CORE-POT Kawakin POT BEARING

CORE-POT bearings are designed, per customer requirements, in accordance with EN 1337, AASHTO, and Japanese standards.

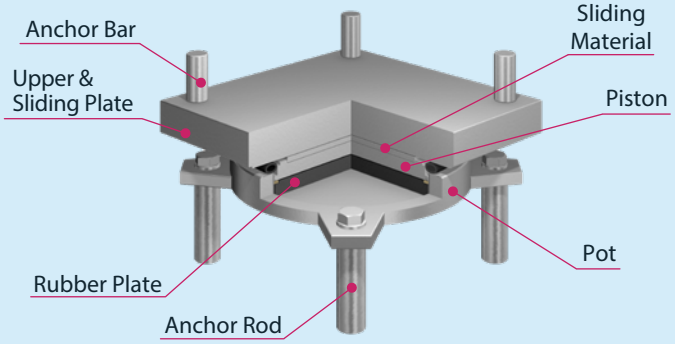
Kawakin has delivered pot bearings for more than 200 projects in and outside Japan!!

Application range

Suitable for a various bridges including steel girders

Function

- Supports vertical loads
- Accommodates horizontal movement and rotation



High Quality

Accurate quality control by rigorous material and performance test

High Durability

- Long-term stability guaranteed by fatigue test
- Corrosion protection by hot-dip galvanizing or
- Aluminum-Magnesium spraying (TAPSR method)

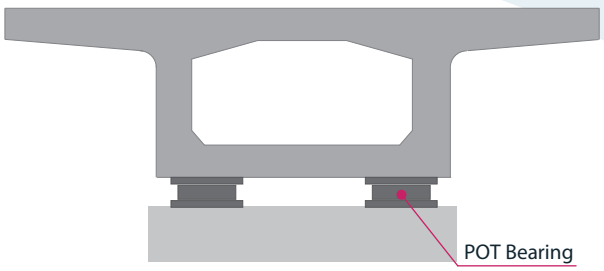
Low cost and Size Line-up

- A broad line-up of pot bearings for supporting small to large vertical loads
- Vertical load capacity up to 25,000 kN

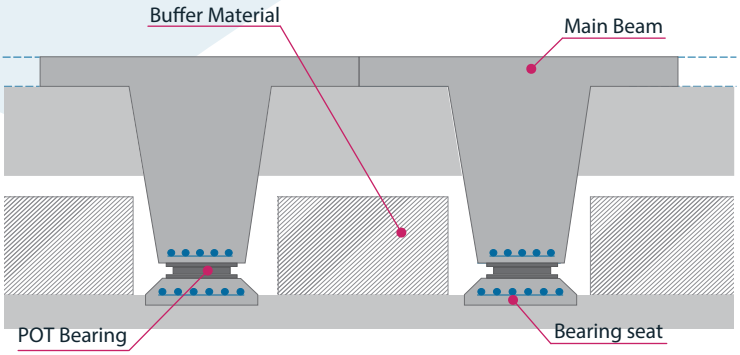
The Kawakin CORE-POT bearing consists of a PTFE sheet, a piston and a rubber pad between the upper plate and the pot to absorb girder movement and rotation. The PTFE sheet has a remarkably low friction coefficient of approx. μ = 0.06, and is reinforced with inorganic filler such as glass fibers to improve its brittleness, abrasion and creep resistance properties. Hot-dip galvanizing or painting are applied according to customers' requirements. Aluminum-magnesium spraying is an option for better protection for corrosion and has been increasingly applied in Japan.

