BEARING TECHNOLOGIES

POT BEARINGS
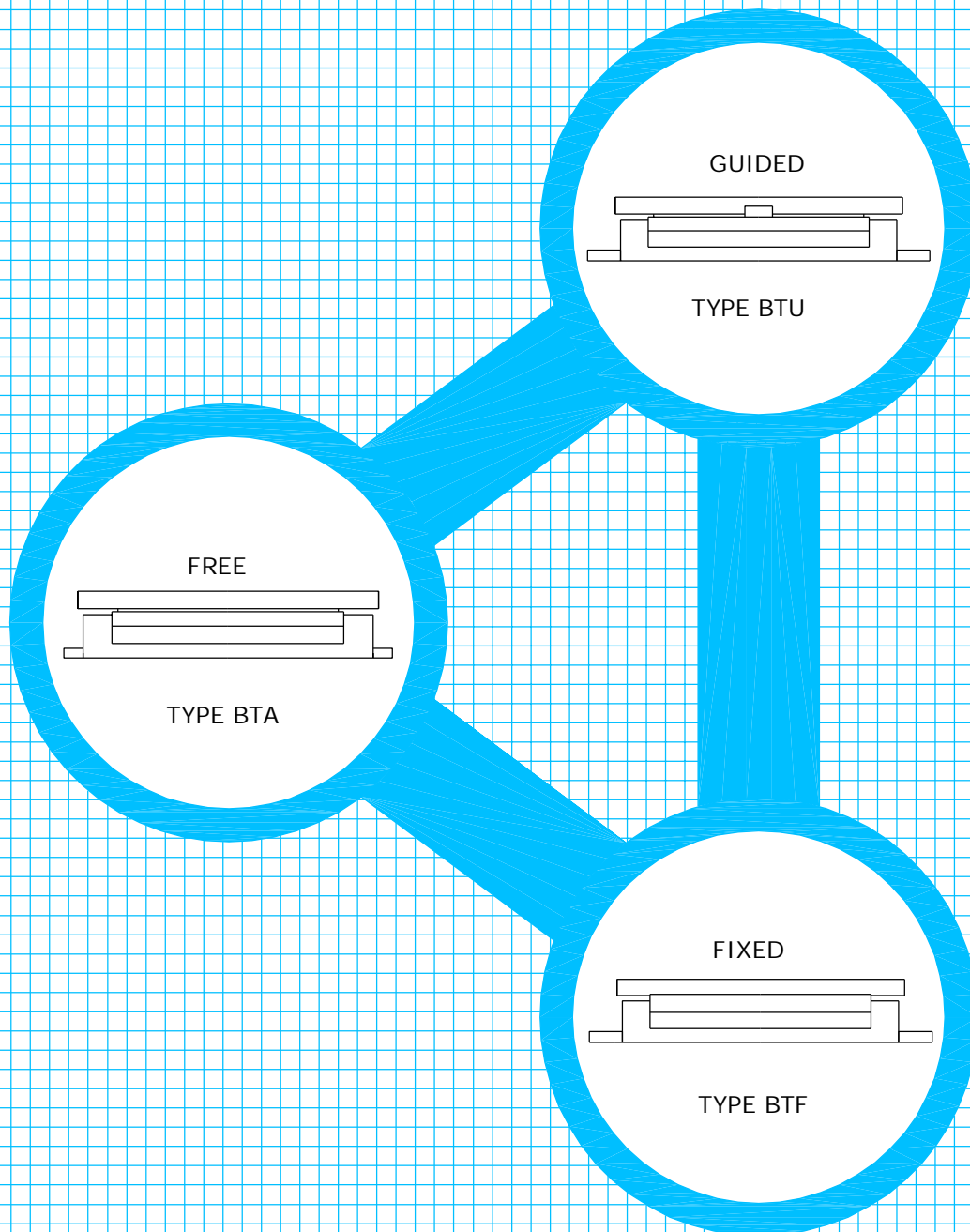# FOR BRIDGES AND STRUCTURES

GUIDED

TYPE BTU

FREE

TYPE BTA

FIXED

TYPE BTF

Dec 2012

POT BEARINGS

In most concrete and steel structures accommodation must be made for relative movement between structural members in order to avoid the build-up of dangerous stresses. The source of this movement may be:

❑ Thermal expansion and contraction
❑ Permanent creep and shrinkage
❑ Post tensioning strain
❑ Live load deflections
❑ Earth movement

It is usually desirable to minimise the resistance forces and moments resulting from these movements and this is the primary function of Structural Bearings.

