



 **fefcon**

"Perfection in Engineering"

**POT & SPHERICAL
BEARINGS**

GENERAL DEFINITIONS

FEFCON Pot and Spherical Bearings are bridge and viaduct elements that ensure safe and durable structures by providing distribution of the loads from superstructure to sub-structure. While these bearings can be used in all kinds of structures, they are also designed to meet the movement and rotational demands. Thus, they work under various high or low loads, movements and rotational values, providing durability and longevity to the structures.

As generally steel plates are used in pot and spherical bearings, they have more load capacities compared to elastomeric bearings.

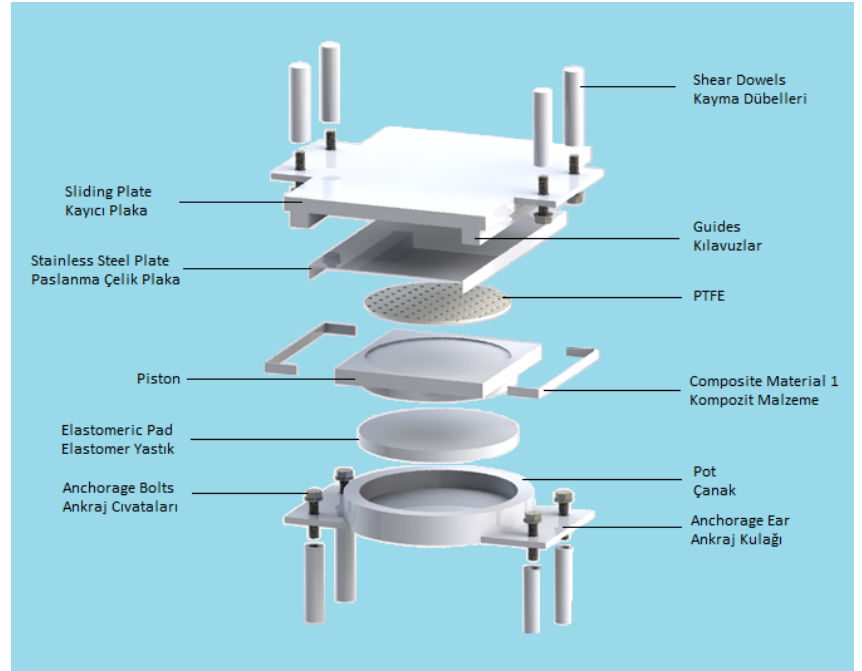
Pot bearings are designed and produced in accordance with EN 1337-5 or AASHTO standards, and spherical bearings are designed and produced in accordance with EN 1337-7 or AASHTO standards, according to customer requirements and project specifications by the expert engineers of FEFCON. In this way, while providing cost advantages with specific optimized designs, high quality and performance are guaranteed at the same time. During the design and production of these sensitive products, it is imperative that the engineering staff has sufficient knowledge and experience, otherwise mistakes are inevitable.



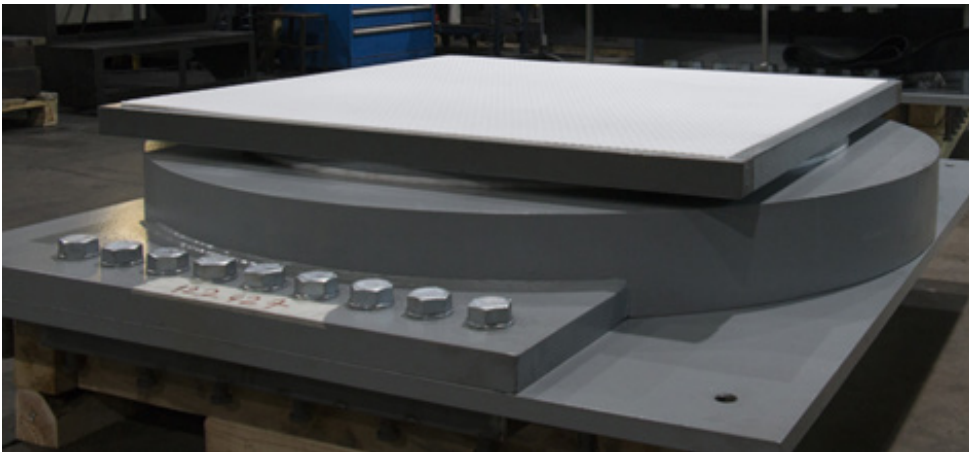
FEFCON POT BEARINGS

There are different elements that create FEFCON Pot Bearings;