Installation

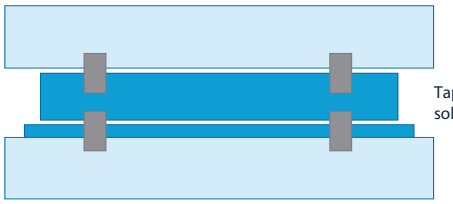
APPLICATION EXAMPLES



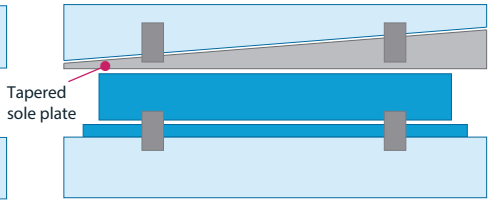
BOX GIRDER



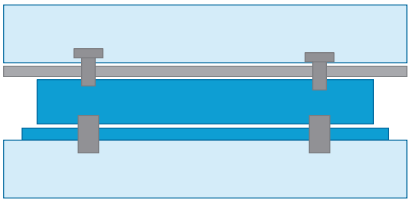
SUPER-T GIRDER



STANDARD INSTALLATION

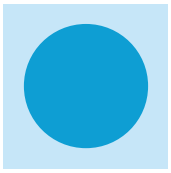
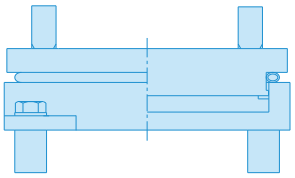
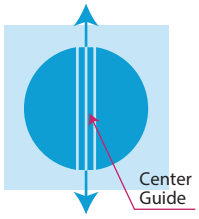
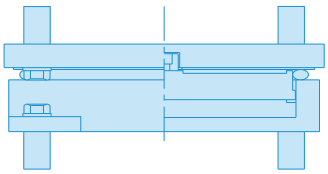
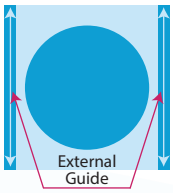
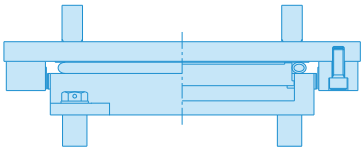
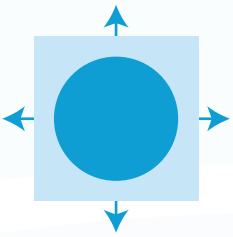
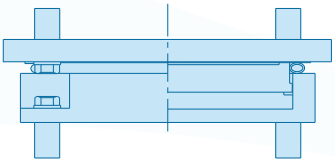


INSTALLATION with Tapered Plate



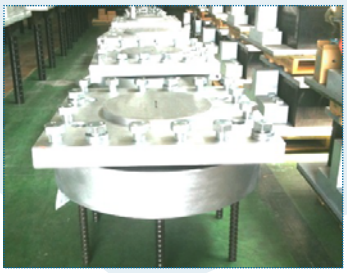
INSTALLATION for Steel Girder

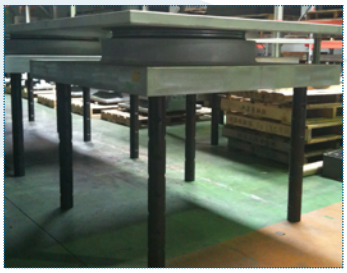
Types of CORE-POT

Fixed Type			This type restricts horizontal movements in all directions even during earthquakes as well as ordinary times.
Guide Type — Center Guide			This bearing is locked in either the longitudinal or the transverse axis and allows for horizontal movements in the other direction. The additionnal center guide plate allows bearing movements in one direction.
Guide Type — External Guide			This bearing is locked in either the longitudinal or the transverse axis and allows for horizontal movements in the other direction. Two external guide plates allow the bearing movement in one direction.
Free Type			This bearing allows horizontal movement in any direction. The sliding material accomodates horizontal displacements without restraints.

Application Examples

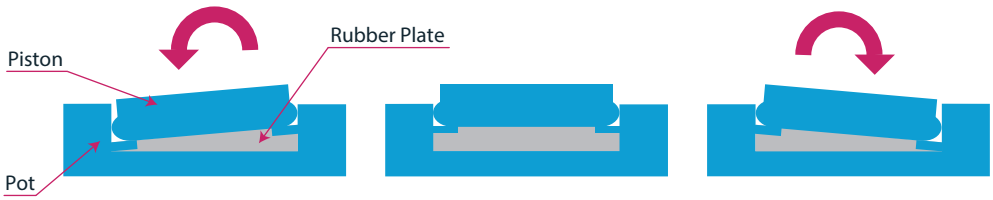

Assembly


Final Product


Final Product

Rotation Function

CORE-POTs have rubber plates in the pots. The rubber can accommodate girder rotations in any direction.