BEARING TECHNOLOGIES range of Pot Bearings provide this function by the most efficient method using well proven concepts combined with modern manufacturing technology and advanced materials.

This is achieved by exploiting the unique low-friction properties of PTFE (polytetrafluoroethylene) and the semi-hydraulic behaviour of restrained elastomers.
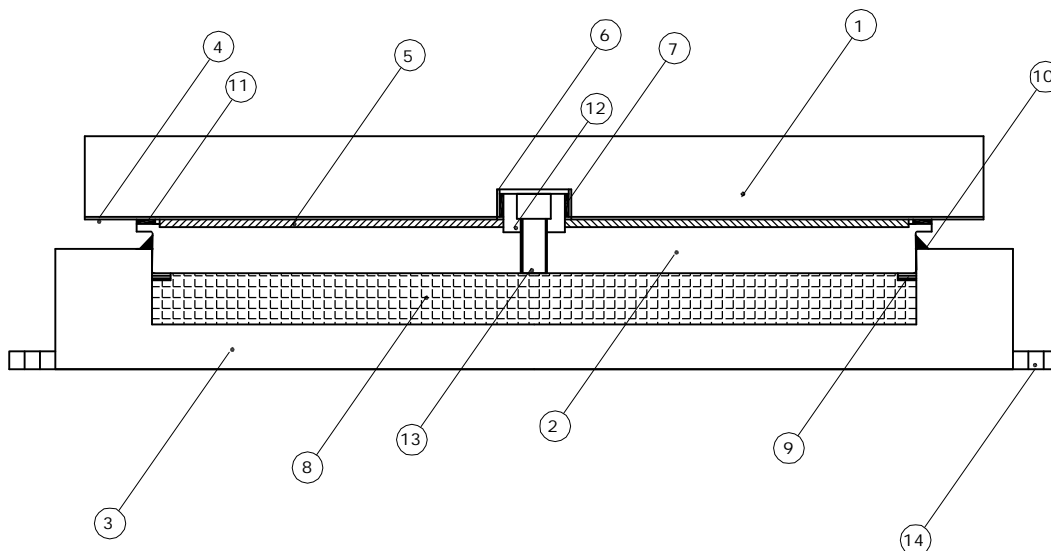
PTFE

PTFE is a well known polymer which possesses some remarkable properties. The coefficient of friction when sliding against a polished surface can be as low as 0.01 which compares with ice sliding on ice. In addition, its coefficient of friction is the lowest at highest specific pressures which make it particularly suitable for use in structural bearings.

CSB10 (DU)

CSB10 is a proprietary composite material comprising a PFTE mixture impregnated into a metallic structure. It is capable of withstanding extreme pressures whilst possessing similar friction properties to those of pure PTFE. It is used in *BEARING TECHNOLOGIES* Pot Bearings for highly stressed components.

ELASTOMERS

In order to minimise space requirements, Pot Bearings are designed for relatively high contact pressures against the structure. This also ensures lowest friction values. Most elastomers cannot sustain such pressures in their free state and must be effectively contained to prevent overstraining. When constrained in this way, the elastomer behaves as a semi-viscous fluid and can safely accomodate useful degrees of angular displacement. All *BEARING TECHNOLOGIES* Pot Bearings can safely accomodate 0.01 radians rotation about any axis.

CONSTRUCTION   Typical type BTU guided Pot Bearing

| item	description	item	description
1	top plate	8	rubber disc
2	piston	9	piston sealing rings
3	pot	10	pot sealant
4	sliding plate	11	dust seal
5	PTFE	12	guide key
6	guide bar bearing strip	13	guide key screws
7	stainless guide strip	14	levelling bracket

DESIGN AND MANUFACTURE

BEARING TECHNOLOGIES Pot Bearings are designed in accordance with BS 5400 Pt 9:1983. Material specifications are selected to ensure reliability, longevity and continuity of supply.

Manufacturing is processed in modern well equipped workshops specialising in precision engineering and operating to quality assurance systems in terms of SABS ISO 9002.