- Pot
- Piston
- Elastomeric Pad
- PTFE
- Stainless Steel Plate
- Sliding Plate
- Guides
- CM1 Sliders
- Anchorage Plates
- Anchorage Elements



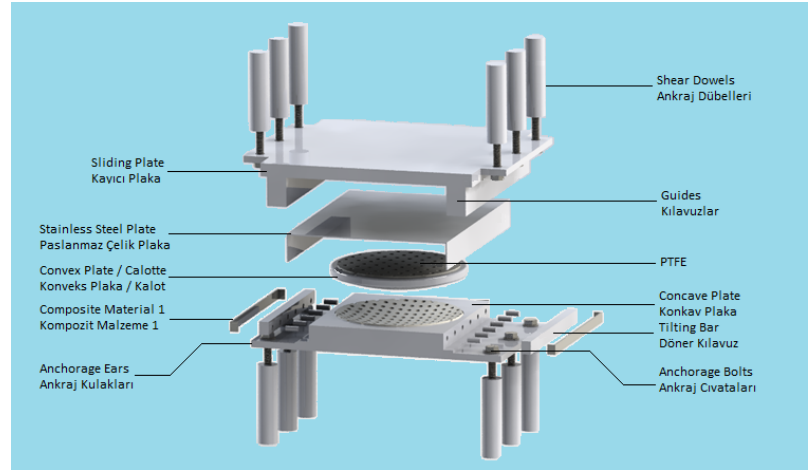
In FEFCON Pot Bearings, elastomeric pad inside of the pot is behave like a liquid under the distributed pressure from piston, so that it is able to rotate in any direction. If the type of bearing is sliding one, then it is possible bearing to move in one or two directions by the help of PTFE that is put inside on the recess on piston. To provide better sliding ability to bearing, stainless steel in which one side polished like a mirror is used against to PTFE. Because the friction coefficient between PTFE and stainless steel is very low. Thus, the effect of unexpected loads on the structure is prevented. Stainless steel is welded to sliding plate or special countersunk bolts can be used for connection. When the guides are used in pot bearings, movement in one direction is restricted. In general, CM1 sliders that have more load capacity compared to PTFE are used on guides. Lastly if needed, additional anchorage plates are used with anchorage elements in order to distribute the load more and provide easy installation.



FEFCON SPHERICAL BEARINGS

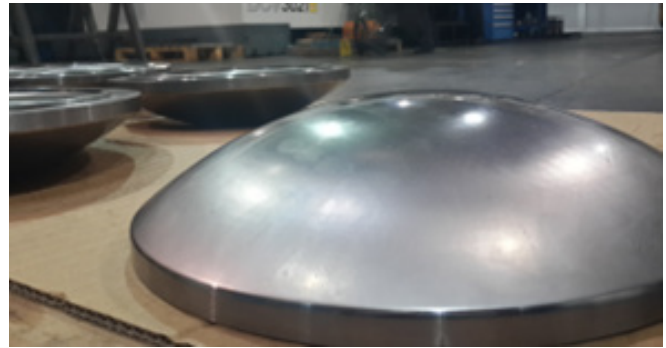
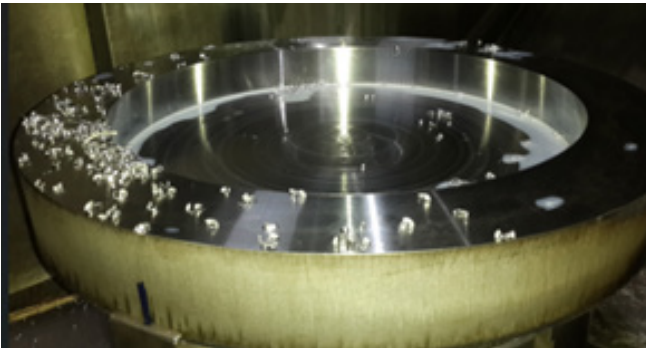
There are different elements that create FEFCON Spherical Bearings;

- Concave Plate
- Convex Plate (Calotte)
- PTFE
- Stainless Steel Plate
- Sliding Plate
- Guides
- Tilting Bar
- CM1 Sliders
- Anchorage Plates
- Anchorage Elements



The load capacity of FEFCON Spherical bearings depending on the capacity of the sliding material used are higher than the pot bearings as it has no elastomeric pad inside. After the vertical load from the superstructure is transferred to the concave plate with the help of the convex plate, it is safely transmitted to the sub-structure. However, since the spherical bearings transfer high pressures to the main structure, either high strength special concrete or grout should be used on the bearing plinths, or the bearing plinths should be designed in accordance with the load distributing principle to withstand the pressure to be transmitted from the bearing.

