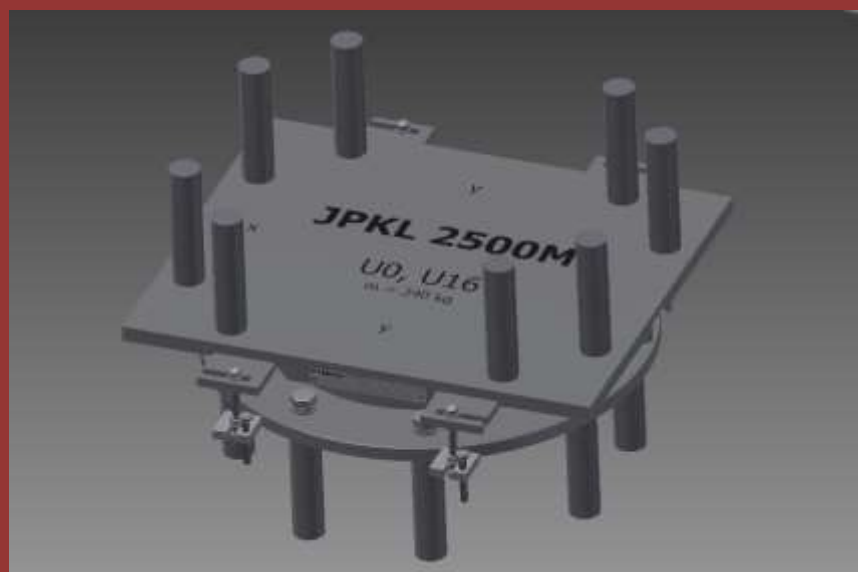


### 3. STRUCTURAL POT BEARINGS CATALOGUE



# POT BEARINGS





Usage of flexible material in a rigid pot for transfer of normal load with the possibility of rotation has been known for ages. This knowledge became increasingly significant after a high-quality and long-lasting elastomeric material has been invented.

A pot bearing consists of a round steel pot with a level bottom, and a non-reinforced elastomeric bearing placed on top of it. The gap between the pot and the piston is sealed with an elastic soft rubber seal. Elastomeric elements allow soft transfer of load from the upper to the lower structural parts.

Standard deformable non-reinforced elastomeric bearing, placed in a rigid steel pot significantly increases its bearing capacity during the influence of vertical load, due to prevention of horizontal deformation.

It is known that the normal allowed stressing of a standard non-reinforced elastomeric bearings is  $CT_d < 5 \text{ MPa}$  (acc. to DIN 4141), and of the elastomeric plate in a pot bearing is  $\sim 25 \text{ MPa}$ . Elastomeric material closed in a pot behaves like a rigid fluid in a hydraulic press. That is why good sealing is essential. In the slot at the edge of the elastomeric bearing there is a round seal made of carbon filled PTFE or brass. The deformability of the elastomere makes the cover rotation possible, so the pot bearings belong to the group of universally rotational (joint, fixed) bearings. Except rotation, pot bearings in combination with the PTFE sliding plate allow structural movements, so they belong to the group of universally rotational shift bearings. The advantages of these bearings in comparison to classical steel and joint bearings are their significantly lower weight and height, with identical bearing capacity and lower maintenance costs.

# FIXED POT BEARINGS (NL)

## APPLICATION SCOPE

In the introductory part we emphasized the possibility of inclining the cover towards the pot in all directions. The fixed pot bearings scope of usage covers the applications in which heavy steel spot-rotational bearings were previously used. A special characteristic of the pot bearings is their ability to take large loads, and equal distribution of the pressure on the base. Additionally, stability with regard to the rubber aging is achieved, since the elastomeric plate in a pot with a cover is fully protected against all UV and ozone influences. The elastomere type and the structure of the rubber compound have been designed to ensure high resistance to ozone and other common atmospheric impacts. Pot bearings can be used in the temperature range from  $-40^{\circ}\text{C}$  (243K) to  $+70^{\circ}\text{C}$  (343K).

