HERCULES POT TYPE BEARINGS (HPT) can be used in steel or concrete structures. This low profile, compact bearings are particularly useful to transmit large vertical load while accommodating large movements and multi-directional rotation. Separate mechanisms for rotation and translation (where applicable) provide minimum eccentricity of the load and minimum frictional resistance to movement. High side loads can also be accommodated simultaneously.

Their design advantages make them particularly suitable for medium to long span structures e.g. Bridges, pipelines, power stations, off shore platforms etc. The continuous research and development on Hercules Pot-type bearings combine simplicity, design efficiency, versatility and economy. They have gained successful track record for its quality and durability throughout the world since its introduction in 1972.

1. STANDARD TYPES

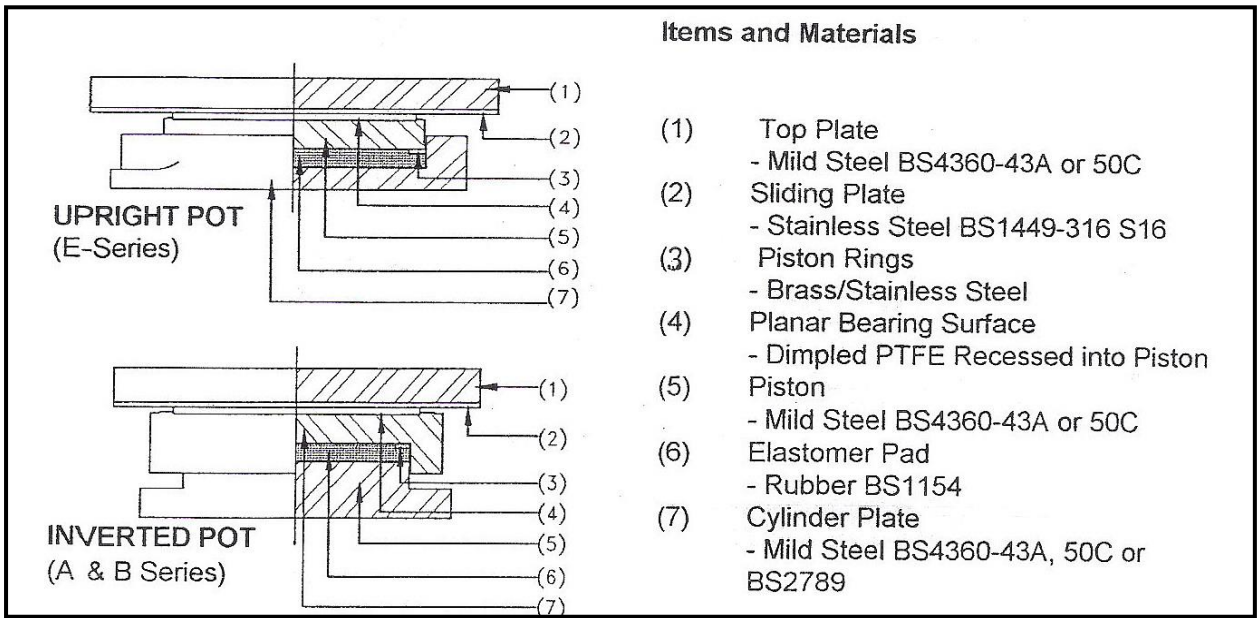
1.1 Fixed Bearings

Fixed [FX] bearings consist of a steel piston fitted closely inside a steel cylinder. Within this cylinder is trapped a rubber pad which, when under load, acts as a confined fluid, enabling the piston to tilt, attracting very little eccentricity of load. This bearing can resist simultaneous vertical and horizontal loads, as well as rotations about any horizontal axis.

1.2 Expansion Bearings

The Sliding Guided [SG] and Free Float [FF] bearings are expansion bearings, similar to the fixed bearing, but with the addition of a steel slide plate faced with stainless steel, which slides on a disc of Poly Tetra Fluoro Ethylene (PTFE) recessed into the cylinder or plate piston. In the case of the [SG] bearings, guides are incorporated to accommodate horizontal loads. These are faced with stainless steel, and slide against low - friction materials.

2. TYPICAL DETAILS



3. CLASSIFICATION BY SERIES

3.1 Series A bearings provide for HIGH horizontal load

3.2 Series B bearings provide for lesser horizontal loads with the additional feature of INTERCHANGEABILITY between some bearing types. This series is offered for the particular convenience of pre-cast girder designers.

HPT-B/SG and HPT-B/FF of the same size and movement capacity are interchangeable (in bolt sizes and centres and heights), (Δt assumed to be ±20mm)

HPT-B/FX bearings are also interchangeable with SGB and FFB bearings (bolt sizes and centres not height) provided that Δs = ±10mm, Δt = ±20mm and Vmax is no greater than 1500 kN

The maximum horizontal loads and movement for A and B Series are shown in the Table 2.1, 2.2 [FX], 2.3, 2.4 [SG] and 2.5 [FF]

The bearings meet the requirements of the Road and Traffic Authority of Australia and are also manufactured to meet Quality Assurance Standard AS 3901, Austroad Bridge Design Code.

3.3 Series C bearings are CUSTOM DESIGNED for any special non-standard design load combination and requirements for specific application such as:

Design Requirements	Applications
Skew Movements	Skewed Sub-Structures
Temporary Longitudinal Keepers	Launching/Erection Stages
Adjustable Lateral Guides	Re-alignment of Segments
Load monitoring (digital readout)	Research & Development; Highway Weighing Bridge
Fire Protection Materials	Fire & Extreme Temperatures Higher/lower Rotation Large Gradient Structure
Large Movements	Long Span / Large Temperature Variation
Durable Protective Coating	Corrosive Environments
Higher Horizontal Load	Seismic / Impact Forces
Uplift Restraints	Seismic & Upward Forces

3.4 Series E bearings provide an ECONOMICAL range of pot-type bearings designed to permit standard angular rotations of 0.015 rads about any axis.

