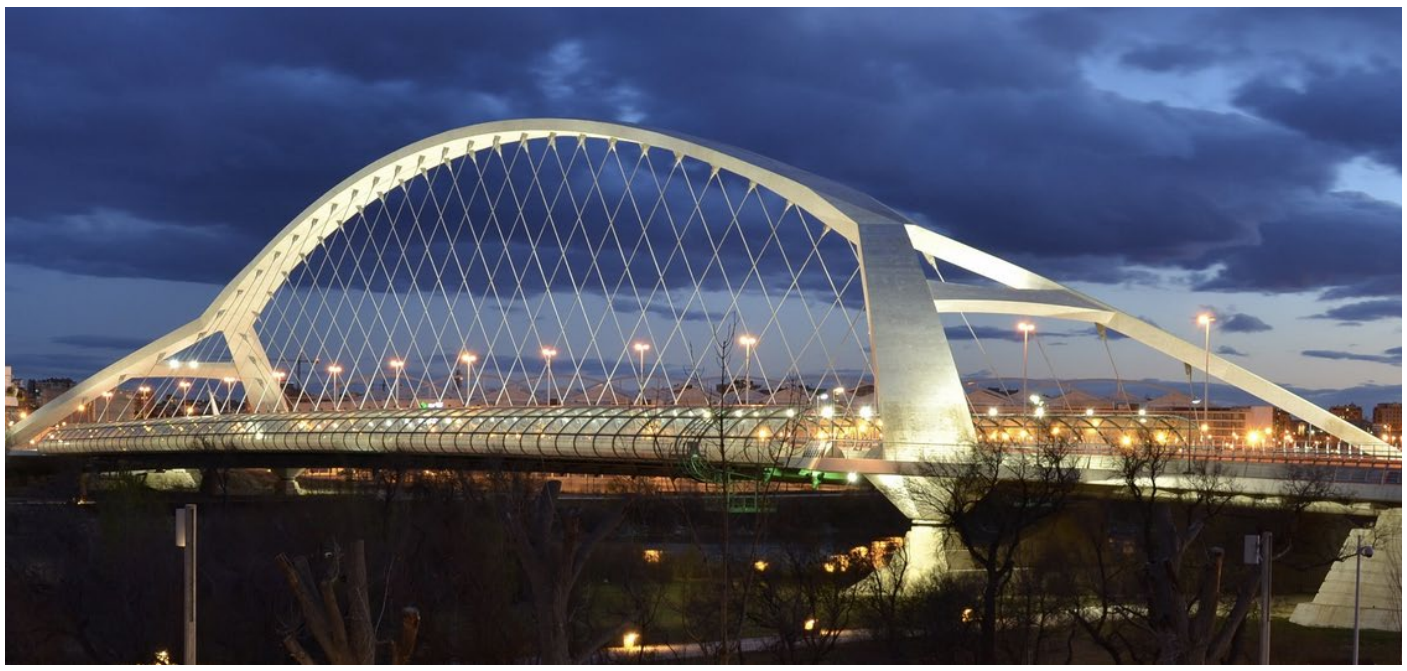


Sealings Standar

3. Selection Of Structural Bearings

Movements allowed on the structures and fixed points are critical parameters, especially on railway bridges. Main selection criteria in order to choose the proper type of bearings to use in the structure are:

— Vertical and horizontal loads
— Horizontal movements
— Horizontal rotations
— Fixations to superstructure
— Fixations to substructure
— Allowable to on piers and abutments
— Maintenance and durability



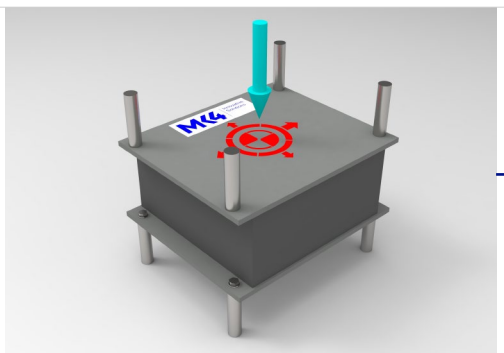
SELECTION OF STRUCTURAL BEARINGS

Type of bearing	Degrees of freedom					
	Movement			Rotation		
	Vertical	Longitudinal	Transversal	Vertical	Longit.	Transv.
Roller	✗	✓ M, G ✗ T, F	✓ M, T ✗ G, F	✗	✓	✗
Rocker	✗	✓ M, G ✗ T, F	✓ M, T ✗ G, F	✗	✓	✗
Elastomeric	✗	✓ M, G ✗ T, F	✓ M, T ✗ G, F	✓	✓	✓
Pot	✗	✓ M, G ✗ T, F	✓ M, T ✗ G, F	✓	✓	✓
Spherical	✗	✓ M, G ✗ T, F	✓ M, T ✗ G, F	✓	✓	✓
Cylindrical	✗	✓ M, G ✗ T, F	✓ M, T ✗ G, F	✗	✓	✗
Guide	✓	✓ G ✗ T	✓ T ✗ G	✗	✓	✓
Restraint (Pin)	✓	✗ F	✗ F	✓	✓	✓

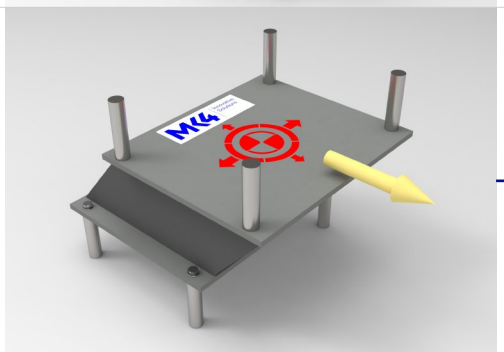
M: Multidirectional | **G:** Guided | **F:** Fixed

→ Laminated elastomeric bearings

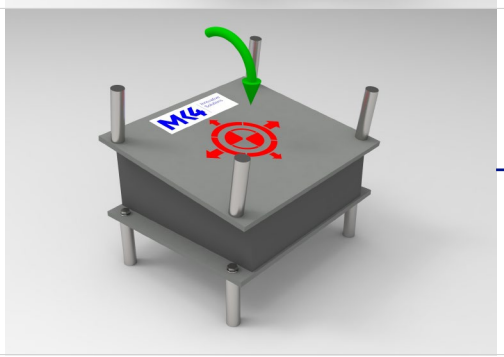
— Used for low to medium vertical loads and movements.
— Deformation capacity determines acceptable movements.
— Load capability decreases as movements and rotation increases.
— Selection of these bearings is better suited to small bridges.
— Made up of a series of elastomeric layers and steel plates vulcanized at high temperature and pressure.
— Dimensions limited to allow for homogeneous vulcanization.
— Connection of deck to piers behaves like a spring.