## VERTICAL LOAD

### elastomeric pad

Vertical load is transferred by means of an elastomeric pad closed on all sides, which, under the conditions, behaves as resistant liquid and transfers the pressure equally on all sides. The maximum allowed normal load on the elastomeric plate is 25 MPa

### steel pot

The steel ring sizes are determined from the internal hydrostatic pressure in the rubber. The bottom of the pot is not taken into account in calculation. The junction size between the ring and the pot bottom are determined by the shear force and the torque from the internal hydrostatic pressure.



## HORIZONTAL LOAD

Horizontal load is transferred from the upper to the lower bearing part through the pot ring. It can be assumed that the horizontal load is distributed on the half of the scope in a parabolic form. The welding dimensions between the ring and the pot bottom are determined by the shear force and the torques caused by the horizontal forces

## ROTATION

Because of the structure bending above the bearing, the upper part of the bearing is rotated in relation to the lower part, and the pressure on the elastomeric pad is not equal. The rotation causes torque.

The torque caused by the horizontal forces is taken into account when calculating the pressure on the bearing base. When transferring horizontal forces from the bearing onto the concrete base, the friction coefficient  $\mu=0,5$  (for steel superstructure  $\mu=0,2$ ) should be taken into account. The friction force is taken as the most unfavorable combination ( $F_t=\mu V_{min}$ ).

$v=1,5$  is taken as the anti-sliding security factor. If the resulting horizontal forces cannot be compensated by friction, the bearings must be anchored.

With bearings exposed to seismic loads, as well as for bearings for railway bridges, friction coefficient is  $\mu=0$ .

## INSTALLATION

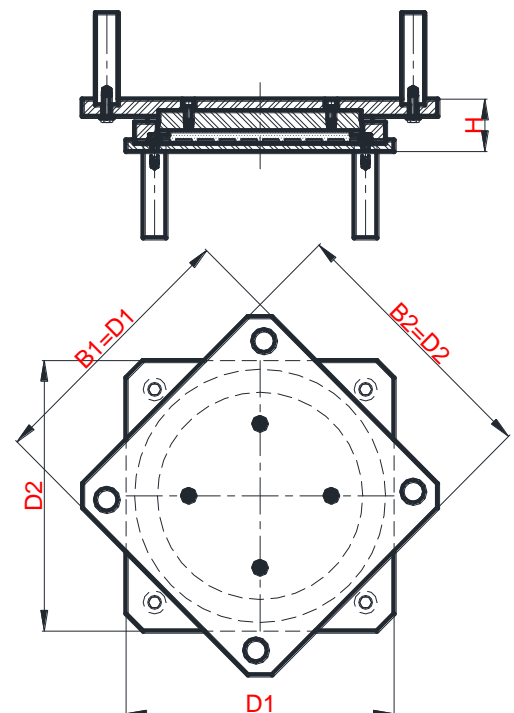
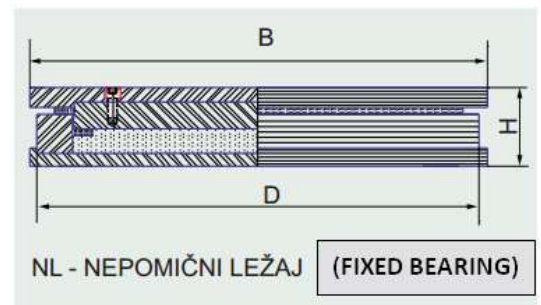
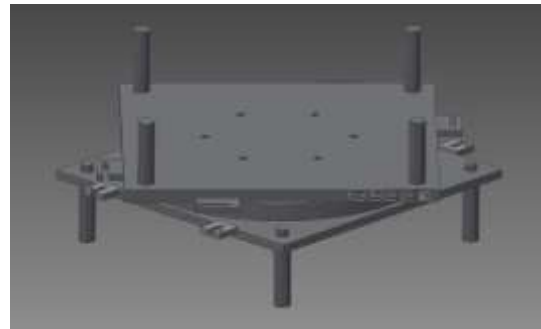
When installing pot bearings, the concrete above and below the bearing should have a high-density value of  $\sigma \geq 45$  MPa, and the base sizing should be performed with the pressure of 26 MPa.