The standard fixed, free and sliding guided bearings are design with maximum vertical loads in serviceability limit state from 300 to 30,000 kN.

The maximum horizontal loads and movement for E Series are shown in the Tables#2.6 [FX], 2.7 [SG] and 2.8 [FF]

The bearings meet the requirements of BS 5400 Part 9.1 and 9.2 and are also manufactured to meet Quality Assurance Standard ISO 9001. The above series of Hercules Pot-type Bearings can be dimensioned in conformity with Particular specifications required by the clients or other standards or regulations e.g. AASHTO, DIN, JIS (JRA) etc.

4. DESIGN FEATURES

4.1 Convenient Designs - Design considerations for the ease of designer, pre- casters & site staff.

Where possible, bearings of like vertical load capacity are made to similar dimensions and bolt centres. This makes them especially convenient for pre-cast girder designers.

Fixing bolts are placed in positions which are accessible, and permit removal of the bearing with minimum jacking of the structure. Attachment plates are fully detailed for the convenience of designers, although sockets are also available.

4.2 Quality Assurance - For consistency, traceability and longevity

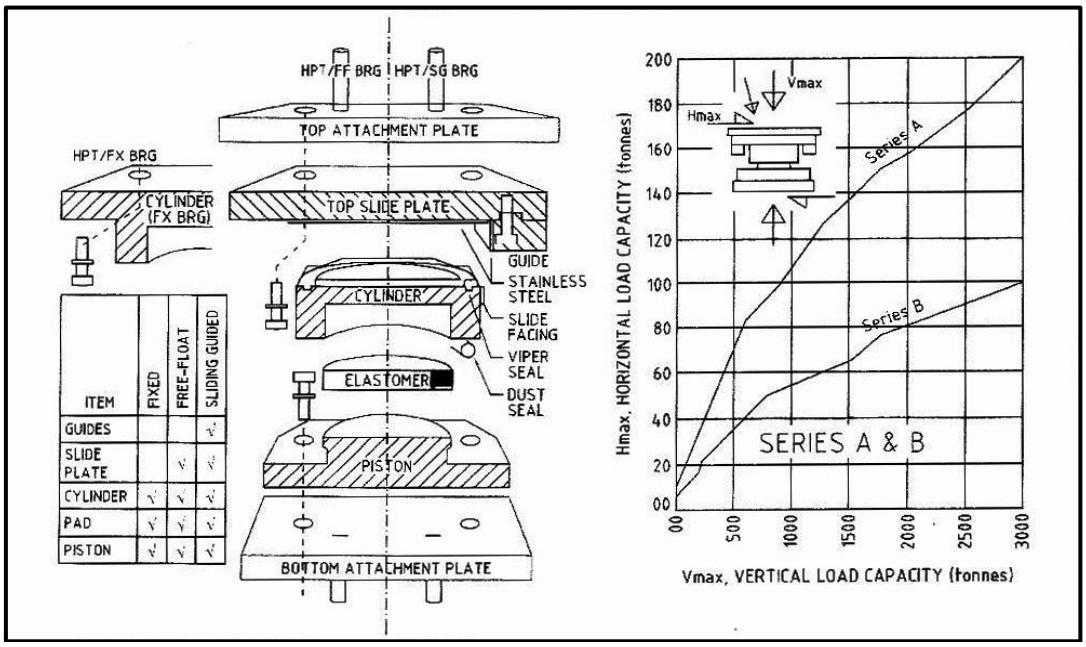
HERCULES ENGINEERING has always been committed to a high standard of quality in design, production, installation and after sales services. We use the principle of QUALITY AT SOURCE and the guidelines provided by AS 3901 and ISO 9001, backed by testing to NATA certification.

Accuracy in machining (bolt centres in particular) is achieved with modern NC machines.

Stainless steel (Gr. 316) is polished to better than CLA .2 µm, and the virgin PTFE is epoxy-bonded, dimpled and greased for minimum friction and optimum life.

Corrosion protection is available in a variety of systems to suit environment and color requirements. Steel components are grit or sand blasted before painting or galvanizing for maximum adhesion and protection, and stainless steel bearings can also be provided for extreme conditions.

Prior to dispatch and delivery, bearings are clearly labeled with serial numbers and individual identification showing locations and orientations.



4.3 Flexible Design - To adapt to local preferences and conditions, all HPT-A and HPT-B Series bearings are provided with dust seals on both rotation and sliding mechanisms. The cylinder is INVERTED over the piston, and is thus self-draining in dust and flood prone conditions and other structures at low terrain areas.

In the case of the more compact HPT-E Series bearings, the piston is contained in the cylinder pot on UPRIGHT position. The HPT-E/SG bearings consist of the central internal guide bar fitted in a slot in the piston.

4.4 Versatility/Optional Features - An option for special dust seal cases

4.4.1 Position-indicating scales indicate the slide plate's relative position with its limits.
4.4.2 Longitudinal keepers to lock the slide plate temporarily (or permanently) at any desired position
4.4.3 Modified guides for lateral control in areas of mine subsidence and/or earthquake-prone areas.
4.4.4 Uplift restraint, using a spherical-seated centre bolt, which permits simultaneous full rotation and side load.
4.4.5 Electrical insulation for railway bridges.
4.4.6 Load monitoring with digital readout (±2% accuracy)

5. STANDARD DESIGNS AND LIMITATIONS

A comprehensive range of capacities is available. Although the HPT bearings have considerable reserve strength and rotational capacity, the following design parameters (consistent with QA requirements) are recommended.