FEFCON Spherical Bearings can meet even very high rotational demands with their curved surfaces and the sliding elements used on these surfaces. To obtain lower friction, chromium cover is used under the convex plate against to PTFE that is put on the concave plate. Since the PTFE used on the convex plate is flat, the same principle as pot bearings is occurred. To provide better sliding ability to bearing, stainless steel in which one side polished like a mirror is used against to flat PTFE surface. Thus, the effect of unexpected loads on the structure is prevented. Stainless steel is welded to sliding plate or special countersunk bolts can be used for connection. Depending on the spherical bearing types, guide elements restrict the movement in one direction. The spherical bearings which do not have the guides can move in both directions. Tilting bars are used in guided spherical bearings in order to help the bearing rotate in perpendicular to sliding directions. These tilting bars have huge rotational capacity; moreover, CM1 sliders that have more load capacity compared with PTFE are used as a sliding material on them. Lastly if needed, additional anchorage plates are used with anchorage elements in order to distribute the load more and provide easy installation.



BEARING TYPES

FEF-POT F : Fixed Pot Bearing

Fixed pot bearings distribute the vertical and horizontal loads to sub-structure safely up to 0,030 radians rotation.



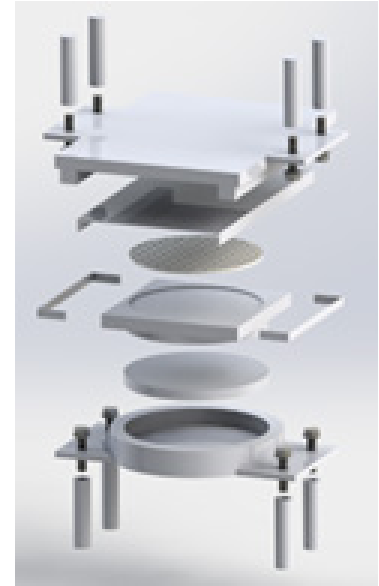
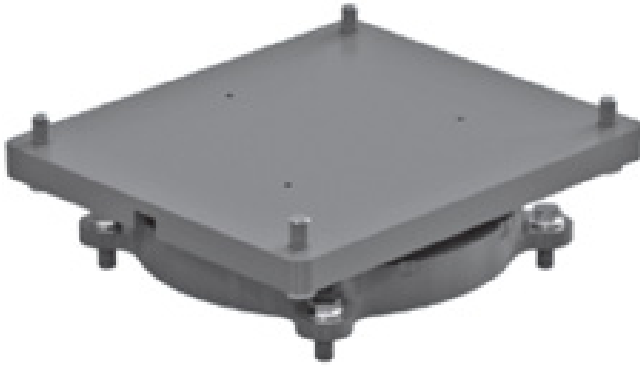
Bearing Name	P (kN)	V _x (kN)	V _y (kN)	θ (rad)	B (mm)	D (mm)	H (mm)
FEF-POT F-1000-100-100	1000	100	100	0,010	310	210	52
FEF-POT F-2000-200-200	2000	200	200	0,010	400	300	58
FEF-POT F-3000-300-300	3000	300	300	0,010	485	365	64
FEF-POT F-4000-400-400	4000	400	400	0,010	575	425	71
FEF-POT F-5000-500-500	5000	500	500	0,010	630	480	76
FEF-POT F-6000-600-600	6000	600	600	0,010	700	525	85
FEF-POT F-8000-800-800	8000	800	800	0,010	790	610	98
FEF-POT F-10000-1000-1000	10000	1000	1000	0,010	850	680	107
FEF-POT F-12000-1200-1200	12000	1200	1200	0,010	925	740	116
FEF-POT F-16000-1600-1600	16000	1600	1600	0,010	1050	860	133
FEF-POT F-20000-2000-2000	20000	2000	2000	0,010	1150	960	146
FEF-POT F-24000-2400-2400	24000	2400	2400	0,010	1300	1100	164
FEF-POT F-30000-3000-3000	30000	3000	3000	0,010	1375	1180	182
FEF-POT F-40000-4000-4000	40000	4000	4000	0,010	1675	1440	200
FEF-POT F-50000-5000-5000	50000	5000	5000	0,010	1875	1625	233