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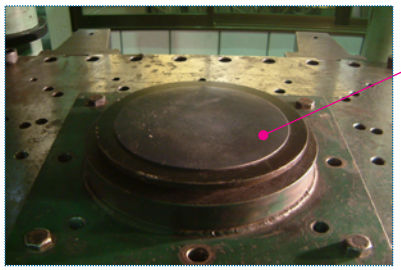
Tomorrow's Technology, Today.
Kawakin Holdings Group
Issued 06/2022

LONG-TERM DURABILITY TEST

The CORE-POT has been subjected to many performance tests to verify its characteristics.

1. Horizontal loading test

Horizontal displacement corresponding to 100-year bridge girder expansion was applied to test pieces under vertical loading. The friction coefficient of the PTFE sheet with filler was approx. 0.06 after the loading. The test piece showed stable performance so that it can maintain its sound and long-term performance for a period of 100 years.



After Test

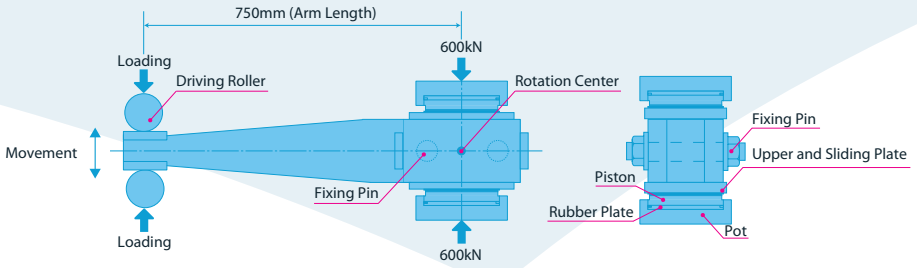
2. Water resistance test

The actual environment in which bridges are placed is not the same as that considered in a laboratory. Rainfall, sand and dust accumulation may damage the bearings. Kawakin reproduced this environment. The test piece of PTFE was immersed into water with dust sprinkled, and horizontal loads are applied. Pure PTFE and PTFE with filler were used for the test. As a results, There is only negligible deterioration of the bearing performance.

3. Fatigue test

The rubber pad is expected to accommodate rotations due to girder deformation, and required to behave stably against repeated live loads without getting damaged. The fatigue test gives over 2,000,000 times of deflections corresponding to design max. rotation angle of supporting points. Little performance change or damages was observed on the test pieces after the loading.

FATIGUE TEST EQUIPMENT

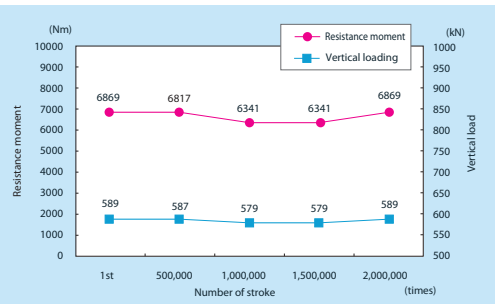


FATIGUE TEST RESULT

PARAMETER CHANGE RATE OF RUBBER PLATE

		1st time	1,000,000 time	2,000,000 time	Increase-decrease Rate (%)
Hardness	Class (JIS A)	52.0	52.0	52.0	±0
Diameter	mm	179.4	179.4	179.4	±0
Thickness	mm	12.0	12.0	12.0	±0
Weight	g	410.5	410.5	410.5	±0

RESISTANCE MOMENT CHANGE



POT INSIDE (AFTER TEST)

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DURABILITY

Kawakin also evaluates long-term usage of bearings by aging tests.

CASE-1

We barely observed surface damages on the bearing used over 15 years in a truss bridge (980m length) located in a coastal area. Its friction remained changed.