5.1 Vertical Load Capacity

Standard sizes range from 300 kN to 30000kN capacity. While the bearings are checked to be perfectly serviceable at 150% of the rated load, they must also be designed to distribute this load to the sub-and super-structures.

5.2 Concrete Stress/Pressure

Contact pressures for standard attachment plate designs have been based on concrete Interfaces and vary up to 20 MPa. Note that this pressure can be increased in steel structure for greater economy. Like wise, should a lower pressure be required, then the standard designs can again be amended accordingly.

However on structures designed in accordance with BS 5400 the allowable concrete stress is dependent upon the relative dimensions of the bearing/structure interfaces, the total support areas and the characteristic strength of the concrete. The stresses on the bearing support structure should therefore be designed and checked against bursting and splitting to ensure that the full capacity of the bearing can be achieved.

5.3 Design Loads

The designation of loading varies from one designer to another in different countries. With the introduction of BS 5400 Part 9.1, the practice of stating working loads and commonly practiced mean concrete stresses of 20MPa become inappropriate on contracts designed in accordance with BS 5400.In order to enable designers to select bearings for either the BS 5400, Limit State or working Load criteria our tables give the maximum loading each bearing is designed to accommodate under each designation of loading.

5.4 Horizontal Load Capacity

Hercules Pot Bearings of both series are available with high and moderate horizontal load capacities. Again, the bearings are checked to be serviceable at 150 % of the rated load. Lateral load is assumed to be co-existent with sliding friction (Vector sum)

In sizing attachment bolts and cast-in anchors. We have adopted the principles of DIN 4141, AUSTROADS BDC Part 4 and BS 5400 Part 9.1 permitting frictional assistance at the various interfaces. Serviceability friction factors of 10% at steel/steel and 33% at steel/concrete interfaces are assumed so that the bolts are only required to take the balance

$$n.H_b = (Hxy - u_{assist.}\ Vcoex)$$

The importance of checking Vcoex is self-evident and light structures subject to vibration or earthquake may also need review. The top attachment bolts of large movement HPT/SG bearings should be checked at the limit of movement as an eccentric bolt group, and additional bolts provided accordingly.

Co-efficient of friction, (ambient temperatures)

Lubricated	0.01	(short term)	0.02	(long term)
Un-lubricated	0.03	(at full load)	0.05	(half load)

5.5 Expansion capacity

Standard SGL and FF bearings are offered with ±50 mm movement in the principal direction of movement and ±20mm in the transverse direction for SGT and FF bearings. (While a small reserve movement is built in, it is up to the designer to specify ultimate movement requirements). Larger (or smaller) movements can be achieved by increasing (or decreasing) the top plate length, C (and width, in the case of FF bearings) Top attachment bolt centres (CC×DD) should also be amended in the general case.

Note that this movement range can be weighted more to one side by introducing a preset, e.g. a standard ±50mm bearing preset ±20mm will accommodate a +30, -70mm movement range (positive presets and movement assumed in the direction of expansion, away from point of fixity) In the case of HPT/SG bearings, the standard lateral clearance to the guides is ±1mm, although this can be amended if required.

5.6 Rotation Capacity

Standard bearings have rotation capacities varying from 0.030 rads for the smaller sizes to 0.015 rads for the larger sizes. Larger (and smaller) rotations can be provided by amending the rubber pad thickness and other modifications as necessary (Special designs are available to 0.200 rads capacity)

We also recommend that the designer considers the premature rotation due to installation tolerances as well as the individual rotations during the construction stages e.g. Especially precast post-tensioned structures to ensure that the design rotation at SLS (or service condition) is not exceeded resulting in the over straining of the confined elastomer.

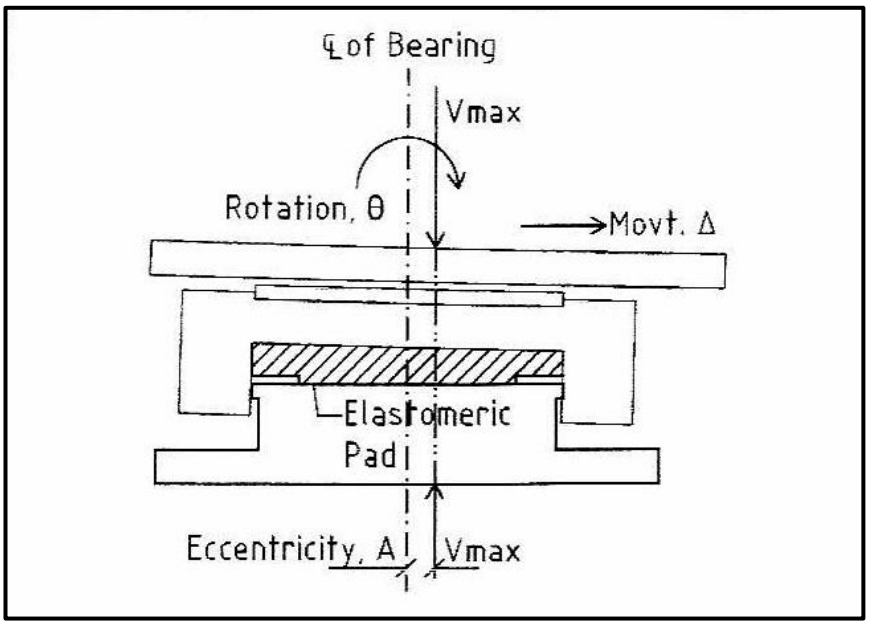
5.7 Eccentricity of Vertical Load due to Rotation and Translation

This varies with pad dimensions, but is generally less than A/50. Designers will note that this is considerably superior to simple laminated Elastomeric bearings. Typically (A/6 ± Δ) or more.