The bearings are fixed with four symmetrically arranged bolts on the lower plate. The bolts should first be cast into concrete, and after the installation is complete, the bolt is reinforced with nuts. At the end of the process, the bearing is cast into diluted cement mortar. If the foreseen horizontal forces can be taken by friction, anchoring can be omitted. If there is no anchoring, the bearings are placed on the cement mortar bed. The cover is connected to the pot with regulating bolts, which are to be removed after the installation. Fixed pot bearings are produced in standard sizes shown in Table 1, with possibility of producing other variations, nonstandard pot bearings, if necessary.



**FIXED BEARING 2.1 (NL)**

Bearing type	Load (kN)	Height H (mm)	Bearing plate width $D_1=D_2$ (mm)	Mass (kg)
NL 1000	1000	70	270	37
NL 1500	1500	75	320	52
NL 2000	2000	80	360	64
NL 2500	2500	85	400	85
NL 3000	3000	90	430	95
NL 3500	3500	92	460	115
NL 4000	4000	94	490	125
NL 4500	4500	98	530	150
NL 5000	5000	101	550	161
NL 5500	5500	104	580	182
NL 6000	6000	106	600	202
NL 6500	6500	110	630	230
NL 7000	7000	112	650	250
NL 7500	7500	114	670	265
NL 8000	8000	116	690	278
NL 8500	8500	120	710	300
NL 9000	9000	124	730	330
NL 9500	9500	128	750	360
NL 10000	10000	131	770	388
NL 12000	12000	139	840	475
NL 14000	14000	150	910	610
NL 16000	16000	158	970	725
NL 18000	18000	168	1030	875
NL 20000	20000	175	1090	1100
NL 22000	22000	183	1140	1300
NL 24000	24000	190	1190	1400
NL 26000	26000	198	1240	1550
NL 28000	28000	203	1280	1700
NL 30000	30000	210	1300	1900



The bearings are typically produced with the following parameters  $tg\alpha = 0,01$  and mean surface pressure of **26 Mpa**.

$V_{min} = 0,5 V_{max}$ , horizontal bearing capacity is  $F_H = 0,1 V_{max}$ .

For larger pressures and movements, bearing dimensions can be determined according to special order.

# SLIDING POT BEARINGS (JPKL, SPKL)

## GENERAL

Pot bearings combined with a steel sliding plate and PTFE sliding plate can be **single-side** movable (JPKL) and universally movable (SPKL) bearings. On the bottom of the steel pot there is an elastomeric plate. At the edges of the rubber plate there is a carbon filled PTFE or brass seal. The rubber plate has a cover. The gap between the pot and the cover is sealed with an elastic rubber seal. On the upper surface of the cover, there is a PTFE sliding plate with pockets filled with the lubrication agent. The upper sliding plate slides on the upper surface of the PTFE plate. The sliding surface is made of stainless steel with surface roughness  $\leq 1 \mu\text{m}$ .

The sliding surfaces and the other functionally important parts are dust-protected with a ribbed rubber cladding. Sliding pot bearings are fixed in the same way as the fixed pot bearings, by anchor bolts in the lower plate. On the upper sliding plate there are openings for the narrow anchor bolts used for fixing to the upper structure part