Vertical contraction



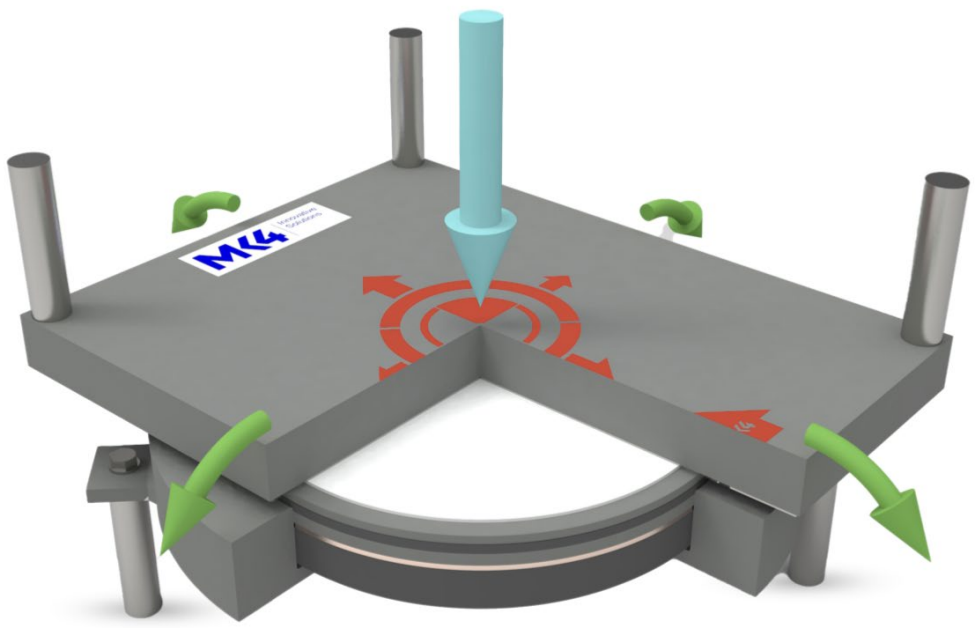
Distortion



Rotation

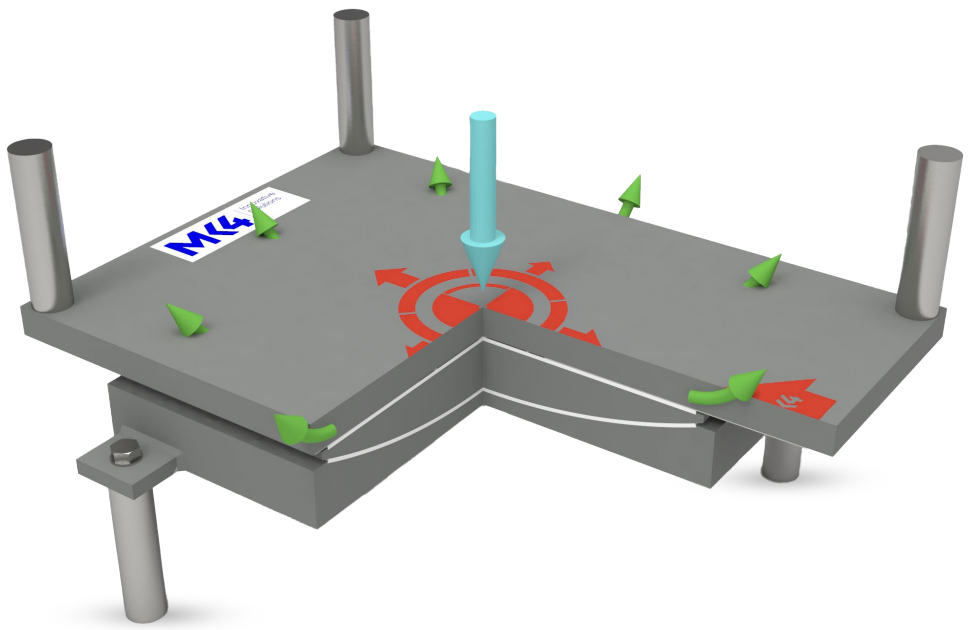
→ POT bearings

— Used to take up large vertical loads and movements
— Withstands much greater loads than elastomeric bearing
— Movements allowed by internal sliding material and stainless steel
— Rotations allowed by elastomeric disc confined in a steel POT
— Deformation of the elastomer defines the rotation capacity
— Rotation up to 30 mrad (with CE Marking).
— Connection of deck to piers: fixed, guided or free



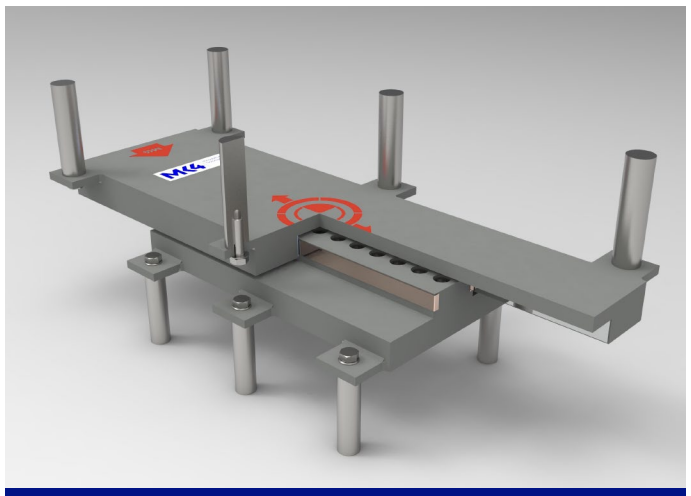
→ Spherical bearings

— Used to take up very large loads, movements and rotations.
— Movements allowed by internal sliding material and stainless steel.
— Withstands greater loads than POT bearing.
— Spherical sliding surface defines the rotation capacity.
— Extremely low resistance to rotation.
— Rotation up to 50 mrad.
— Connection of deck to piers: fixed, guided or free.



→ Guide bearings and Restraint bearings

— Used to take up horizontal loads. No vertical load capacity.
— Made up of steel components.
— Steel/steel contact or sliding surfaces.
— Connection of deck to piers: fixed or guided.



Shear Key:
Horizontal loads
without vertical load

Shear Pin:
Vertical rotation only

4. Structural Bearing Design Criteria

MK4 bearings are designed to meet the requirements of the European Standard EN 1337 and have the qualification of the CE mark. Nevertheless, MK4 can also supply POT and spherical bearings complying with other standards as designs are always prepared upon request due to the variability of parameters from one bridge to another and the increasing complexity of requirements arising from ever more sophisticated structures.