BEARING APPEARANCE after 15 years

Bearings in floor framing structure

Beam

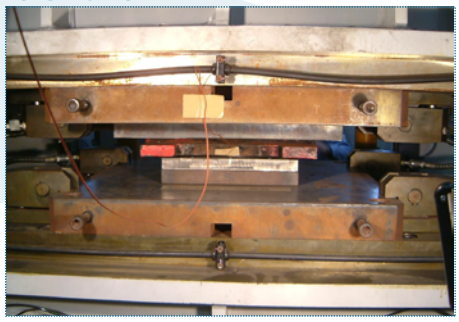
Although coating is partially deteriorated, no defects by surface damages were observed. (The purpose of the bearing replacement is aseismic reinforcement against higher design seismic force.)

BEARING DETAIL

Despite showing some signs of wear, the PTFE sliding plate (left image) maintained its shape and performance. The stainless steel plate in contact with the PTFE was also in good condition.

LOADING TEST

Biaxial loading test is to evaluate the friction coeffecient of bearing.
The test results showed that the 15 year used bearing maintained its initial performance.



CASE-2

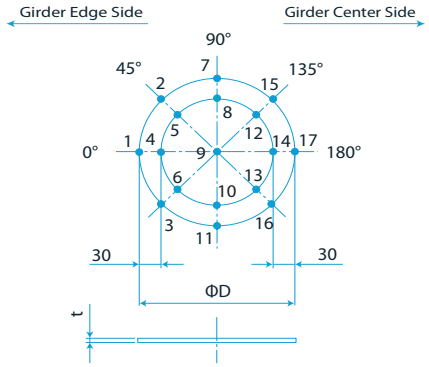
BEARING DETAIL

PTFE

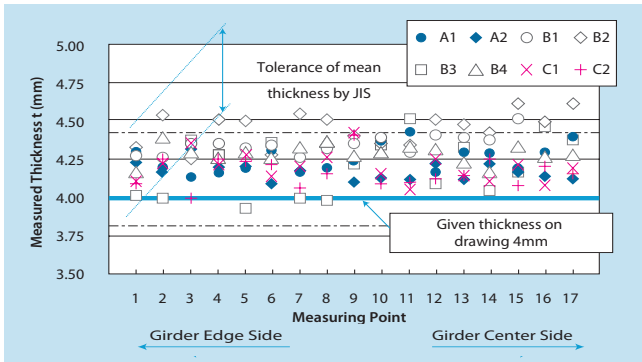
SUS

No abnormality was found in the bearing that have been used for 10 years in a highway in a city highway.
The PTFE thickness was hardly changed. Little wear was observed and the performance of the PTFE was kept sound

THICKNESS MEASUREMENT POINT



PTFE THICKNESS MEASUREMENT RESULT



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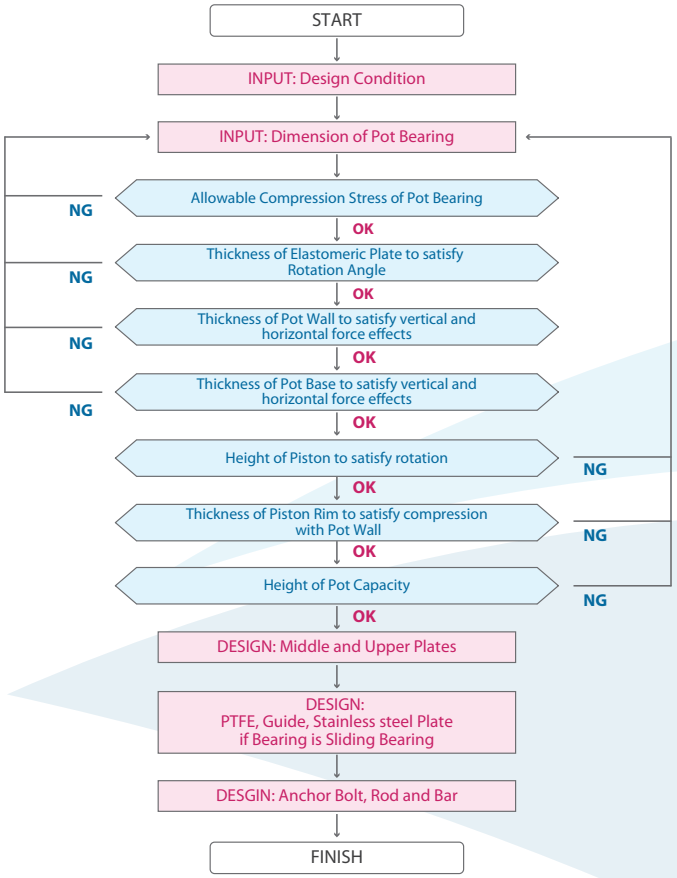
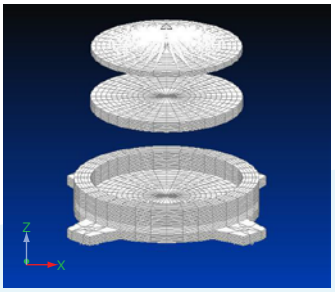
DESIGN STANDARD