5.8 Vertical Deflection, Full Service Load

This varies from 0.5mm to 2.0mm depending on size

5.9 Maximum Operating Temperature: 90ºC



6. DEFINITIONS / TERMINOLOGIES

TERM	LIMIT STATE	DEFINITION	UNITS
Vmax	Serviceability Ultimate	Maximum Vertical Load Capacity (SLS)(Vult = 1.5 Vmax)	kN
Vcoex	SLS or ULS	Maximum Vertical Load required co-existent with maximum horizontal load	kN
Hmax	Serviceability Ultimate	Maximum Imposed Horizontal Load (SLS)(Hult = 1.5 Hmax, co-existent with Vcoex)	kN
Hxy	SLS or ULS	Vector Sum of Hmax and PTFE friction	kN
μ_{assist}	Serviceability Ultimate	Frictional assistance at interfaces w/structure 0.1 steel/steel, 0.33 steel/concrete (SLS) 0.15 steel/steel, 0.50 steel/concrete (ULS)	kN/ kN
n.H	Serviceability Ultimate	Shear load taken by n attachment bolts (SLS) (n.Hb) ult = 1.5× n.Hb	kN
Vmin	SLS or ULS	Minimum vertical load for full rotation in the case of HPT/FF bearings (unless uplift is provided)	kN
Rmax	Serviceability Ultimate	Maximum rotation capacity (SLS) Rult =1.5 Rmax	rads
± Δs	SLS or ULS	Movement capacity in principal slide direction(±)	mm
± Δt	SLS or ULS	Movement capacity in transverse direction (±)	mm
+so	SLS or ULS	Preset in the principal slide direction [usually +ve, preset range becomes]+(Δs-so)1-(Δs+so)	mm

7. DESIGNATION OF PART NUMBER

For ease of reference, we recommend that design engineers specify the full bearing part number as per example below:

Table 6.1 POT BEARING PART No.

Manufacturer	Type	Series	Form	Maximum SLS Vertical Load (kN)	Total Movement	
					Longitudinal (mm)	Transverse (mm)
Hercules	HPT	A	SGL	2000	100	0
Hercules	HPT	A	FF	8000	100	20
Hercules	HPT	C	FX	3000	0	-
Hercules	HPT	E	SGT	5000	0	20

The full part number for examples [i] and [iv] are:

[i] Hercules Pot-Type Bearing, HPT - A /SGL 2000/100/0
[iv] Hercules Pot-Type Bearing, HPT - E /SGT 5000/0/20

This denotes a HERCULES Pot-Type Bearing under "A Series" in the form of Sliding Guided Longitudinally and "E Series" in the from of Sliding Guided Transversely.

[i] Maximum vertical load is 200 kN
Total Longitudinal Movement is 100mm
Total Transverse movement is 0mm

[iv] Maximum vertical load is 5000 kN
Total Longitudinal Movement is 0mm
Total Transverse movement is 20mm

8. NOMENCLATURE

HERCULES Pot-Type Bearings are available in the following design forms :

FX	- Fixed	Fixed in all directions
FF	- Free Float	Multi-directional movement
SG	- Sliding Guided	Uni-directional movement
SGT	- Sliding Guided Transversely	Uni-directional movement in transverse direction
SGL	- Sliding Guided Longitudinal	Uni-directional movement in longitudinal direction

The above design forms will be followed by 'U' when uplift restraint is required e.g. SGU.

9. ATTACHMENT ALTERNATIVES

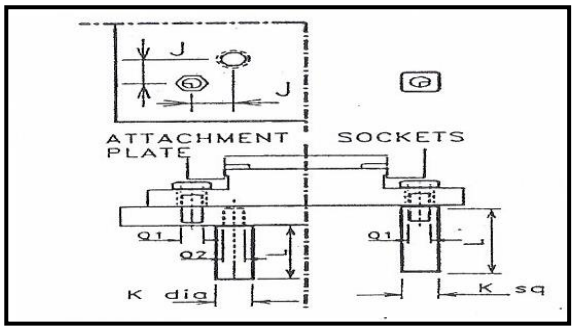
Several options are available for both top and bottom plates.

9.1 Zero option (No positive anchorage attachment bolts or cast-in)
9.2 Cast-in sockets
9.3 Attachment Plates with cast-in dowels (as per the following tables)
9.4 Attachment Plates with cast-in hold down bolts (bottom plates in particular)
9.5 Tapped holes in bearing's top and bottom plates (commonly in steel construction)

Up to 1500kN capacity (Vmax) sockets can be used without exceeding the 20 MPa mean pressure limit, i.e. Attachment plates are optional.