P : Axial Force
 V_x : Transversal Force
 V_y : Longitudinal Force
 θ : Rotational Capacity

B : Pot Bearing Width
 D : Piston Diameter
 H : Pot Bearing Height

FEF-POT G : Guided Pot Bearing

Guided pot bearings distribute the vertical load and the horizontal load from one side up to 0,030 radians rotation safely. At the same time, bearing can move in the opposite side of the horizontal load. Guides do not allow bearing to move in one direction.



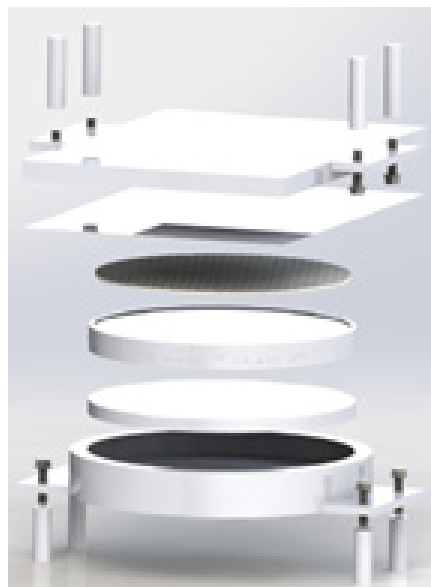
Bearing Name	P (kN)	V _x (kN)	v ₁ (mm)	θ (rad)	B (mm)	L (mm)	C (mm)	H (mm)
FEF-POT G-1000-100/50	1000	100	+50	0,010	375	315	425	86
FEF-POT G-2000-200/50	2000	200	+50	0,010	430	365	475	92
FEF-POT G-3000-300/50	3000	300	+50	0,010	500	405	535	98
FEF-POT G-4000-400/50	4000	400	+50	0,010	580	460	600	111
FEF-POT G-5000-500/50	5000	500	+50	0,010	625	495	635	117
FEF-POT G-6000-600/50	6000	600	+50	0,010	685	530	680	133
FEF-POT G-8000-800/50	8000	800	+50	0,010	775	600	750	148
FEF-POT G-10000-1000/50	10000	1000	+50	0,010	840	660	800	163
FEF-POT G-12000-1200/50	12000	1200	+50	0,010	925	730	880	164
FEF-POT G-16000-1600/50	16000	1600	+50	0,010	1025	810	950	208
FEF-POT G-20000-2000/50	20000	2000	+50	0,010	1150	900	1030	235
FEF-POT G-24000-2400/50	24000	2400	+50	0,010	1275	990	1140	259
FEF-POT G-30000-3000/50	30000	3000	+50	0,010	1350	1080	1190	297
FEF-POT G-40000-4000/50	40000	4000	+50	0,010	1625	1265	1400	324
FEF-POT G-50000-5000/50	50000	5000	+50	0,010	1825	1440	1570	337

P : Axial Force
V_x : Transversal Force
v₁ : Longitudinal Movement Capacity
θ : Rotational Capacity

B : Pot Bearing Width
L : Short Edge of the Sliding Plate
C : Long Edge of the Sliding Plate
H : Pot Bearing Height

FEF-POT S : Free Sliding Pot Bearing

Free sliding pot bearings distribute the vertical load up to 0,030 radians rotation safely. At the same time, bearing can move in any directions thanks to sliding elements.