The specifications of the CORE-POT are the achievement of Kawakin's 50 years experiences. High quality and durability are achieved through detailed analysis results, such as design analysis and FEM analysis, research on the behavior of bearings used for existing bridges, and inspections, tracking investigations on damages caused by earthquakes.

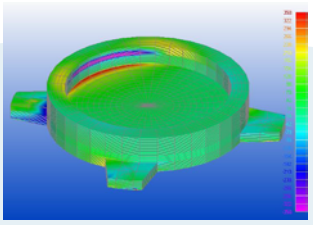
POT BEARING DESIGN FLOWCHART



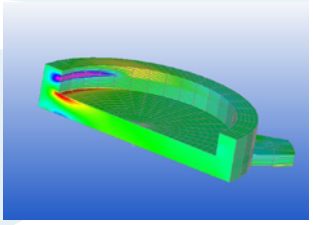
ANALYSIS AND RESULT



FEM ANALYSIS MODEL



ANALYSIS RESULT 1



ANALYSIS RESULT 2

MATERIAL

Materials used for CORE-POTs conform to the standards such as AASHTO and JIS.The most common sliding material is PTFE with filler and its friction coefficient is approx. μ=0.005 - 0.1. PTFE is the most frequently used in Japan and its durability has been proved by existing constructions. For thousands ton class large-scaled bearings that require lower friction coefficient, we provide pure PTFE with dimples that will be lubricated with grease. (The specification complies with EN standards.)

CORROSION PROTECTION

Durability varies depending on the environments where bearings are placed, such as cities, mountains, and coastal areas. Kawakin has three corrosion protection methods: paint coating, hot-dip galvanizing, and thermal spraying to increase bearing durability and reduce life cycle costs.

1. Paint coating

This method is commonly used. The coating quality depends on the application method and the operator's skills. Kawakin's experience allows stable quality and optimum coating.

2. Hot-dip galvanizing

This method is also commonly used and requires large-scale equipment. Strict quality control procedures are required.

3. Aluminum-Magnesium Thermal Spray (TAPS)

Spraying is a new method and has become popular recently. Kawakin has established its own spraying method, called CORE-TAPS, using an aluminum and magnesium alloy. Test results show that a service life of 100 years can be expected when protecting the bearings with this method.

Corroded Steel Bearing

Spraying CORE-TAPS

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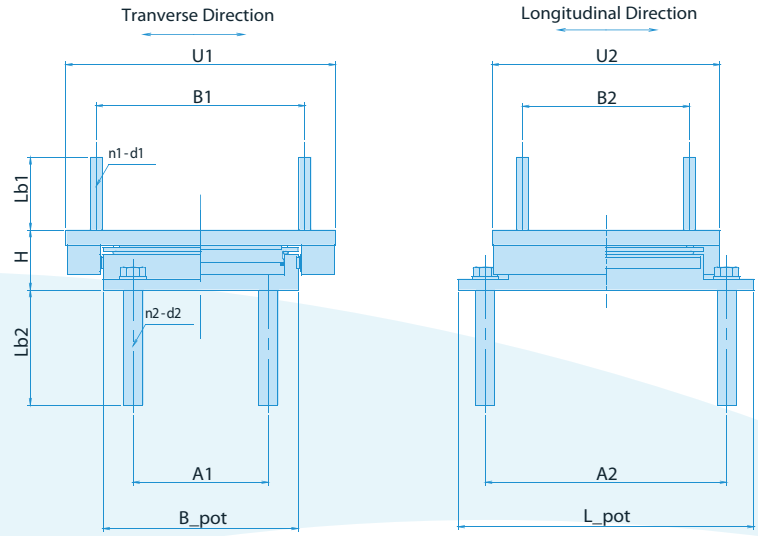
CORE-POT Kawakin POT BEARING