TABLE 6.2

Bolt Size	Standard Dowels				Standard	
M12 GR 8.8	12	25	25	100	25	100
M16 GR 8.8	16	30	32	130	32	130
M20 GR 8.8	20	35	40	160	40	160
M24 GR 8.8	24	45	45	180	45	180
M30 GR 8.8	30	55	50	220	50	220
M36 GR 8.8	36	65	62	250	62	250
M36 GR 12.9	42	75	75	300	75	300

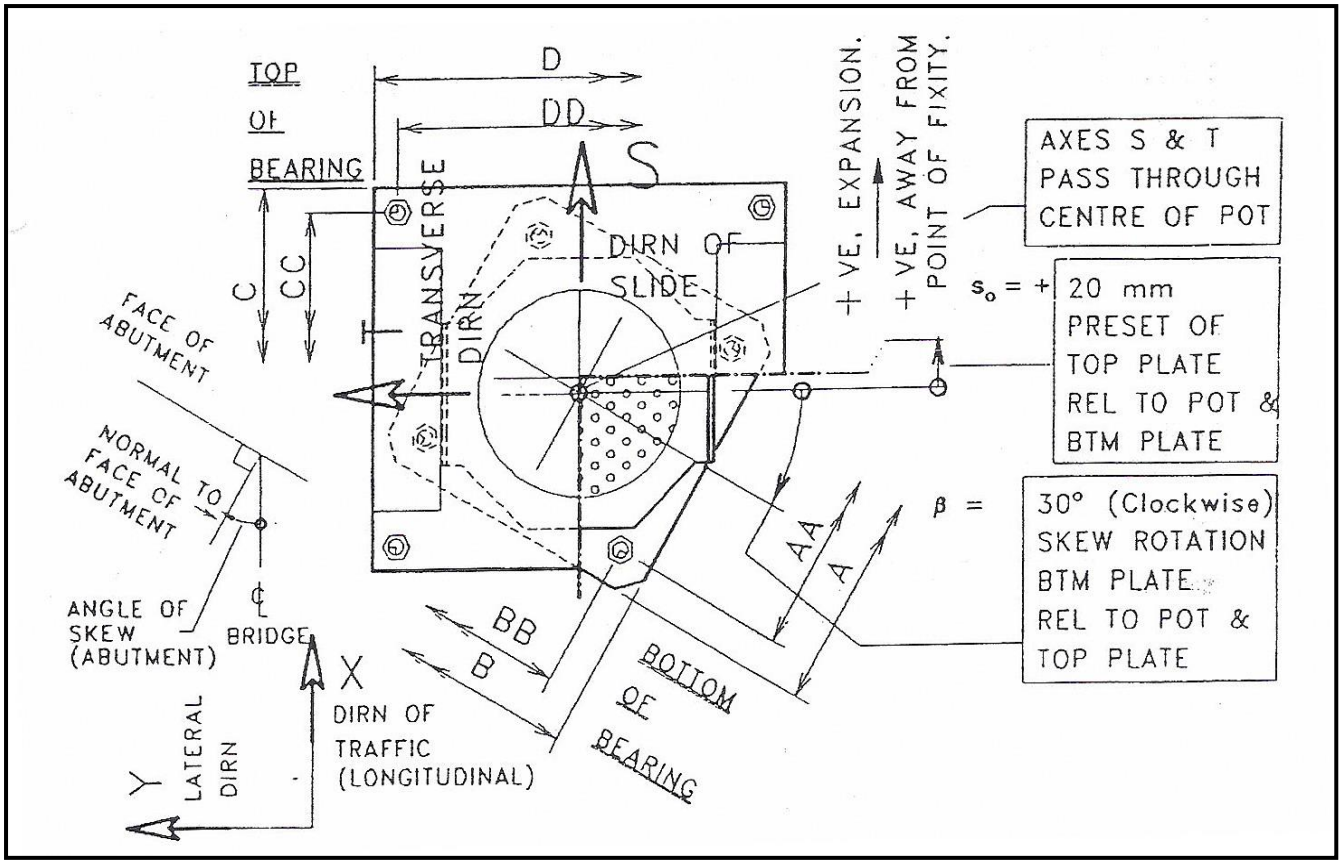


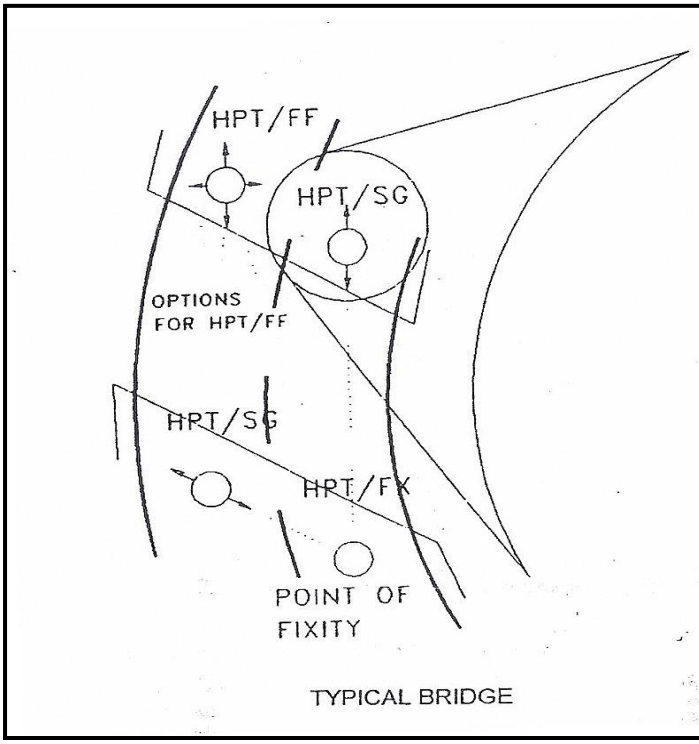
Note that in some cases standard dowels and sockets must be amended to provide uplift against overturning

10. REFERENCE AXES, TERMINOLOGY & SIGN CONVENTIONS

The sketch below indicates SIGN CONVENTIONS and TERMINOLOGY for the case of preset and skew rotation. REFERENCE AXES are also shown, S-T for the bearings and X-Y for the bridge or structure (at that location) The sketch indicates the particular case of the direction of slide (S) being parallel to the direction of traffic (X) of the highway bridge and the skew rotation of the bearing the same as that for the abutment or pier in question. In general, this may not be the case.