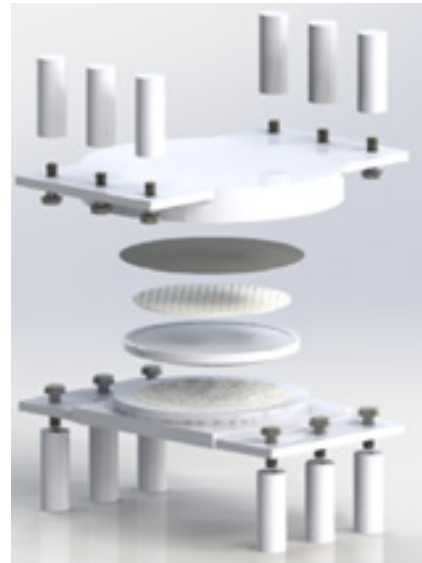
Bearing Name	P (kN)	v ₁ (mm)	v ₂ (mm)	θ (rad)	B (mm)	L (mm)	C (mm)	H (mm)
FEF-POT S-1000/50-20	1000	± 50	± 20	0,010	310	210	370	71
FEF-POT S-2000/50-20	2000	± 50	± 20	0,010	380	280	450	82
FEF-POT S-3000/50-20	3000	± 50	± 20	0,010	440	340	500	91
FEF-POT S-4000/50-20	4000	± 50	± 20	0,010	485	380	540	98
FEF-POT S-5000/50-20	5000	± 50	± 20	0,010	535	430	575	101
FEF-POT S-6000/50-20	6000	± 50	± 20	0,010	575	460	610	107
FEF-POT S-8000/50-20	8000	± 50	± 20	0,010	650	520	670	113
FEF-POT S-10000/50-20	10000	± 50	± 20	0,010	730	580	750	128
FEF-POT S-12000/50-20	12000	± 50	± 20	0,010	790	630	800	143
FEF-POT S-16000/50-20	16000	± 50	± 20	0,010	930	720	920	164,5
FEF-POT S-20000/50-20	20000	± 50	± 20	0,010	1025	800	1000	186,5
FEF-POT S-24000/50-20	24000	± 50	± 20	0,010	1150	900	1100	210,5
FEF-POT S-30000/50-20	30000	± 50	± 20	0,010	1250	960	1200	240,5
FEF-POT S-40000/50-20	40000	± 50	± 20	0,010	1405	1150	1350	266
FEF-POT S-50000/50-20	50000	± 50	± 20	0,010	1550	1250	1460	325

P : Axial Force
v₁ : Longitudinal Movement Capacity
v₂ : Transversal Movement Capacity
θ : Rotational Capacity

B : Pot Bearing Width
L : Short Edge of the Sliding Plate
C : Long Edge of the Sliding Plate
H : Pot Bearing Height

FEF-SPH F : Fixed Spherical Bearing

Fixed spherical bearings distribute the vertical and horizontal loads to sub-structure safely up to 0,050 radians rotation.



Bearing Name	P (kN)	V _{x,y} (kN)	θ (rad)	B (mm)	D (mm)	H (mm)
FEF-SPH F-1000-100	1000	100	0,030	275	275	95
FEF-SPH F-2000-200	2000	200	0,030	335	335	110
FEF-SPH F-3000-300	3000	300	0,030	405	405	125
FEF-SPH F-4000-400	4000	400	0,030	450	450	140
FEF-SPH F-5000-500	5000	500	0,030	505	505	150
FEF-SPH F-6000-600	6000	600	0,030	565	565	150
FEF-SPH F-8000-800	8000	800	0,030	635	635	170
FEF-SPH F-10000-1000	10000	1000	0,030	710	710	190
FEF-SPH F-12000-1200	12000	1200	0,030	775	775	200
FEF-SPH F-16000-1600	16000	1600	0,030	910	910	215
FEF-SPH F-20000-2000	20000	2000	0,030	1000	1000	240
FEF-SPH F-24000-2400	24000	2400	0,030	1100	1100	255
FEF-SPH F-30000-3000	30000	3000	0,030	1225	1225	280
FEF-SPH F-40000-4000	40000	4000	0,030	1415	1415	315
FEF-SPH F-50000-5000	50000	5000	0,030	1580	1580	350

P : Axial Force

V_{x,y} : Resultant Horizontal Force

θ : Rotational Capacity

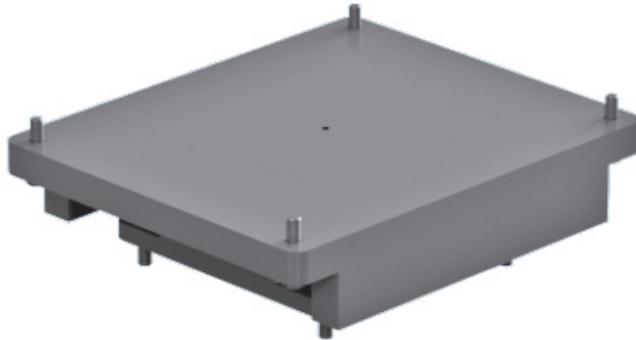
B : Spherical Bearing Width

D : Spherical Bearing Top Diameter

H : Spherical Bearing Height

FEF-SPH G : Guided Spherical Bearing

Guided spherical bearings distribute the vertical load and the horizontal load from one side up to 0,050 radians rotation safely. At the same time, bearing can move in the opposite side of the horizontal load. Guides do not allow bearing to move in one direction.