STANDARD DIMENSIONS

CENTER GUIDE TYPE *One Direction Free*



DESIGN CONDITION

- Design conditions are determined at the strength limit state.
- Displacement of bearing in the longitudinal direction is shown in the table below.
- Displacement of bearing in the transverse is restrained.
- Rotation angle is taken as 0.02 rad. This value considers construction requirements.
- Design is based on the AASHTO LRFD Specification 2010.
- Units for dimensions and weight are “mm” and “kg” , respectively.

Vertical Load (Ru)	Vertical Load (Rs)	Horizontal Load	Dis.	B-pot	L-pot	A1	A2	B1	B2	U1	U2	H	n2	d2	Lb2	n1	d1	Lb1	Weight
500	358	75	20	190	310	120	240	120	240	380	310	112	4	30	165	4	16	90	74.0
1000	715	150	20	250	370	180	300	170	290	440	370	121	4	30	165	4	20	110	114.8
1500	1072	225	20	280	420	200	340	200	340	470	420	131	4	35	195	4	20	110	150.1
2000	1429	300	20	330	490	240	400	230	390	520	490	134	4	40	220	4	24	135	200.5
2500	1786	375	20	360	540	260	440	250	430	550	540	143	4	45	250	4	27	150	257.0
3000	2143	450	20	400	600	290	490	280	480	610	600	147	4	50	275	4	30	165	323.3
3500	2500	525	20	420	630	300	510	300	510	630	630	152	4	55	305	4	30	165	368.7
4000	2858	600	50	460	720	310	570	310	520	670	720	160	4	65	360	4	36	200	484.2
4500	3215	675	50	480	740	330	590	330	590	690	740	164	4	65	360	4	36	200	521.2
5000	3572	750	50	500	760	350	610	350	610	730	760	168	4	65	360	4	36	200	577.8
6000	4286	900	50	550	830	390	670	390	650	780	830	177	4	70	385	4	39	215	716.8
7000	5000	1050	50	600	900	430	730	430	710	830	900	185	4	75	415	4	42	235	856.1
8000	5715	1200	50	630	950	450	770	450	770	880	950	192	4	85	470	4	45	250	1031.1
9000	6429	1350	50	680	1000	500	820	480	800	930	1000	196	4	85	470	4	48	265	1153.9
10000	7143	1500	80	710	1060	510	860	500	850	960	1060	208	4	90	495	4	52	290	1356.0
11000	7858	1650	80	750	1120	540	910	540	910	1020	1120	211	4	95	525	4	52	290	1550.4
12000	8572	1800	80	780	1150	570	940	550	920	1050	1150	214	4	95	525	4	56	310	1648.8
13000	9286	1950	80	810	1210	580	980	580	980	1080	1210	219	4	100	550	4	56	310	1823.9
14000	10000	2100	80	840	1240	610	1010	600	1000	1130	1240	226	4	100	550	4	60	330	2031.3
15000	10715	2250	80	860	1280	620	1040	620	1040	1150	1280	235	4	105	580	4	60	330	2182.6