A heavy duty corrosion protection system is applied to all exposed surfaces not embedded in concrete. This comprises zinc-rich epoxy primer with subsequent coats of Micacious Iron Oxide epoxy (MIO) paint. Experience has shown that this system is more consistently reliable in protecting exposed areas than other specifications although alternative systems can be used if specified by customers.
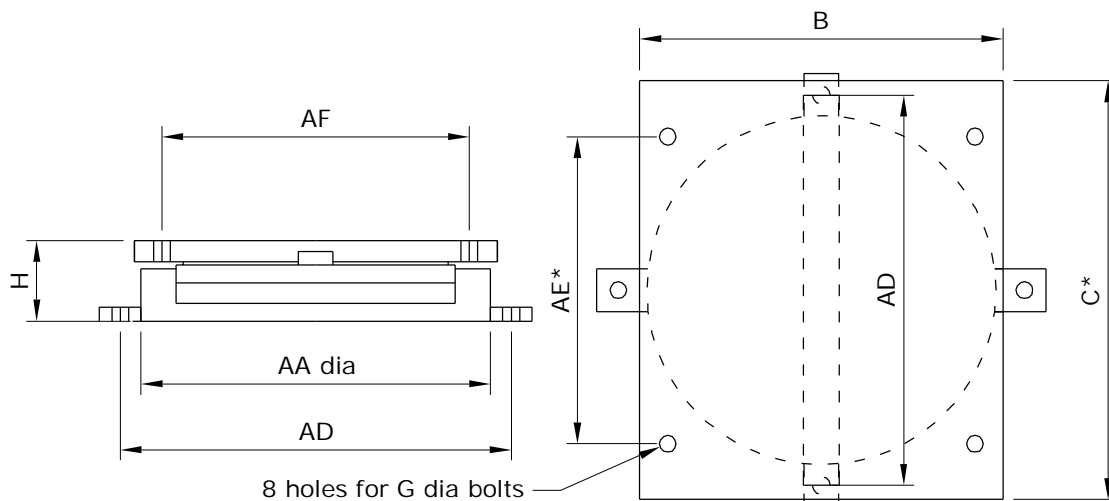
POT BEARINGS-FREE Type BTA

8 holes G dia
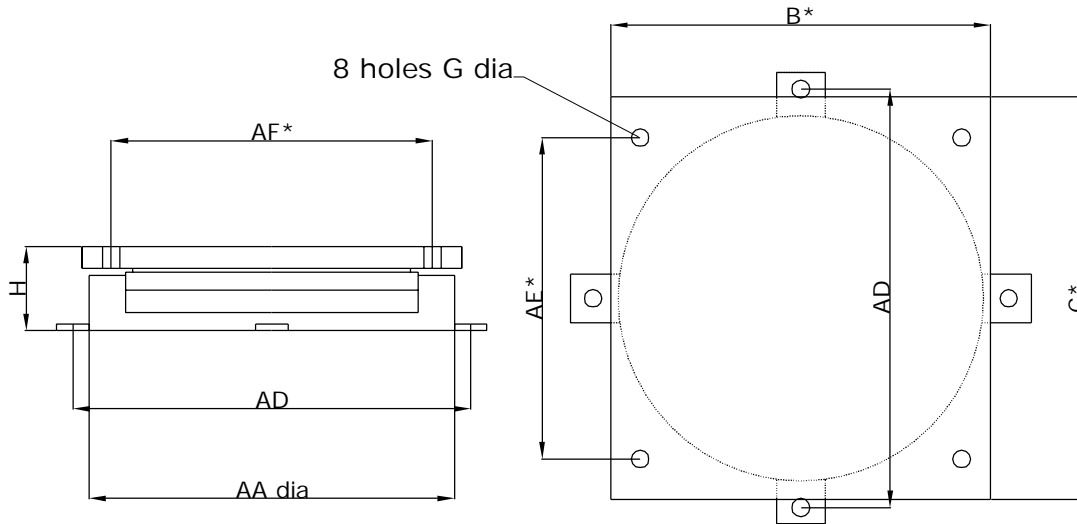
Bearing Reference No.	Max.vert. load kN	Base dia. AA mm	Pl width B mm	Pl length C mm	Hole ctrs AD mm	Hole ctrs AE* mm	Hole ctrs AF* mm	Hole dia G mm	Height H mm	Net mass kg
BTA50/20/*/*	500	197	207	207	250	170	170	14	49	10
BTA75/20/*/*	750	234	236	236	290	200	200	14	50	13
BTA100/20/*/*	1000	265	265	265	320	230	230	14	57	20
BTA125/20/*/*	1250	293	293	293	345	245	245	14	64	27
BTA150/20/*/*	1500	317	317	317	370	270	270	14	70	36
BTA175/20/*/*	1750	342	342	342	395	295	295	14	73	44
BTA200/20/*/*	2000	366	366	366	420	320	320	14	78	53
BTA250/20/*/*	2500	409	409	409	470	345	345	18	84	72
BTA300/20/*/*	3000	450	450	450	510	385	385	18	89	92
BTA350/20/*/*	3500	472	472	472	535	410	410	18	100	117
BTA400/20/*/*	4000	505	505	505	565	440	440	18	104	141
BTA450/20/*/*	4500	536	536	536	595	470	470	18	111	170
BTA500/20/*/*	5000	565	565	565	625	470	470	18	116	194
BTA550/20/*/*	5500	592	592	592	655	495	495	18	120	223
BTA600/20/*/*	6000	619	619	619	680	525	525	18	124	252
BTA700/20/*/*	7000	668	668	668	730	570	570	18	131	311
BTA800/20/*/*	8000	714	714	714	775	620	620	18	145	390
BTA900/20/*/*	9000	758	758	758	820	660	660	18	144	440
BTA1000/20/*/*	10000	799	799	799	860	705	705	18	154	530
BTA1200/20/*/*	12000	875	875	875	940	780	780	18	164	670
BTA1400/20/*/*	14000	945	945	945	1010	815	815	18	175	831
BTA1600/20/*/*	16000	1010	1010	1010	1075	880	880	18	184	1002
BTA1800/20/*/*	18000	1071	1071	1071	1135	945	945	18	193	1182
BTA2000/20/*/*	20000	1129	1129	1129	1190	1000	1000	18	202	1372