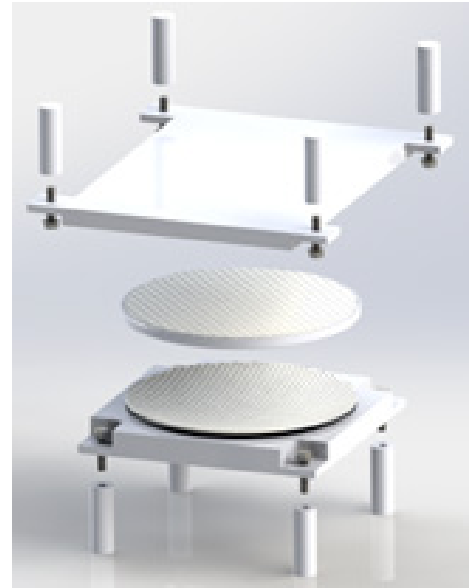
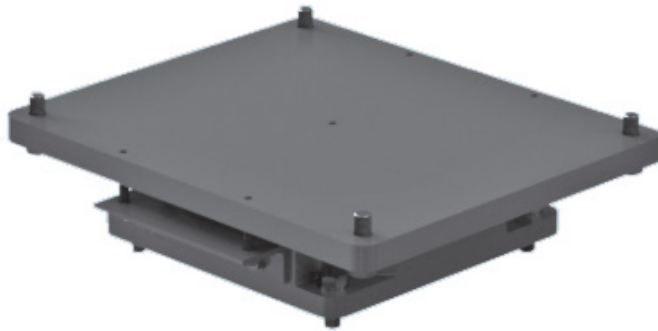
Bearing Name	P (kN)	V _x (kN)	v ₁ (mm)	θ (rad)	B (mm)	L (mm)	C (mm)	H (mm)
FEF-SPH G-1000-100/50	1000	100	±50	0,030	240	350	370	115
FEF-SPH G-2000-200/50	2000	200	±50	0,030	310	420	450	125
FEF-SPH G-3000-300/50	3000	300	±50	0,030	380	470	540	135
FEF-SPH G-4000-400/50	4000	400	±50	0,030	425	520	595	145
FEF-SPH G-5000-500/50	5000	500	±50	0,030	470	560	640	155
FEF-SPH G-6000-600/50	6000	600	±50	0,030	510	590	690	160
FEF-SPH G-8000-800/50	8000	800	±50	0,030	595	670	775	180
FEF-SPH G-10000-1000/50	10000	1000	±50	0,030	655	720	845	185
FEF-SPH G-12000-1200/50	12000	1200	±50	0,030	715	780	905	185
FEF-SPH G-16000-1600/50	16000	1600	±50	0,030	815	870	1035	215
FEF-SPH G-20000-2000/50	20000	2000	±50	0,030	915	960	1135	230
FEF-SPH G-24000-2400/50	24000	2400	±50	0,030	1020	1050	1250	245
FEF-SPH G-30000-3000/50	30000	3000	±50	0,030	1140	1170	1400	270
FEF-SPH G-40000-4000/50	40000	4000	±50	0,030	1340	1350	1630	290
FEF-SPH G-50000-5000/50	50000	5000	±50	0,030	1520	1510	1830	320

P : Axial Force
 V_x : Transversal Force
 v₁ : Longitudinal Movement Capacity
 θ : Rotational Capacity

B : Spherical Bearing Width
 L : Short Edge of the Sliding Plate
 C : Long Edge of the Sliding Plate
 H : Spherical Bearing Height

FEF-SPH S : Free Sliding Spherical Bearing

Free sliding spherical bearings distribute the vertical load up to 0,050 radians rotation safely. At the same time, bearing can move in any directions thanks to sliding elements.