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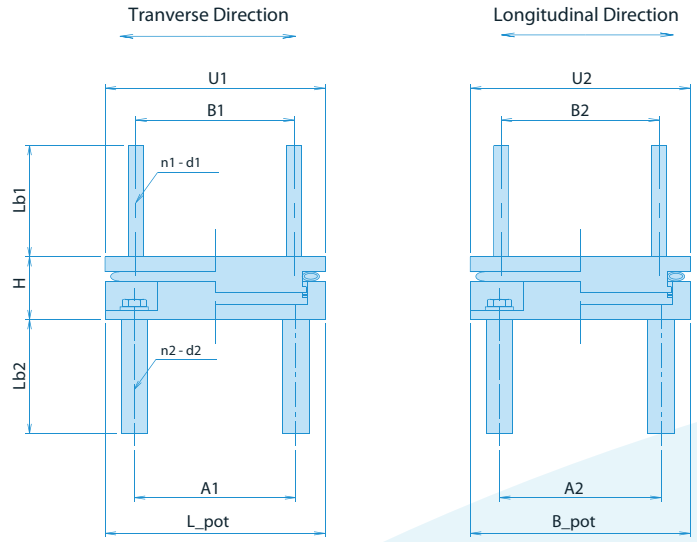
CORE-POT Kawakin POT BEARING

DESIGN DIMENSIONS

FIX TYPE



DESIGN CONDITION

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- Rotation angle is taken as 0.02 rad. This value considers constructivity.
- Design is based on the AASHTO LRFD Specifications 2010.
- Units for dimensions and weight are “mm” and “kg” , respectively.

Vertical Load (Ru)	Vertical Load (Rs)	Horizontal Load	L_pot	B_pot	A1	A2	B1	B2	U1	U2	H	n2	d2	Lb2	n1	d1	Lb1	Weight
500	358	75	235	235	165	165	165	165	235	235	67	4	30	165	4	16	90.0	25.9
1000	715	150	275	275	205	205	195	195	275	275	78	4	30	165	4	20	110.0	40.3
1500	1072	225	325	325	245	245	245	245	325	325	83	4	35	195	4	20	110.0	59.0
2000	1429	300	365	365	275	275	265	265	365	365	90	4	40	220	4	24	135.0	82.1
2500	1786	375	410	410	310	310	300	300	410	410	98	4	45	250	4	27	150.0	114.0
3000	2143	450	455	455	345	345	335	335	455	455	106	4	50	275	4	30	165.0	150.2
3500	2500	525	485	485	365	365	365	365	485	485	108	4	55	305	4	30	165.0	177.2
4000	2858	600	555	555	405	405	405	405	555	555	120	4	65	360	4	36	200.0	264.3
4500	3215	675	570	570	420	420	420	420	570	570	127	4	65	360	4	36	200.0	288.0
5000	3572	750	580	580	430	430	270	270	580	580	129	4	65	360	4	36	200.0	299.1
6000	4286	900	635	635	475	475	475	475	635	635	143	4	70	385	4	39	215.0	395.5
7000	5000	1050	685	685	515	515	515	515	685	685	152	4	75	415	4	42	235.0	485.7
8000	5715	1200	725	725	545	545	545	545	725	725	159	4	80	440	4	45	250.0	580.3
9000	6429	1350	760	760	580	580	560	560	760	760	167	4	80	440	4	48	265.0	658.6
10000	7143	1500	805	805	605	605	595	595	805	805	180	4	90	495	4	52	290.0	808.6
11000	7858	1650	855	855	645	645	645	645	855	855	182	4	95	525	4	52	290.0	929.5
12000	8572	1800	875	875	665	665	645	645	875	875	190	4	95	525	4	56	310.0	1002.7
13000	9286	1950	925	925	695	695	695	695	925	925	193	4	100	550	4	56	310.0	1127.8
14000	10000	2100	945	945	715	715	705	705	945	945	205	4	100	550	4	60	330.0	1245.0
15000	10715	2250	980	980	740	740	740	740	980	980	212	4	105	580	4	60	330.0	1385.8