As bearings are designed for each structure, basic parameters are essential for a proper design. Typical bearing schedule is given in Table B.1 of EN 1337-1. The more information is obtained, the more refined designs will be achieved. Minimum information requested is:

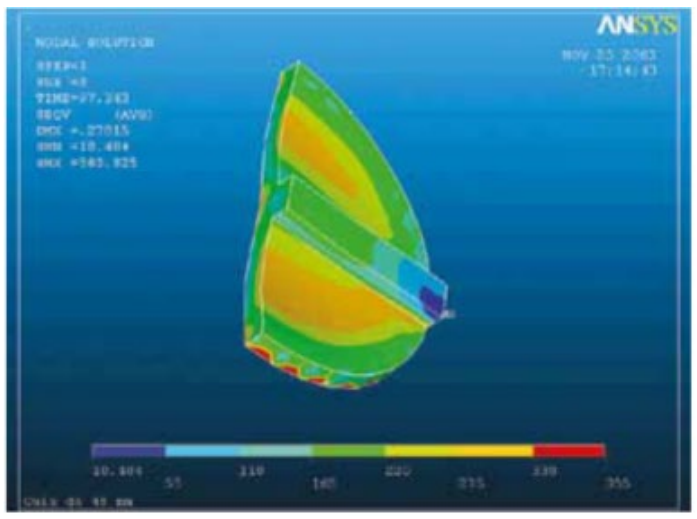
POT BEARINGS
DESIGN CRITERIA

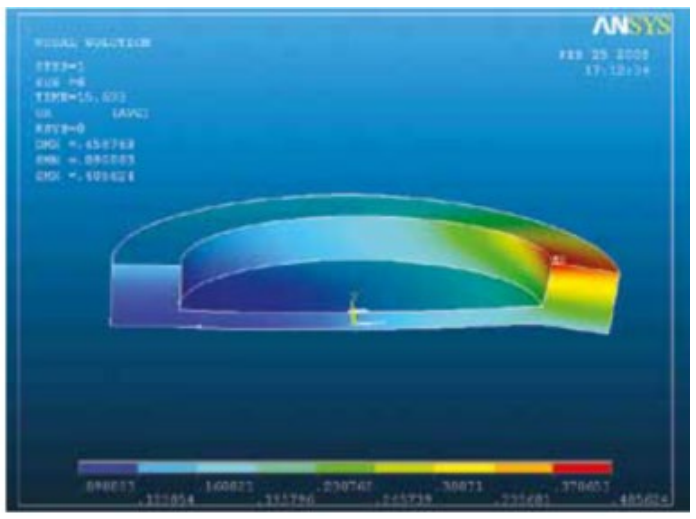
Parameter		Type of bearing			
		POT	Spherical	Elastomeric	Others
		Free	Guided		Fixed
Vertical design load (kN)	ULS	Maximum	Permanent		Minimum
	SLS				
Horizontal design load (kN)	ULS	Longitudinal		Transversal	
	SLS				
Displacements (mm)	ULS	Longitudinal	Irreversible		Reversible
		Transversal			
	SLS	Longitudinal			
		Transversal			
Rotations (rad.)	ULS	Longitudinal	Irreversible		Reversible
		Transversal			
	SLS	Longitudinal			
		Transversal			

In the absence of fundamental data, the following assumptions are applied on designs:

Parameter		Type of bearing		
		Free	Guided	Fixed
Vertical design load (kN)	Permanent	70%		
	Minimum	50%		
Horizontal design load (kN)	Longitudinal	3%	3%	10%
	Transversal		10%	
Displacements (mm)	Longitudinal	±50	±50	0
	Transversal	±20	0	
Rotations (rad.)	Total	0,01		

% of maximum vertical load





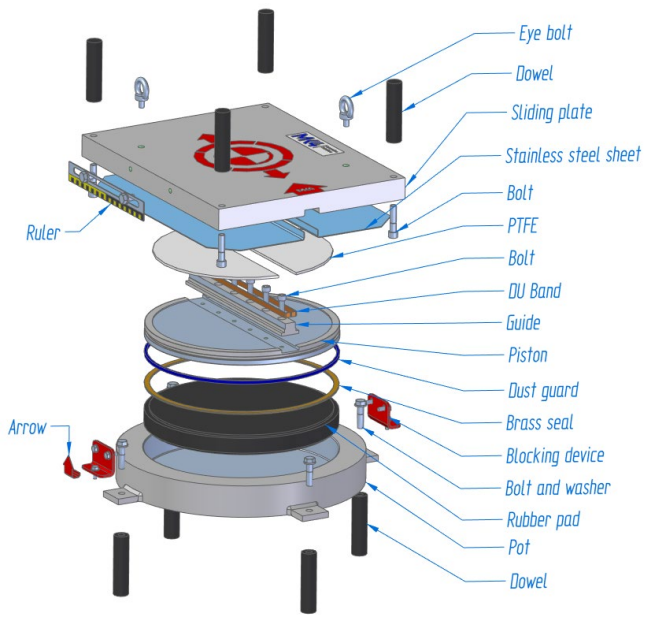
5. Types Of POT Bearings

MK4 POT bearings are available in three main types: **type PF** (Fixed), **type PG or PT** (longitudinally Guided sliding or Transversally guided sliding), **and PM** (Multidirectional or free sliding). All three types allow rotation. Fixed bearings provide restraint in all horizontal directions.

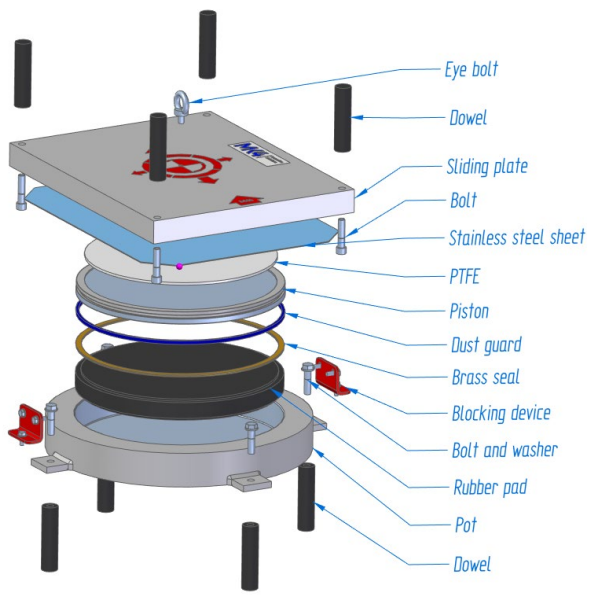
Guided bearings allow movement in one horizontal direction and provide restraint in the other direction. Free sliding bearings allow movement in all horizontal directions. All three types utilize a confined elastomeric pad which enables the POT bearing to support high pressures. The inherent properties of the confined elastomeric material allow it to shift much like a viscous liquid upon rotation, o ffering low resistance.

Designs are always specifically prepared for each structure upon request due to the variability of parameters from one bridge to another and the increasing complexity of requirements arising from each time more sophisticated structures.