## INSTALLATION

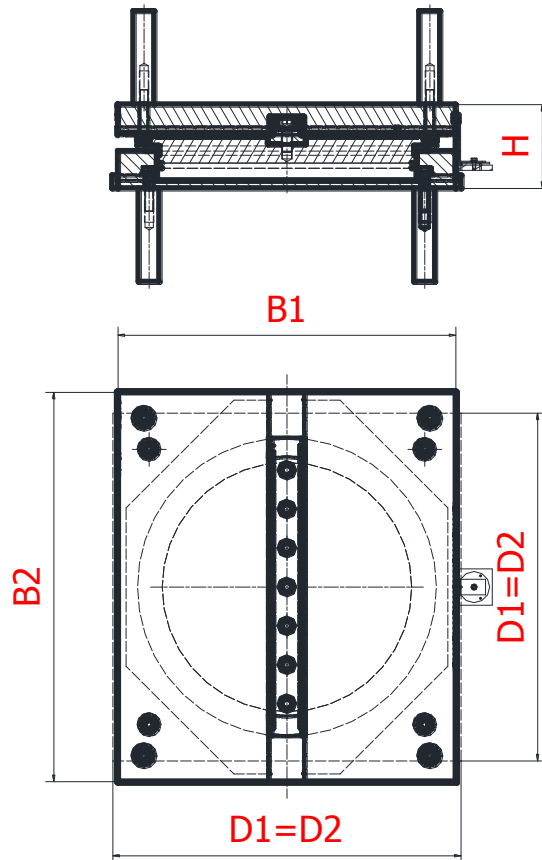
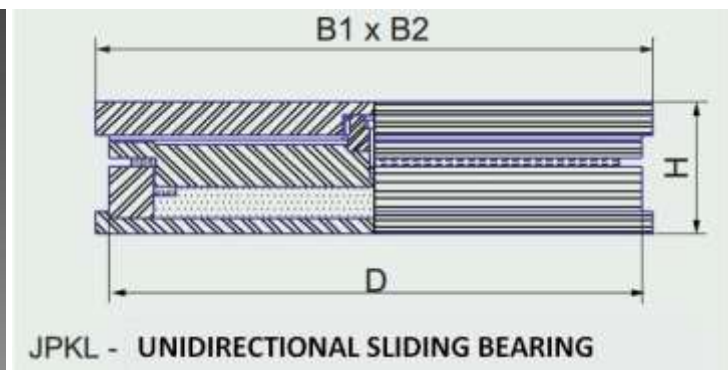
A unidirectional sliding bearing is produced by installing a single-direction guide to the sliding plate of a multidirectional sliding bearing. Sliding pot bearings are applicable in complex bridge structure solutions. Sliding pot bearings are characterized by low height and weight in comparison to classical steel movable bearings, and also by low friction when sliding, and easy and low control and maintenance. The bearings are designed in such way that the wear and tear parts can be easily replaced. By factory settings, they are set to a desired shift value. During installation, four bolts are used to level the bearing in desired height and slope. The installation order is the same as with pot bearings. After installing the bearing and loading it with superstructure, fixing bolts and levelling bolts are to be removed from the bearing to enable its function. With universally movable bearings, where the friction force on the bearing-base junction is 1,5 times stronger than the horizontal force, the anchoring procedure can be omitted



**BEARING MARKING**

Factory assembled bearings are labeled according to their type and function. Beside standard label acc. to EN 1337-1, containing producer's name, also year of manufacturing, serial number, type, bearing capacity and movement capacity are stated. All these labels are clear and permanently visible, and part of them is additionally placed on top of the bearing. For sliding bearings, on the top of bearing is also stated the customer, weight of the bearing, position in structure, movement direction and movement capacity.