AXES & SIGN CONVENTIONS





TYPICAL BRIDGE

10.1 Note on Skewing

The requirement for pre-setting and skewing of bearings is rarely encountered except on highway bridges such as in the example above and at left. Even then, skewing represents an additional cost and standard bearings may not be suitable without adjustment. The alternative is to set the block outs for the bottom attachment plate dowels 'square' to the principal axis, S and at an angle to the abutment face. This is usually preferable.

10.2 Alignment of Guided Bearings

As a general rule guided bearings should be aligned (S axis) along chords radiating from the point of fixity whereas free float bearings will have several options in their orientation depending on the choice of Δs and Δt. In the case of buildings or other structures read 'Reference Direction, ℄ Girder or North or East etc. for 'Direction of Traffic', X Axis

11. GENERAL NOTES ON HANDLING OF BEARINGS DURING SITE INSTALLATION

Hercules Pot-Type bearings are manufactured to close tolerance by trained technicians working in clean conditions. To obtain the required performance from bearings it is imperative that they are properly handled at the construction site and installed with the same care as when they were assembled in the factory. The following notes will assist those responsible for specifying and supervising the installation of structural bearings.

11.1 Level and Setting

Hercules Pot-type Bearings shall be installed to specified plan alignment to within ±3mm of the correct position. They are to be set level and parallel within a tolerance of 1 in 200 in any direction.

11.2 Presetting

If the bearings are designed with preset [e.g. Where once only large movements may occur during stressing operations or skew angle of the sub-structure relative to superstructure], design engineers should specify this as a design requirement and should only be carried out in factory prior to delivery.

11.3 Storage

Hercules Pot-type bearings are protected from contamination under normal working conditions by an efficient sealing system. Care should be taken in storage to prevent contamination and damage to the working surfaces.

11.4 Site Handing

Transportation brackets are fitted to all Hercules Pot-Type bearings to ensure the working surfaces are maintained in close contact before and during installation. The brackets are normally painted RED and should not be used for slinging or suspending bearings beneath beams.

Due to the unpredictable conditions during transportation or handing on site, the alignment and presetting (if applicable) of the assembly should be checked against the drawing. Do not endeavor to rectify on site. The bearings should be returned to Hercules or when practical, a Hercules engineer should be informed to inspect or reassemble.

11.5 Bearing Plinths

Bearing must be supported on a flat rigid plinth. Bottom attachment plates must be machined flat and smooth to meet exactly with the bearings upper and lower faces. Bearing plinths may also be grouted on epoxy or non-shrink grout or by dry packing. Whichever system is preferred, it is of EXTREME IMPORTANCE that the final bedding is free from high or hard spots, shrinkage, voids, etc. Unless specified otherwise all bearings especially its PTFE sliding faces must be installed in a horizontal plane.

Large bearings which are too heavy to be lifted by hand, should be properly lifted with lifting facility e.g. Crane, forklift, etc. Correct installation of bearings is vital for its performance. Too often, expensive remedial works are required as a result of inadequate specification or sub-standard site supervision during bearing installation. Bearings should only be loaded when the grout plinth has gained sufficient strength.

11.6 Cast-in-situ Structures

All interfaces between the bearing top slide plate and form work should be protected and sealed with masking tape or alike. Owing to the loading effects of a wet concrete mass, the bearing top plates should be propped to prevent rotation and plate distortion. Free Float or Sliding Guided bearings are especially vulnerable in this respect.

11.7 Bearing Removal

We recommend to the design engineers that all pot-type bearings be incorporated with attachment plates for ease of removal without damaging any structural parts of the bridge including the grout plinths.

11.8 Transportation Bracket

All transportation brackets are temporary. Unless special bracketing has been specified, all transit brackets are NOT designed to take any forces except the self weight of the bearings and are only to be removed under engineer's instruction.

11.9 Damaged Paint Work

Touch-up paint [finish coat] can be supplied in small tins by Hercules in the event where the paint system has been damaged during transit.

Contact us for further installation information on different construction methods

SHIPPING WEIGHTS OF HERCULES POT - TYPE BEARINGS

Vertical Load(kN)	FIXED BEARINGS, HPT/FX						SLIDING GUIDED BEARINGS, HPT/SG						FREE FLOAT BEARINGS, HPT/FF		
	A Series			B Series			A Series			B Series			B Series		
	Brg. Wt. Wto (kg)	Btm. Atmt Plate Wt1 (kg)	Top Atmt. Plate Wt2 (kg)	Brg. Wt. Wto (kg)	Btm. Atmt Plate Wt1 (kg)	Top Atmt Plate Wt2 (kg)	Brg. Wt. Wto (kg)	Btm. Atmt Plate Wt1 (kg)	Top Atmt Plate Wt2 (kg)	Brg. Wt. Wto (kg)	Btm. Atmt Plate Wt1 (kg)	Top Atmt Plate Wt2 (kg)	Brg. Wt. Wto (kg)	Btm. Atmt. Plate Wt1 (kg)	Top Atmt. Plate Wt2 (kg)
300	12	5	7	10	3	5	23	5	9	16	3	7	12	3	7
500	17	6	8	13	4	7	31	6	12	21	4	8	16	4	8
750	26	11	14	21	8	14	47	11	21	38	8	15	30	8	15
1000	33	13	17	25	9	16	61	13	25	45	9	17	36	9	17
1250	37	15	20	31	10	18	75	15	27	52	10	19	42	10	19
1500	48	24	25	38	13	23	94	24	36	62	13	21	51	13	21
1750	54	25	28	45	15	22	104	25	40	73	15	24	60	15	24
2000	63	28	32	55	16	25	120	28	45	88	16	28	73	16	28
2500	77	48	51	67	27	41	169	48	69	110	27	42	91	27	42
3000	98	52	57	82	31	46	195	52	78	133	31	48	111	31	48
3500	116	57	66	101	38	56	226	57	90	173	38	56	146	38	56
4000	157	65	74	126	43	62	266	65	100	198	43	62	168	43	62
5000	169	103	121	152	62	101	332	103	147	239	62	83	205	62	83
6000	239	123	140	183	77	124	415	123	170	285	77	97	245	77	97
7000	304	149	159	221	93	150	469	149	196	348	93	109	303	93	109
8000	358	173	182	280	108	174	553	173	223	421	108	122	370	108	122
9000	358	199	200	327	141	194	636	199	246	479	141	135	419	141	135
10000	425	215	216	376	172	210	701	215	258	520	172	167	457	172	167
12500	597	261	263	522	232	256	965	261	315	727	232	226	643	232	226
15000	733	339	308	641	340	300	1168	339	371	911	339	292	88	339	292
17500	770	440	362	811	401	355	1351	440	415	1191	400	343	163	400	343
20000	1074	539	411	968	540	399	1602	539	471	1392	539	431	1245	539	431
25000	1418	791	577	1373	792	540	2193	791	628	1895	791	579	1702	791	579
30000	1895	1061	811	1828	1062	763	2818	1061	877	2462	1061	814	2219	1061	814