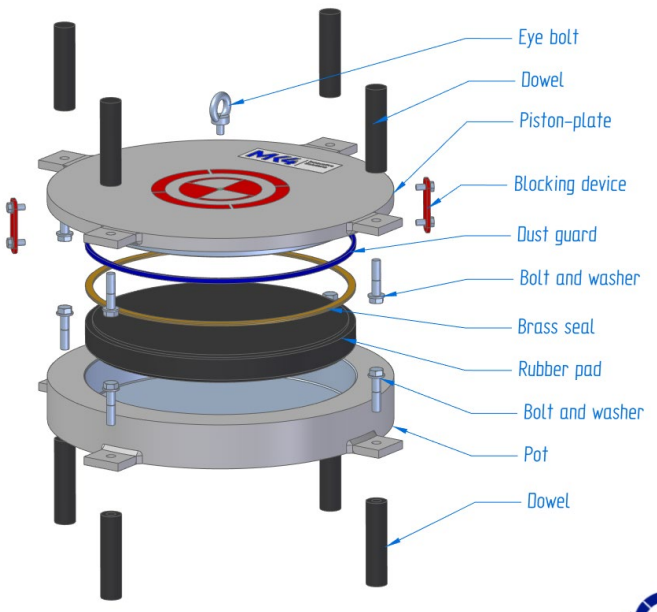
→ PG - GUIDED



→ PM-free/multidirectional



→ PF - FIXED

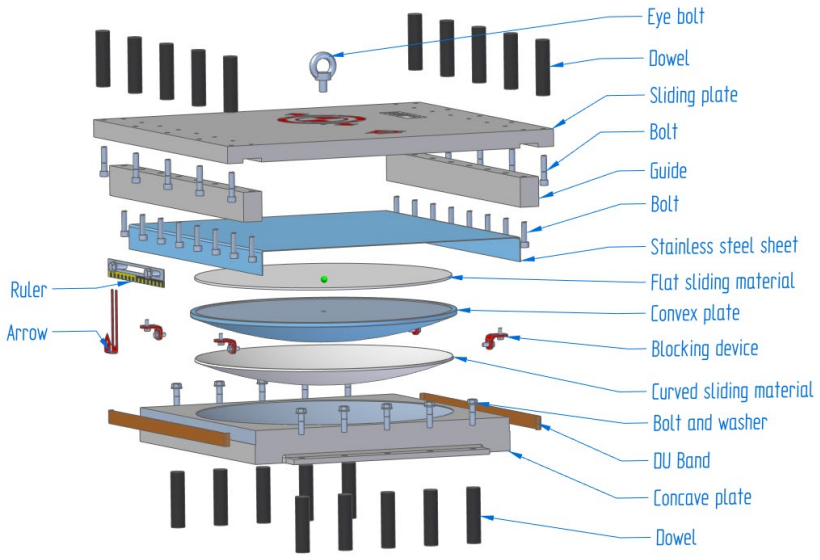


6. Types Of Spherical Bearings

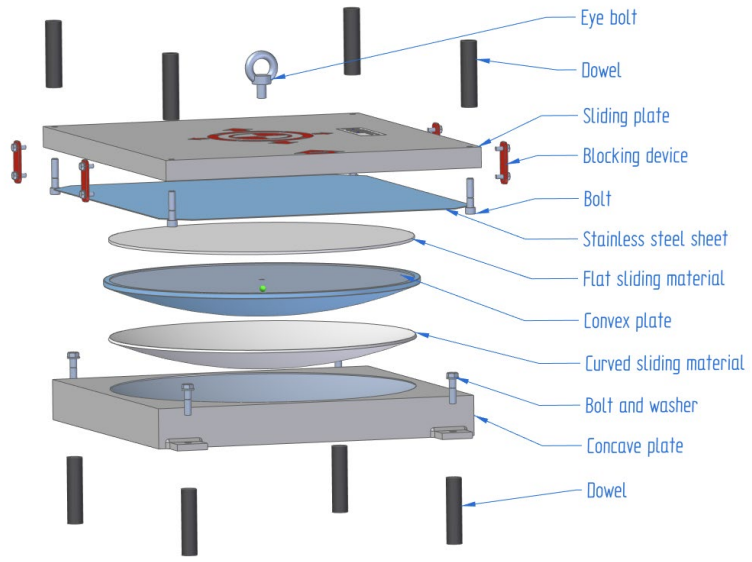
Spherical bearings are designed according to EN 1337 and EAD MKSM. Spherical bearings are available in three main types: **type SF** (Fixed), **type SG or ST** (longitudinally Guided sliding or Transversally guided sliding), and **type SM** (Multidirectional or free sliding). All three types allow rotation in any axle.
Fixed bearings provide restraint in all horizontal directions.

Guided bearings allow movement in one horizontal direction and provide restraint in the other direction. Free sliding bearings allow movement in all horizontal directions. All three types utilize a spherical sliding surface which enables the spherical bearing to support very high pressures.The sliding material allow it to rotate around any horizontal axis, offering extremely low resistance.

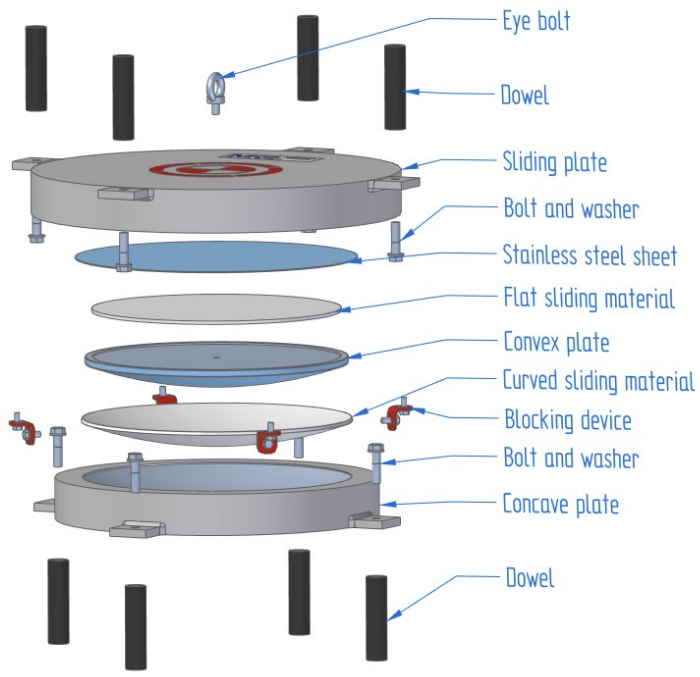
→ SG - GUIDE



→ SM-Free /Multidirectional



→ SF - FIXED



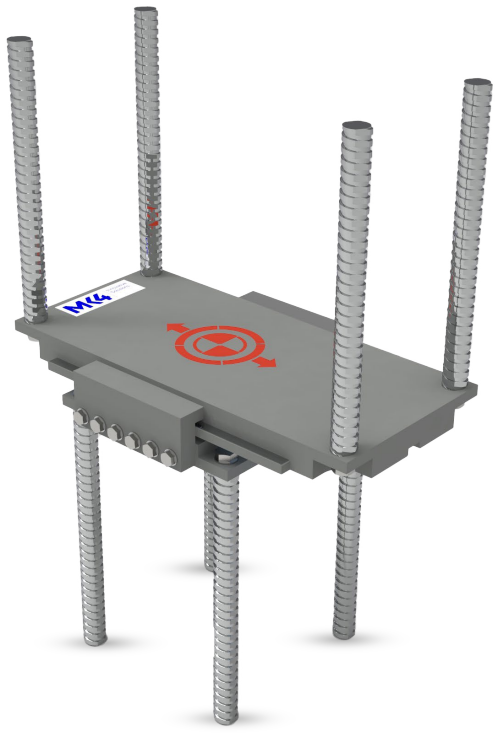
7. Options for Structurals Bearings

Where sophisticate structures require more capabilities than those offered by standard bearings, special designs are developed to satisfy all the demands of the project. Illustration of special bearings are:

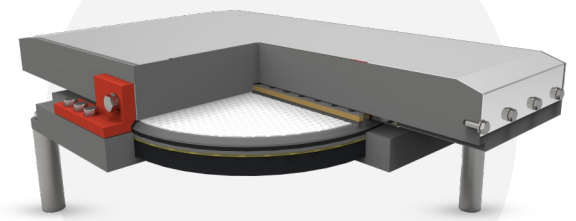
→ **Up - lift:** where transient vertical traction load is acting on the bearing. Different solutions are designed based either on lateral retainers or central pin.