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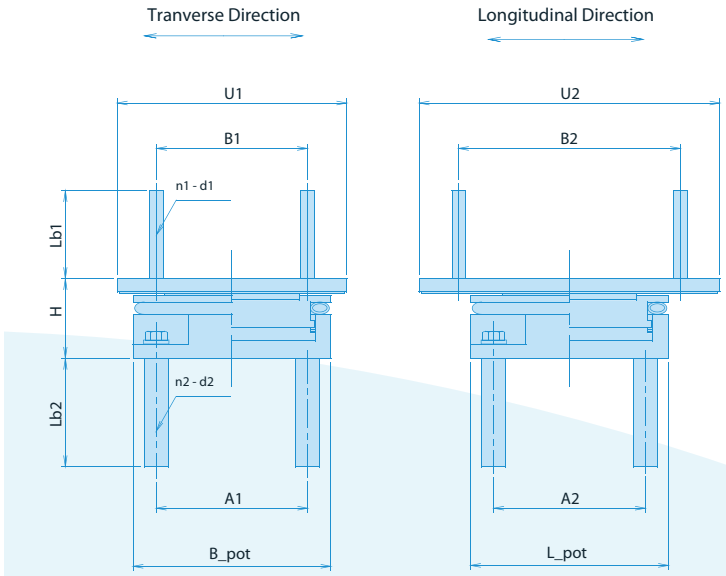
CORE-POT

Kawakin POT BEARING

STANDARD DIMENSIONS

FREE TYPE



DESIGN CONDITION

- Design conditions are determined at the strength limit state.
- Displacement of bearing in the longitudinal direction is shown in the table below.
- Displacement of bearing in the transverse direction is 10mm.
- Rotation upto 0.02 rad.
- Design is based on the AASHTO LRFD Specifications 2010.
- Units for dimensions and weight are “mm” and “kg” , respectively.
- Horizontal force is taken as the effect of friction force in a bearing during movement.
  H = 0.1*V

Vertical Load (Ru)	Vertical Load (Rs)	δL	δT	L_pot	B_pot	A1	A2	B1	B2	U1	U2	H	n1	d1	Lb1	n2	d2	Lb2	Weight
500	358	20	10	250	250	180	180	180	180	250	250	80	4	16	90	4	30	165	30.9
1000	715	20	10	285	285	215	215	215	215	285	285	85	4	16	90	4	30	165	41.8
1500	1072	20	10	310	310	240	240	230	230	310	310	96	4	20	110	4	30	165	55.9
2000	1429	20	10	360	360	280	280	280	280	360	360	104	4	20	110	4	35	195	80.4
2500	1786	20	10	385	385	305	305	295	295	385	385	111	4	22	125	4	35	195	95.4
3000	2143	20	10	420	420	330	330	320	320	420	420	111	4	24	135	4	40	220	118.1
3500	2500	20	10	445	445	355	355	335	335	445	445	125	4	27	150	4	40	220	148.6
4000	2858	50	15	480	480	380	380	370	370	480	480	127	4	27	150	4	45	250	176.7
4500	3215	50	15	510	510	400	400	390	390	510	510	133	4	30	165	4	50	275	209.1
5000	3572	50	15	540	540	420	420	420	420	540	540	135	4	30	165	4	55	305	240.7
6000	4286	50	15	620	620	470	470	470	470	620	620	148	4	36	200	4	65	360	356.5
7000	5000	50	15	655	655	505	505	505	505	655	655	159	4	36	200	4	65	360	413.4
8000	5715	50	15	675	675	525	525	515	515	675	675	164	4	39	215	4	65	360	463.5
9000	6429	50	15	725	725	565	565	565	565	725	725	173	4	39	215	4	70	385	554.3
10000	7143	80	20	745	745	585	585	575	575	745	745	182	4	42	235	4	70	385	608.6
11000	7858	80	20	790	790	620	620	610	610	790	790	187	4	45	250	4	75	415	716.4
12000	8572	80	20	830	830	650	650	650	650	830	830	195	4	45	250	4	85	470	839.8
13000	9286	80	20	850	850	670	670	650	650	850	850	198	4	48	265	4	85	470	891.9
14000	10000	80	20	900	900	700	700	700	700	900	900	207	4	48	265	4	90	495	1026.3
15000	10715	80	20	910	910	710	710	700	700	910	910	219	4	52	290	4	90	495	1110.8

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