DESIGN SCHEDULES OF ALL TYPES OF BEARINGS ARE AVAILABLE IN THE HERCULES POT TYPE BEARING (HPT SERIES) CATALOGUE

SPECIFICATION

CONTENTS

1. GENERAL

1.1 Description

The work specified in this sub-section includes the design, manufacture, supply and installation of Hercules Engineering Pot-type Bearings or approved equivalent.

Each pot-type bearing shall consist of disc of elastomer confined in a steel pot inverted over a piston to allow self-draining of water. The horizontal movement if required shall be provided be means of a P.T.F.E pad sliding against a smooth, truly plane stainless steel mating surface.

1.2 Design and Applicable Codes

Unless otherwise specified in this specification, all bearing shall be designed, manufactured and installed in accordance to the requirements of Part 9 of BS 5400 and bearing schedule provided on the drawing.

1.3 Manufacturer

The bearing manufacturer proposed as supplier for the bearings shall have NOT less than 10 years successful experience in manufacturing similar type and capacity bearings. The proposed bearing manufacturer must also be accredited to Quality Assurance ISO 9001.

2. INFORMATION TO BE SUBMITTED

The Contractor shall supply the following information for each bearing type:

a) Name of Manufacturer & Quality Management

b) Drawings of all bearing types showing
-Plan and elevation of the bearings.
-Bearing locations and directions of slide.
-Rated loads and movement capacities.

c) Design calculations showing
-Maximum average pressure on P.T.F.E
-Maximum design pressure on elastomeric pad.

d) Installation and replacement instruction

e) Any variation from drawings or specification

3. BEARING PROPORTIONS AND MATERIALS

3.1 Pot and Elastomer

Each bearing shall be proportioned so that at the maximum vertical load shown on the drawings, the average pressure on the Elastomeric disc does not exceed 40 MPa. The dimensions of the elastomeric disc shall be such that, at the maximum vertical strain, the design rotation must be achieved.

3.2 Sliding bearings

The PTFE pad shall have minimum thickness of 4mm and a maximum thickness of 6mm. The PTFE pad shall be adhesive bonded and restrained by recessing it into the backing material to a depth of half the thickness of the PTFE.

Two-lip wiper seal shall be incorporated around the perimeter of the PTFE to protect the PTFE from dirt ingress and excessive draining of lubricant.

The mating surface shall consist of approved stainless steel sheet. The sliding bearing design of the stainless steel shall comply with the following requirements:

a) Stainless steel sliding surface shall completely cover the PTFE surface in all operating positions of the bearing.

b) Stainless steel sliding surface shall be positioned so that the sliding movement causes the dirt and dust accumulation to fall from the surface of the stainless steel without contaminating the PTFE.

The backing material to the PTFE and mating surface shall be sufficiently rigid to ensure the PTFE layer is uniformly loaded. The average pressure on the PTFE layer shall not exceed 45 MPa under the maximum load.

Where guides are provided on bearings to resist transverse forces, these shall be faced with fixed PTFE or similar material.

4. PROPERTIES OF MATERIALS

4.1 Stainless Steel

The stainless steel used in the manufacture of the sliding surface shall be Grade 316 S16.

4.2 PTFE (Poly Tetra Fluoro Ethylene)

The PTFE sliding pad shall consist of unfilled PTFE sheet.

The resin used in the manufacture of PTFE sliding pads shall be 100 % virgin material with a relative density of 2.13 to 2.23 and durometer hardness of 50 to 65.

4.3 Elastomer

The physical properties of the compounded and cured elastomeric material specified for Hercules Engineering in Table A shall strictly be complied with and tested for in the event that the contractor proposes an alternative equivalent.

Contractor shall submit three samples to be tested from every independently mixed batch or less of mixed elastomeric material and each sample shall meet the requirements specified.

TABLE A PROPERITES OF ELASTOMER

PROPERTY	REQUIREMENTS
Hardness	50 points minimum
Ultimate Tensile Strain	4.75
Tensile Strength	17.0 MPa min.
Tear Resistance	40.0 kN/m min
Compression set - 22 hours -70 degree Celsius	30% max.
*Ozone resistance	No visible cracks after 100 hours
Accelerated ageing	Maximum permissible change in properties: Hardness +4 Tensile Strength 1.0% Ultimate Tensile Strain 15%

*Evidence of recent testing of identical material may be accepted by the Engineer

5. INSPECTION OF BEARINGS

Each bearing shall be dismantled and visually inspected by the Engineer, at the manufacturer's works, prior to the delivery.