These up-lift devices are integrated into the bearing itself, resisting the negative vertical tensile loads while allowing movements and rotations. Lateral retainers are the most common solution for POT bearings, while the central pin, due to its characteristics, is more appropriate for spherical bearings.

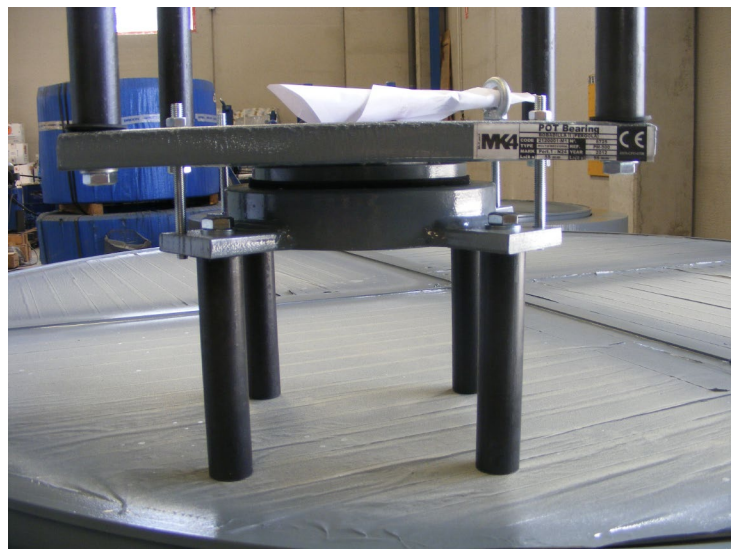
These up-lift bearings are “tailor made” according to the different specifications and requirements corresponding to each particular project.

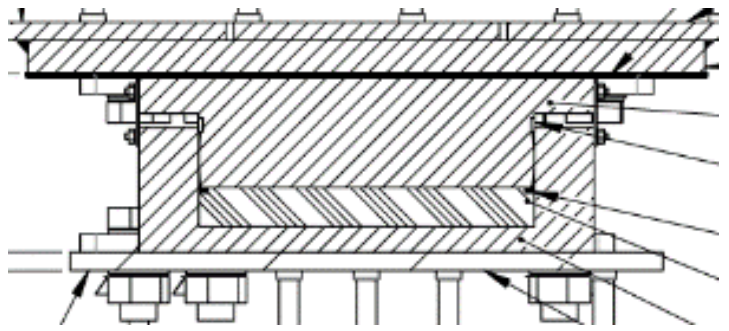


→ **ILM:** bearings specially designed as provisional and definitive bearings on bridges built with the incremental Launching Method.



→ **Electrical isolation:** on railway structures, electrical leakages from the superstructure can lead to catalytic corrosion of the superstructure. Traditional isolation devices focus on preventing leakages from the rail while in the proximity of crossing over metal conductions passing under the line, but on steel deck bridges it is recommended, or in some countries mandatory, that the deck itself gets electrically isolated. With MK4's electrically isolated bearings, this can be easily achieved by adding of special accessories to the bearings which provide an electrical resistance of at least $2x10^6$ Ω under a current of 500V, without significant increase of their dimensions.





→ **Monitoring:** bearings equipped with load cells, tilt meters, displacement gauges, and/or other instrumentation devices like temperature or corrosion sensors in order to provide valuable information of the structure's behavior in real time. Other elements of the bridge like expansion joints, cable stays, or tensile bars can also be monitored and connected to the same system, as well as traffic counting loops.

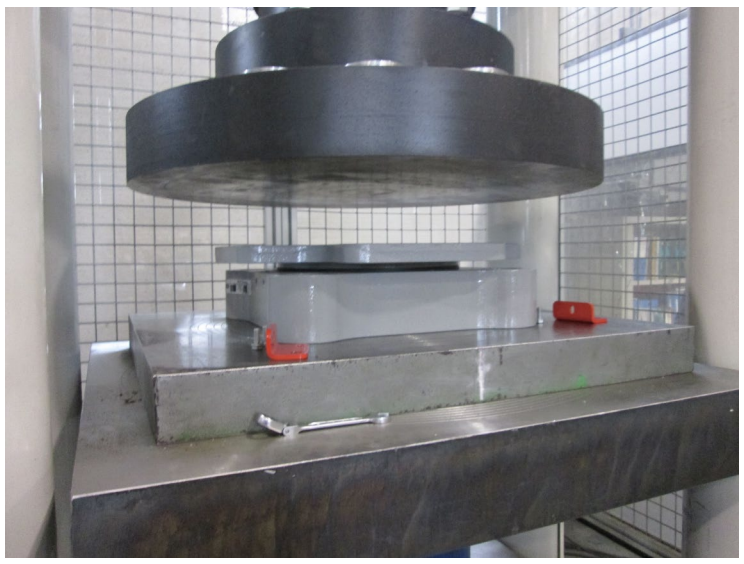
Characteristics:

- Data transfer: via internet from a secure server either by mobile app or web interface, or be downloaded directly from the data logger on site.
- Frequency from 1 value per 30s
- High precision and long life sensors: accuracy from 5% to 0.03% of the full scale measurements
- 24-hour online data presentation
- Download of measured data: files CSV, Modbus, MQTT Client
- Sensors assembly: in factory or on site

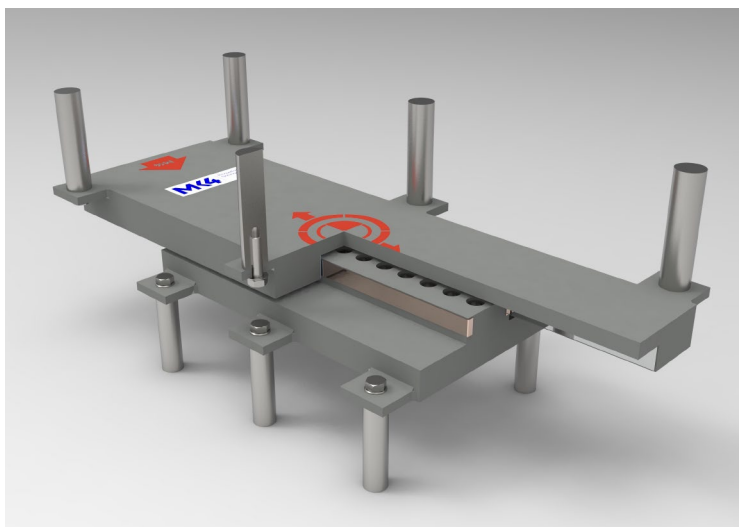
With this system, the need for personal inspections gets reduced, and there is even the possibility of setting up alerts for specific conditions.