Bearing Name	P (kN)	v ₁ (mm)	v ₂ (mm)	θ (rad)	B (mm)	L (mm)	C (mm)	H (mm)
FEF-SPH S-1000/50-20	1000	± 50	± 20	0,030	220	250	350	85
FEF-SPH S-2000/50-20	2000	± 50	± 20	0,030	280	320	420	95
FEF-SPH S-3000/50-20	3000	± 50	± 20	0,030	330	370	470	100
FEF-SPH S-4000/50-20	4000	± 50	± 20	0,030	370	420	520	115
FEF-SPH S-5000/50-20	5000	± 50	± 20	0,030	420	470	570	120
FEF-SPH S-6000/50-20	6000	± 50	± 20	0,030	460	510	610	130
FEF-SPH S-8000/50-20	8000	± 50	± 20	0,030	540	590	690	135
FEF-SPH S-10000/50-20	10000	± 50	± 20	0,030	610	660	760	145
FEF-SPH S-12000/50-20	12000	± 50	± 20	0,030	675	720	820	155
FEF-SPH S-16000/50-20	16000	± 50	± 20	0,030	785	830	930	175
FEF-SPH S-20000/50-20	20000	± 50	± 20	0,030	880	930	1030	190
FEF-SPH S-24000/50-20	24000	± 50	± 20	0,030	970	1020	1120	205
FEF-SPH S-30000/50-20	30000	± 50	± 20	0,030	1090	1140	1240	250
FEF-SPH S-40000/50-20	40000	± 50	± 20	0,030	1265	1320	1420	270
FEF-SPH S-50000/50-20	50000	± 50	± 20	0,030	1420	1470	1570	290

P : Axial Force
v₁ : Longitudinal Movement Capacity
v₂ : Transversal Movement Capacity
θ : Rotational Capacity

B : Spherical Bearing Width
L : Short Edge of the Sliding Plate
C : Long Edge of the Sliding Plate
H : Spherical Bearing Height

BEARING MATERIALS

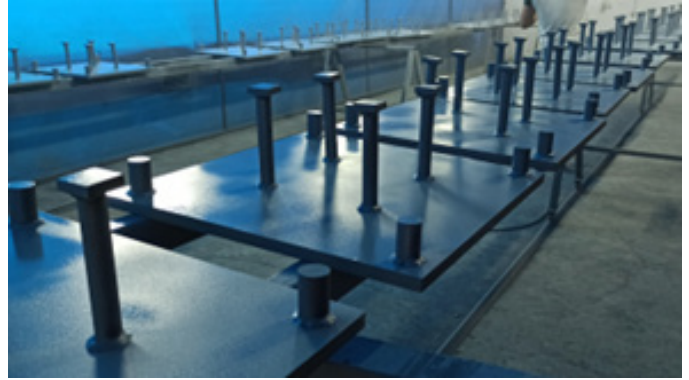
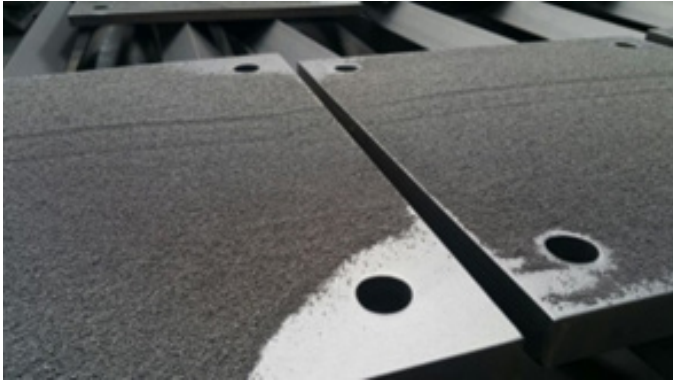
FEFCON POT BEARINGS		
Name of the Element	Material	Standard
Pot	S355J2+N	EN 10025
Piston	S355J2+N	EN 10025
Elastomeric Pad	NR (Natural Rubber)	ISO 6446
PTFE	PTFE (Teflon)	EN 1337-2
Stainless Steel Plate	X2CrNiMo17-12 / X5CrNiMo17-12	EN 10088
Sliding Plate	S355J2+N	EN 10025
Guides	S355J2+N	EN 10025
CM1 Sliders	Composite Material	EN 1337-2
Anchorage Plates	S355J2+N	EN 10025
Anchorage Elements	8.8 / 10.9 / 12.9	EN 20898