**UNIDIRECTIONAL SLIDING POT BEARING (JPKL)**



## UNIDIRECTIONAL SLIDING POT BEARING (JPKL)

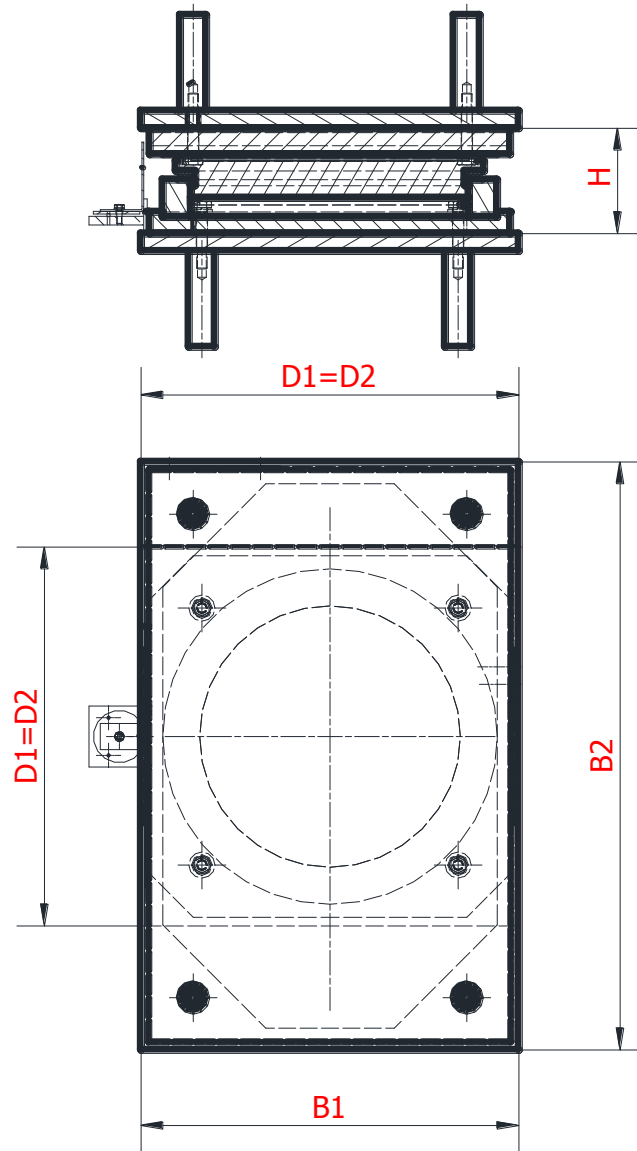
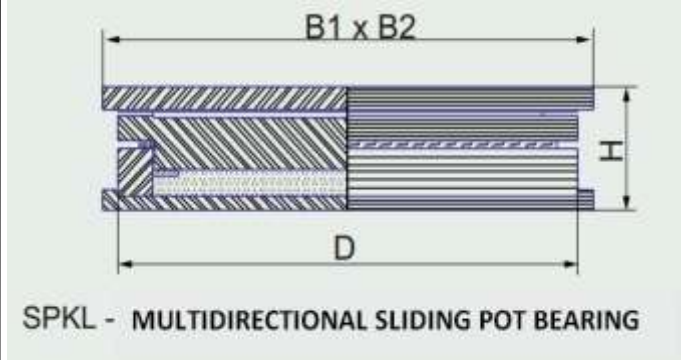
Bearing type	Load (kN)	Height H (mm)	Width B <sub>1</sub> (mm)	e <sub>x</sub> =±50		e <sub>x</sub> =±100		e <sub>x</sub> =±150	
				Width B <sub>2</sub> (mm)	Mass (kg)	Width B <sub>2</sub> (mm)	Mass (kg)	Width B <sub>2</sub> (mm)	Mass (kg)
JPKL 1000	1000	117	300	400	115	500	125	600	140
JPKL 1500	1500	120	350	450	130	550	150	650	170
JPKL 2000	2000	123	400	500	160	600	170	700	190
JPKL 2500	2500	126	420	520	180	620	200	720	230
JPKL 3000	3000	129	450	550	200	650	220	750	250
JPKL 3500	3500	133	500	600	240	700	260	800	280
JPKL 4000	4000	136	520	620	280	720	300	820	300
JPKL 4500	4500	141	560	660	310	760	340	860	370
JPKL 5000	5000	145	580	680	350	780	380	880	400
JPKL 5500	5500	147	600	700	370	800	410	900	450
JPKL 6000	6000	149	620	720	400	820	450	920	500
JPKL 6500	6500	153	650	750	420	850	470	950	520
JPKL 7000	7000	156	670	770	450	870	500	970	550
JPKL 7500	7500	159	700	800	500	900	550	1000	600
JPKL 8000	8000	162	720	820	550	920	600	1020	650
JPKL 8500	8500	166	730	830	570	930	620	1030	680
JPKL 9000	9000	169	750	850	600	950	650	1050	720
JPKL 9500	9500	172	770	870	650	970	700	1070	780
JPKL 10000	10000	175	800	900	700	1000	780	1100	820
JPKL 12000	12000	186	880	980	910	1080	950	1180	1050
JPKL 14000	14000	195	950	1050	1000	1150	1100	1250	1200
JPKL 16000	16000	203	1000	1100	1250	1200	1350	1300	1450
JPKL 18000	18000	217	1050	1150	1500	1250	1600	1350	1700
JPKL 20000	20000	226	1110	1210	1700	1310	1800	1410	1900
JPKL 22000	22000	236	1180	1280	1900	1380	2150	1480	2250
JPKL 24000	24000	243	1220	1320	2200	1420	2350	1520	2500
JPKL 26000	26000	250	1260	1360	2500	1460	2600	1560	2800
JPKL 28000	28000	263	1320	1420	2900	1520	3050	1620	3200
JPKL 30000	30000	270	1360	1460	3200	1560	3350	1660	3500