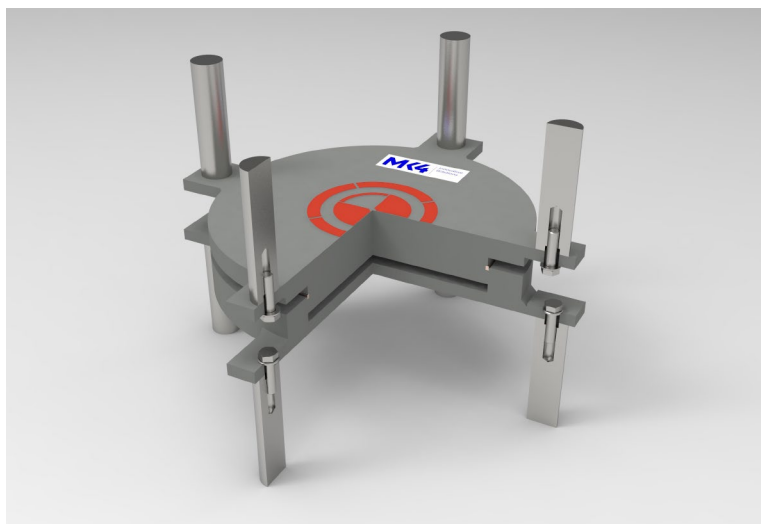
TYPES OF SPHERICAL BEARINGS

→ Monitoring:



→ **Pins and Guides (Shear Keys):** where horizontal loads are not transmitted by the standard bearings the structure can be fixed or guided by these special devices.

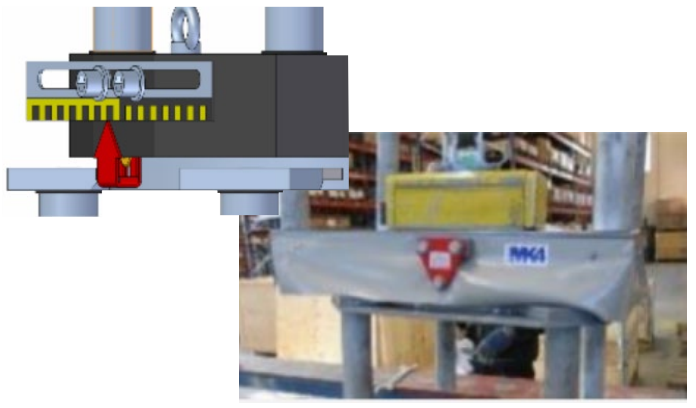




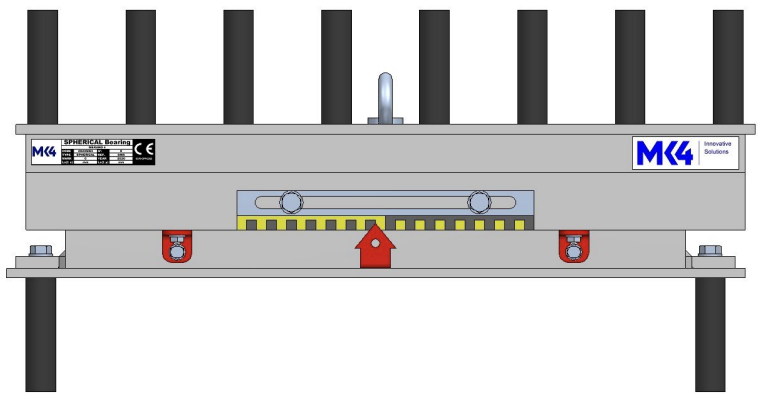
8. Accessories

Standard and special bearings can be equipped with accessories to improve their installation and long term behaviour. Illustration of accessories are:

→ **Antidust skirt:** The addition of a skirt around the sliding plate protects the internal sliding surfaces from contamination, preventing an accelerated wear of those surfaces.

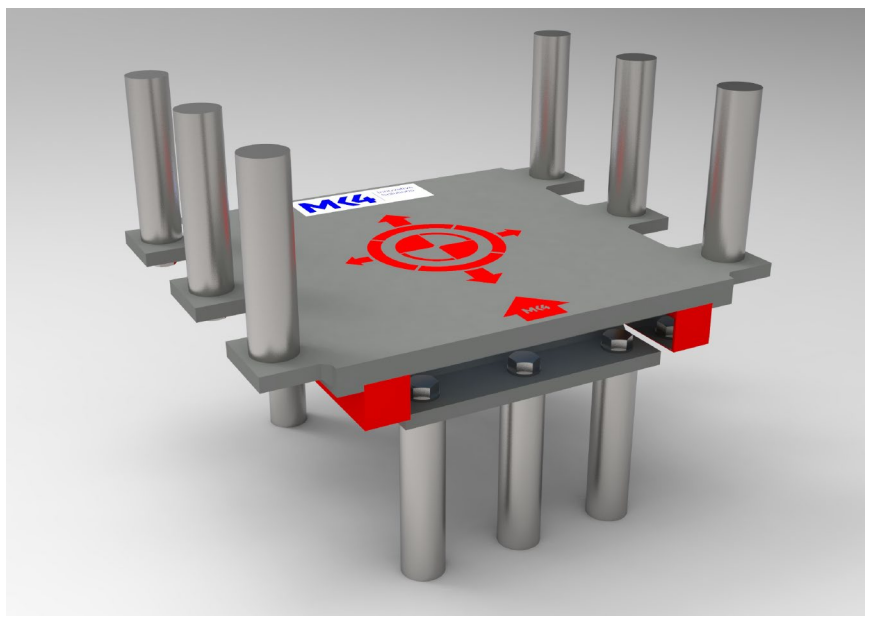


→ **Measuring kit:**
equipment for an easy and precise measurement of the horizontal movements of the bearing, giving a valuable information of its behaviour and facilitating the regular inspection of the bearing.



→ **Leveller:**
adding spirit levels to the bearing the proper installation on site is quicker with much more precision, resulting on the most efficient behaviour of the bearing even at long term.

→ **Provisional blockage:**
when provisional restrictions are needed for different construction phases of the structure, provisional blockages are included in the design of the bearings.



9. Technical Specifications

→ **Materials:** Bearings are available made in carbon steel as default, and in stainless steel for applications where corrosion is a potential problem. Main standard materials used in the bearing fabrication are:

Element	Parameter	EN 1337	AASTHO
Steel elements			
Pot, piston, top plate, dowels, masonry plates	Standard	EN 10025	ASTM A709-11
	Grade	S355	GR.50 TYPE 1
Rubber pad			
Natural ruber NR Clorophrene CR	Standard	ISO 6446	ASTM D 4014
	Hardness	50±5 HSh	50±5 HSh
	Tensile strength	≥15,5 Mpa	≥15,5 Mpa
	Elongation	≥400%	≥400%
	Compression set (22h, 70°C)	≤25%	≤25%
Brass Seals			
Brass Seals	Standard	EN 12163 - EN 12167	ASTM B36
	Grade	CuZn39Pb3 (A.2.1)	B36M C26800 H02 half hard
Sliding surfaces: PTFE or MKSM© sheet vs Stainless Steel, Chrome or anodized surface			
PTFE dimpled sheet	Standard	EN 1337-2	ASTM 4894
	Specific gravity	2.14 - 2.20 gr/cm³	2.13 - 2.19 gr/cm³
	Tensile strength	29.0 - 40.0 MPa	≥27.6 MPa
	Elongation	300%	300%
MKSM© dimpled sheet	Standard	ETA	ETA
Lubrifiant (Silicon grease)	Standard	EN 1337-2	SAE
	Grade	Table 8	AS 8660
Stainless steel sheet	Standard	EN 10088-2	ASTM A 240
	Grade	1.4404+2B (AISI 316)	304 (AISI 304)
Hard chromium plating	Standard	EN ISO 6158	
Aluminium alloy anodized	Standard	ISO 3522	
	Alloy	Al-Mg6M or Al-Si7MgTF	Experience provided