6. TESTING OF BEARINGS

6.1 General

One representative bearing selected by the Engineer from every 10 bearings, or part thereof, of each size and type of bearings delivered at one time, shall be tested. The cost of this testing shall be borne by the Contractor.

Testing shall be carried out at a laboratory approved by the Engineer and the method of testing the bearings shall be subject to the approval of the Engineer. The equipment for testing bearings shall be capable of determining loads to an accuracy of ±3% and deflections to ±1%. Where necessary, to achieve the specified accuracy for testing, equipment shall be calibrated and test results corrected accordingly. All testing shall be carried out in the presence of the Engineer of his representative, who shall be given at least one week prior notice of the test.

6.2 Test Loads

Bearings shall be loaded in compression to 1.5 times the maximum vertical load shown on drawings and the load shall be maintained for a minimum of two minutes. Bearings which are required to resist lateral forces shall be further tested to 1.5 times the lateral load stated on the drawings. The load shall be maintained for two minutes.

6.3 Test for coefficient of friction

In addition to testing to the requirements of clause 6.2 for vertical and lateral forces, the coefficient of friction of sliding surfaces of sliding bearings shall be determined. The value of the coefficient of friction shall be taken as the average result of three (3) tests and shall be determined for both maximum and minimum vertical loads shown on the drawings. Friction tests shall be performed at room temperature.

The friction coefficients of the tests with sliding surface NOT lubricated and then later lubricated with the lubricant to be used in service shall be recorded. The bearings may be given two preliminary sliding runs under the load prior to talking the test readings. The friction coefficient of the sliding surfaces NOT lubricated shall NOT exceed the valued given in Table B for the relevant stresses on the PTFE surface. Values shall be interpolated for immediate bearing pressures.

6.4 FRICTION COEFFICIENT OF SLIDING SURFACES

TABLE B

Bearing Pressure	5 MPa	15 MPa	20 MPa	30 MPa or greater
Friction Coefficient	0.08	0.05	0.04	0.03

6.5 Inspection

After testing, the stainless steel shall be checked for flatness. The bond to the backing plate shall be unaffected. The PTFE shall be free from mechanical damage. The elastomeric pad shall show no damage. For compliance, tested bearings shall show no apparent surface flaws.

7. TEST CERTIFICATES

The Contractor shall furnish certified Test Reports, Material Certificates and a Certificate of Compliance for each bearing.

8. CORROSION PROTECTION

All steel edges shall be chamfered 2mm before treatment of protective coating. The protective treatment for the exposed parts of bearings shall be painted by sand blasting to Class 2.5, followed by the application of Inorganic Zinc-In-Silicate undercoat (75µm); exposed edges shall have a further two coats of Epoxy MIO (100µm each). All paint coats shall be factory applied prior to assembly of the bearings.

All cast in sockets, washers, screws and bolts shall be hot-dip galvanized.

9. PRODUCT DELIVERY, STORAGE AND HANDLING

9.1 Marking and Assembly

Each pot bearing shall be assembled at the plant, marked for identification and delivered to the construction site as a complete unit. Each bearing shall be marked to indicate the normal position of the bearing and the principal direction of slide in the case of sliding bearing. Permanent tags indicating name of manufacturer, year of manufacture, bearing type and design capacities of the bearing shall be installed on each bearing.

Clear details on lifting arrangement, including eyebolts, shall be provided. The transportation brackets shall be removed within 2 days of first set of the concrete.

9.2 Care and Protection

During handling, transport, storage and installation, bearings shall be kept clean and free from contaminants and other deleterious effects.

10. INSTALLATION

All bearings which have been pre-assembled with skew angle, preset, if required and shall not be dismantled, except with the prior approval of the consultant. If for any reason the bearing has to be dismantled, it shall be done under specialist supervision and the manufacturer's assistance shall be sought.

All bearings shall be installed in accordance to the manufacturer's instructions and under the supervision of the bearing specialist from the manufacturer.

The grout used for setting the cast in sockets and bearing seating shall be high strength non-shrink cementations grout, minimum strength of 50 N/mm^2……. at 28 days.

The bearings shall be installed without concrete or dirt on the slide faces, and with all components horizontal.

11. BEARING REPLACEMENT

All bearings shall be installed in such a manner that they can be replaced sometime in the future subject to a limiting vertical lift of the superstructure of 5 mm. All bearings shall be designed with necessary suitable handling attachments to the bearings to facilitate the replacement process. Replacement would require jacking space. All bearing shall be designed such that the attachment bolts, having jacked up the superstructure, can be removed and the bearing would be able to slide out horizontally.

The superstructure shall be designed such that when it subject to 5mm vertical lift during replacement of bearings, would not cause excessive strain of cracks.

12. MAINTENANCE PROGRAM

12.1 Painting

The bearing shall require painting every 20 years. However, if the bearing shows any sign of corrosion during inspection, the engineer should be informed so that the bearing can be repainted.

12.2 Cleaning

Cleaning of dirt or moisture on the surface of stainless steel should be performed once every five (5) years.

12.2.1 Movement

Inspection should be made of the movement indicators installed on the bearings if the movement in any direction exceeds the design movements indicated on the bearing, the engineer should be informed so that the bearing can be made good.

12.2.2 Dirt or moisture

Any dirt or moisture on the surface of the stainless steel should be cleaned during each inspection.