FEFCON SPHERICAL BEARINGS		
Name of the Element	Material	Standard
Concave Plate	S355J2+N	EN 10025
Convex Plate (Calotte)	S355J2+N	EN 10025
PTFE	PTFE (Teflon)	EN 1337-2
Stainless Steel Plate	X2CrNiMo17-12 / X5CrNiMo17-12	EN 10088
Sliding Plate	S355J2+N	EN 10025
Guides	S355J2+N	EN 10025
Tilting Bars	S355J2+N	EN 10025
CM1 Sliders	Composite Material	EN 1337-2
Anchorage Plates	S355J2+N	EN 10025
Anchorage Elements	8.8 / 10.9 / 12.9	EN 20898



CORROSION PROTECTION ON BEARINGS

Since most of the elements of FEFCON Pot and Spherical Bearings are steel, they must be protected against possible corrosion over time. Corrosion protection is carried out according to ISO 12944 standard and is applied as C4 class (depends on the location of the structure) unless otherwise stated in the project requirements. Steel plates are sandblasted first, so that the paint adheres to the plates easily, then plates are protected from corrosion by applying 3 or 4 layers of paints. Thin or thick layers may cause problems on the surface of the plates.



INSTALLATION, INSPECTION AND MAINTENANCE ON BEARINGS

Installation of FEFCON Pot and Spherical Bearings must be done according to EN 1337-11 standard. Pot or spherical bearings should be stored in a suitable storage area before installation and care should be taken to avoid any damage on the bearings. Depending on whether the structure in which the bearings will be used is steel, cast-in-situ reinforced concrete or precast reinforced concrete, different installation methods can be applied.

The surface on which the pot or spherical bearings will be installed should be smooth, free from dirt and clean. In addition, even though the pot or spherical bearings are assembled and sent to the construction site by not allowing any movement or rotation, unforeseen effects may occur during service life of bearing if proper installation is not applied at site. For this reason, installation surface must be flat so that the bearing will not subject to any additional rotations and loads from the superstructure to the sub-structure. Due to the fact that the pot or spherical bearings are prevented from slipping or rotating during shipment and on-site assembly, the transport brackets should be removed after the concrete of the bridge deck has cured, or after the assembly of the steel beams.

Depending on the anchoring method of pot or spherical bearings, high strength self levelling grout can be used on bearing plinths during installation. In order to provide better adhesion, chipping can be done on concrete surfaces. Casting of the grout must be done from one side of the plinth, and it must completely fill the lower surface of the bearing. Epoxy resin cannot be used for the installation of pot or spherical bearings, like they used in simple elastomeric bearing installation.

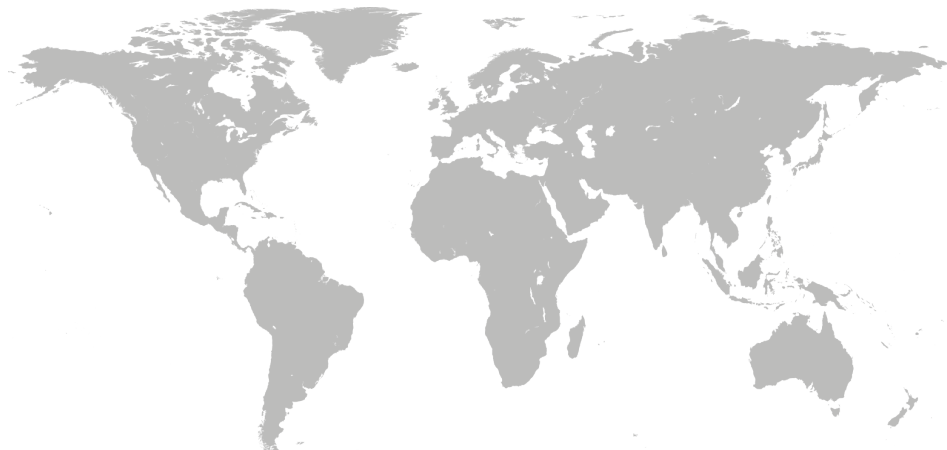
After installation, pot or spherical bearings should be inspected at certain intervals. While designing these type of bearings, possible future replacements are also taken into consideration. Thus, if necessary, these bearings can be replaced with the new ones by lifting the structure with the lifting jacks that have enough capacities.





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