Sliding surface on guides: CM1 vs Stainless Steel
Bolts: 10.9

TECHNICAL SPECIFICATIONS

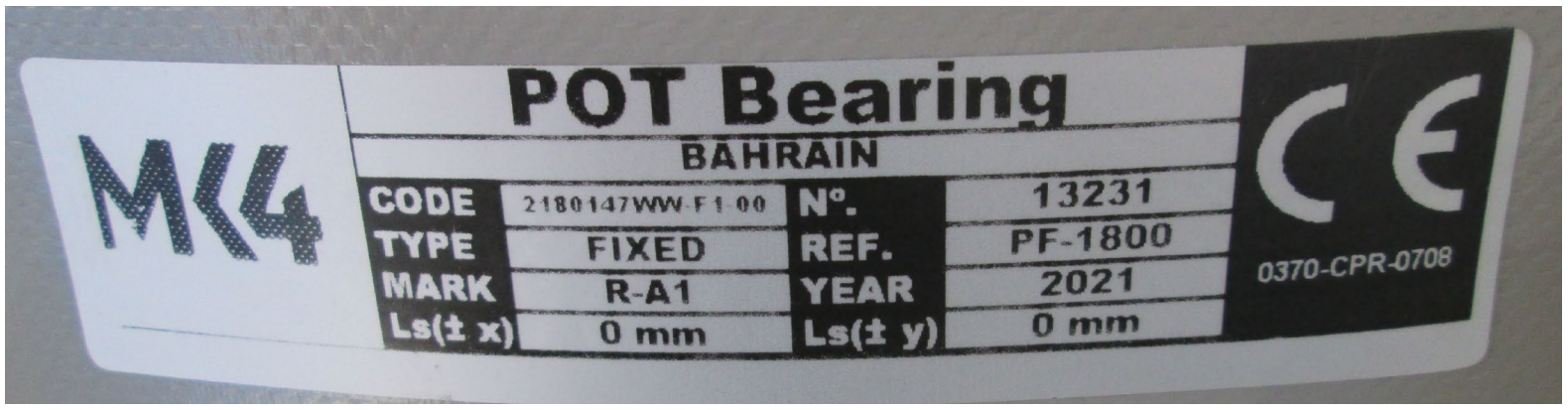
→ **Corrosion protection:** All bearing components are protected against corrosion according to the requirements of Project Specifications, EN 1337-9, EN ISO 12944, ACQPA, SERIES 1900 – PROTECTION OF STEELWORK AGAINST CORROSION or custom made. Standard RAL color for the final layer is 7037.

Standard corrosion protection on MK4 structural bearings is provided y one of the following systems:

Code	Designation	Corrosivity category	Type of surface	Primer NDFT	Inter NDFT	Inter NDFT	Final NDFT	Total NDFT	Expected Durability
EN ISO 12944-5	C4.11-EP-PUR	C4	Mechanical Cleaning	Zn (R) 60 µm	Epoxy 70 µm	Epoxy 70 µm	AP 60 µm	260 µm	Very High
	C5.07-EP-PUR	C5	Mechanical Cleaning	Zn (R) 60 µm	Epoxy 70 µm	Epoxy 70 µm	AP 60 µm	260 µm	High
	C5.08-EP-PUR	C5	Mechanical Cleaning	Zn (R) 60 µm	Epoxy 100 µm	Epoxy 100 µm	AP 60 µm	320 µm	Very High
	TSM 4.02-EP-PUR	C4	TS 85Zn-15Al	Epoxy 60 µm	Epoxy 80 µm	NA	AP 60 µm	200 µm	Very High
	TSM 5.02-EP-PUR	C5	TS 85Zn-15Al	Epoxy 60 µm	Epoxy 60 µm	Epoxy 60 µm	AP 60 µm	240 µm	Very High

AP: Aliphatic Polyurethane **TS: Thermal Spray coating**
C4: Highly Corrosive **C5: Extremely Corrosive**

→ **Labelling:** All MK4 bearings are supplied with a metal label, indicating all important bearing information and references for complete traceability.
In addition, a general drawing of the structure is supplied with the position and direction of each bearing to assist in the correct installation on site.



10. CE, Quality Control and Testing

→ **Quality Control:** MK4 is always working on the design and production process in order to ensure that the bearings comply with the client requirements and to guarantee the achievement of optimum quality.

MK4 Quality System is certified according to the ISO 9001:2015.

MK4 POT ; spherical bearings elastomeric; guide have the qualification of the CE Mark, which confirms that all bearings are manufactured in accordance with the EN 1337-5 ; EN 1337-7; EN1337-1 ; EN1337-2;

EN1337-3; EN1337-8 Standards.

The quality and conformity performance of bearings are regularly tested according different standards (AASTHO, BS, DIN, EN 1337, ...) at accredited laboratories.

CERTIFICATE OF CONSTANCY OF PERFORMANCE
LGAI Technological Center, S.A. (APPLUS)
Notified Body Nr. 0370
No. 0370-CPR-0708

In compliance with Regulation (EU) No. 305/2011 of the European Parliament and of the Council of 9 March 2011 (the Construction Products Regulation or CPR), this certificate applies to the construction product:

STRUCTURAL "POT" BEARINGS
- **PF –** FIXED BEARING
- **PM –** FREE BEARING
- **PG –** GUIDED BEARING

Placed on the market under the name of:

MK4 WORLD WIDE, S.L.
C/ CAN NADAL, NAVE 1ª – P.I. CAN NADAL
08185 LLIÇÀ DE VALL (BARCELONA)

And produced in the manufacturing plant:

MK4 WORLD WIDE, S.L.
C/ CAN NADAL, NAVE 1ª – P.I. CAN NADAL
08185 LLIÇÀ DE VALL (BARCELONA)

This certificate attests that all provisions concerning the assessment and verification of constancy of performance described in Annex ZA of the standard

EN 1337-5:2005

under system 1 for the performance set out in this certificate are applied and that the factory production control conducted by the manufacturer is assessed to ensure the constancy of performance of the construction product.

This certificate was first issued on 26th September 2008 and will remain valid as long as neither the harmonised standard, the construction product, the AVCP methods nor the manufacturing conditions in the plant are modified significantly, unless suspended or withdrawn by the notified product certification body. It is confirmed and modified on 14th October 2022.

The monitoring assessment will be done before 31st October 2023

Bellaterra, 14th October 2022
Xavier Ruiz Peña
Managing Director, Product Conformity B.U.

This document is not valid without its technical annex; whose number coincides with that of the certificate.