The bearings are typically produced with the following parameters  $\text{tg}\alpha = 0,01$ , mean surface pressure of **26 Mpa** and one direction movement of  $e = \pm 50 \text{ mm}$  to  $e = \pm 150 \text{ mm}$

$V_{\min} = 0,5 V_{\max}$ , horizontal bearing capacity is  $F_H = 0,1 V_{\max}$ .

For larger pressures and movements, bearing dimensions can be determined according to special order.

**MULTIDIRECTIONAL SLIDING POT BEARING (SPKL)**



## MULTIDIRECTIONAL SLIDING POT BEARING (SPKL)

Bearing type	Load (kN)	Height H (mm)	Width B <sub>1</sub> (mm)	e <sub>x</sub> =±50		e <sub>x</sub> =±100		e <sub>x</sub> =±150	
				Width B <sub>2</sub> (mm)	Mass (kg)	Width B <sub>2</sub> (mm)	Mass (kg)	Width B <sub>2</sub> (mm)	Mass (kg)
SPKL 1000	1000	100	270	370	75	470	90	570	100
SPKL 1500	1500	104	320	420	100	520	120	620	135
SPKL 2000	2000	107	360	460	120	560	135	660	150
SPKL 2500	2500	110	390	490	140	590	150	690	170
SPKL 3000	3000	113	420	520	160	620	175	720	190
SPKL 3500	3500	117	450	550	180	650	200	750	230
SPKL 4000	4000	120	480	580	200	680	230	780	250
SPKL 4500	4500	125	510	610	230	710	260	810	280
SPKL 5000	5000	129	530	630	260	730	280	830	310
SPKL 5500	5500	131	550	650	280	750	320	850	350
SPKL 6000	6000	133	570	670	300	770	340	870	370
SPKL 6500	6500	136	590	690	325	790	370	890	400
SPKL 7000	7000	138	610	710	350	810	390	910	425
SPKL 7500	7500	141	630	730	380	830	420	930	470
SPKL 8000	8000	144	650	750	400	850	450	950	500
SPKL 8500	8500	148	670	770	440	870	480	970	530
SPKL 9000	9000	151	680	780	470	880	510	980	560
SPKL 9500	9500	154	690	790	500	890	540	990	590
SPKL 10000	10000	156	710	810	530	910	570	1010	620
SPKL 12000	12000	174	790	900	720	1000	780	1100	850
SPKL 14000	14000	182	840	950	840	1050	910	1150	990
SPKL 16000	16000	190	930	1030	1000	1130	1080	1230	1150
SPKL 18000	18000	199	980	1080	1150	1180	1250	1280	1350
SPKL 20000	20000	208	1050	1150	1350	1250	145	1350	1550
SPKL 22000	22000	219	1100	1200	1550	1300	1680	1400	1780
SPKL 24000	24000	224	1150	1250	1700	1350	1800	1450	1900
SPKL 26000	26000	231	1200	1300	1900	1400	2000	1500	2150
SPKL 28000	28000	240	1230	1330	2150	1430	2300	1530	2400
SPKL 30000	30000	246	1280	1380	2350	1480	2500	1580	2650

The bearings are typically produced with the following parameters  $\text{tg}\alpha = 0,01$  mean surface pressure of **26 MPa** and one direction movement of  $e = 50 \text{ mm}$  do  $e = 150 \text{ mm}$ . Total movement in perpendicular direction is **10 mm**.

$V_{\min} = 0,5 V_{\max}$ , horizontal bearing capacity is  $F_H = 0,1 V_{\max}$ .

For larger pressures and movements, bearing dimensions can be determined according to special order.