You can check the validity of this certificate on our website: www.appluslaboratories.com/certified_products

The manufacturer, after the completion of the conformity assessment procedures and the declaration of performance, may affix the CE Marking under his responsibility

CERTIFICATE OF CONSTANCY OF PERFORMANCE
LGAI Technological Center, S.A. (APPLUS)
Notified Body Nr. 0370
No. 0370-CPR-2252

In compliance with Regulation (EU) No. 305/2011 of the European Parliament and of the Council of 9 March 2011 (the Construction Products Regulation or CPR), this certificate applies to the construction product:

SPHERICAL AND CYLINDRICAL PTFE BEARINGS.
SPEHERICALS PTFE BEARINGS:
FS: FIXED SPHERICAL BEARING; **GS**: GUIDE SPHERICAL BEARING; **MS**: MULTIDIRECTIONAL SPHERICAL BEARING

Placed on the market under the name of:

MK4 WORLD WIDE, S.L.
C/ CAN NADAL, NAVE 1ª – P.I. CAN NADAL
08185 LLIÇÀ DE VALL (BARCELONA)

And produced in the manufacturing plant:

MK4 WORLD WIDE, S.L.
C/ CAN NADAL, NAVE 1ª – P.I. CAN NADAL
08185 LLIÇÀ DE VALL (BARCELONA)

This certificate attests that all provisions concerning the assessment and verification of constancy of performance described in Annex ZA of the standard

EN 1337-7:2004

under system 1 for the performance set out in this certificate are applied and that the factory production control conducted by the manufacturer is assessed to ensure the **constancy of performance of the construction product.**

This certificate was first issued on 30th October 2015 and will remain valid as long as neither the harmonised standard, the construction product, the AVCP methods nor the manufacturing conditions in the plant are modified significantly, unless suspended or withdrawn by the notified product certification body. It is confirmed and modified on 14th October 2022.

The monitoring assessment will be done before 31st October 2023

Bellaterra, 14th October 2022
Xavier Ruiz Peña
Managing Director, Product Conformity B.U.

This document is not valid without its technical annex; whose number coincides with that of the certificate.

You can check the validity of this certificate on our website: www.applusla boratories.com/certified_products

The manufacturer, after the completion of the conformity assessment procedures and the declaration of performance, may affix the CE Marking under his responsibility

CERTIFICATE OF CONSTANCY OF PERFORMANCE
Notified Body Nr. 0370
No. 0370-CPR-6524

In compliance with Regulation (EU) Nr. 305/2011 of the European Parliament and of the Council of 9 March 2011 (the Construction Products Regulation or CPR), this certificate applies to the construction product:

STRUCTURAL BEARINGS. GUIDE BEARINGS

Placed on the market under the name of:

MK4 WORLD WIDE, S.L.
C/ CAN NADAL, NAVE 1A – POL. IND. CAN NADAL
08185 LLIÇÀ DE VALL (BARCELONA) SPAIN

And produced in the manufacturing plant:

C/ CAN NADAL, NAVE 1A – POL. IND. CAN NADAL
08185 LLIÇÀ DE VALL (BARCELONA) SPAIN

This certificate attests that all provisions concerning the assessment and verification of constancy of performance described in Annex ZA of the standard

EN 1337-8:2007

under system 1 for the performance set out in this certificate are applied and that the factory production control conducted by the manufacturer is assessed to ensure the constancy of performance of the construction product.

This certificate was first issued on 23rd September 2022 and will remain valid as long as neither the harmonised standard, the construction product, the AVCP methods nor the manufacturing conditions in the plant are modified significantly, unless suspended or withdrawn by the notified product certification body.

The monitoring assessment will be done before 30th September 2023

Bellaterra, 23rd September 2022
Xavier Ruiz Peña
Managing Director, Product Conformity B.U.

This document is not valid without its technical annex; whose number coincides with that of the certificate.

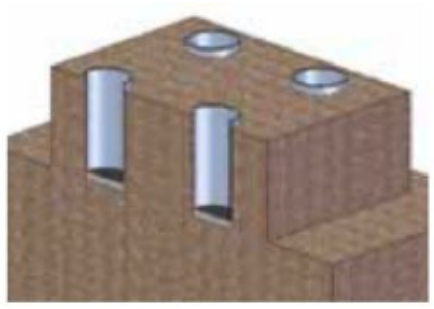
You can check the validity of this certificate on our website: www.applusla boratories.com/certified_products

The manufacturer, after the completion of the conformity assessment procedures and the declaration of performance, may affix the CE Marking under his responsibility

→ **Testing:** Full scale tests on bearings can be performed:

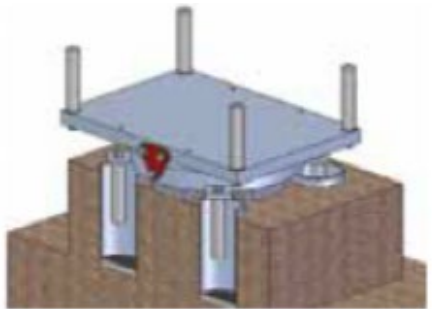
- Vertical load up to 100.000 kN.
- Combined Vertical and Horizontal Load.
- Rotation.
- Friction performance.
- Cold flow.
- Dynamic Loads.
- Behaviour under high and low temperature.

11. Site Installation



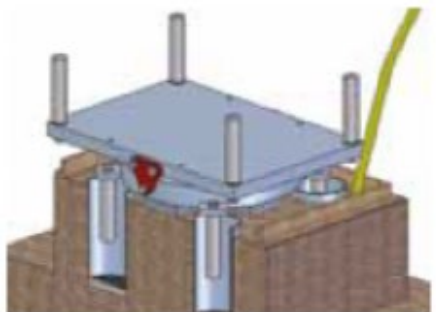
01 — **Preparation of the piers**

Before concrete casting in piers/abutments, prepare recesses for bearing dowels using plastic ducts sealed at their lower point with cellulose caps. Ducts shall protrude to avoid any entrance of concrete during the casting operation.



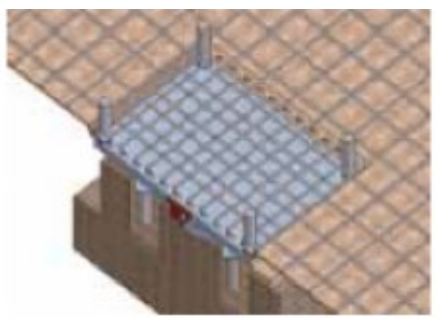
02 — **Placing in position and levelling the bearing**

Place the bearing on its final position according to topography. It is very important to assure that the bearing is perfectly horizontal. For this operation, levelling coves or timber wedges can be used. Furthermore, there must be enough space between the duct which is housing the dowels and the bearing base, in order to allow the mortar to flow properly and make sure that the ducts are being completely filled up.



03 — **Mortar Filling**

A small formwork for the plinth has to be built. High resistance self-levelling mortar shall be poured from one end, vibrating if necessary, to assure the correct execution of the plinth.



04 — **Deck formwork and reinforcement**

Deck formwork is placed embedding the upper dowels of the bearing. The corresponding bearing´s reinforcement steel should be positioned on the deck.

05 — **Removal of fastening accessories**

Finally, after the concrete casting of the deck, the bearing has to be unlocked, removing the lateral fastening accessories and blocking device.

Innovative Solutions

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