The average bearing pressure on the concrete is 20Mpa.

All dimensions are for bearings with +/-10mm movement in both directions. For larger movements dimensions B,C,AE,AF are increased accordingly. The suffix //* in the Reference No. indicates required +/- movement in Longitudinal and transverse directions respectively.

POT BEARINGS- UNIDIRECTIONAL Type BTU

8 holes for G dia bolts

Bearing Reference No.	Max.vert. Load	Max.horiz load	Base dia. AA	Pl width B	Pl length C*	Hole ctrs AD	Hole ctrs AE*	Hole ctrs AF	Hole dia G	Height H	Mass
	kN	kN	mm	mm	mm	mm	mm	mm	mm	mm	kg
BTU50/20/*	500	100	209	209	242	265	205	175	14	71	20
BTU75/20/*	750	100	242	242	271	295	235	205	14	74	27
BTU100/20/*	1000	100	273	273	296	325	260	235	14	75	34
BTU125/20/*	1250	125	302	302	318	365	255	240	18	78	41
BTU150/20/*	1500	150	329	329	336	390	265	265	18	84	53
BTU175/20/*	1750	175	354	354	357	415	290	290	18	88	62
BTU200/20/*	2000	200	377	377	377	440	315	315	18	90	71
BTU250/20/*	2500	250	419	419	419	490	340	340	22	101	99
BTU300/20/*	3000	270	457	457	457	530	375	375	22	105	120
BTU350/20/*	3500	298	492	492	492	565	410	410	22	116	157
BTU400/20/*	4000	320	525	525	525	605	430	430	27	120	183
BTU450/20/*	4500	338	556	556	556	635	460	460	27	125	214
BTU500/20/*	5000	375	585	585	585	665	440	440	27	127	237
BTU550/20/*	5500	385	612	612	612	690	470	470	27	132	270
BTU600/20/*	6000	420	639	639	639	720	495	495	27	136	304
BTU700/20/*	7000	455	688	688	688	780	510	510	33	140	357
BTU800/20/*	8000	520	734	734	734	825	555	555	33	149	435
BTU900/20/*	9000	585	778	778	778	870	600	600	33	155	498
BTU1000/20/*	10000	650	819	819	819	910	640	640	33	165	591
BTU1200/20/*	12000	720	895	895	895	985	715	715	33	174	739
BTU1400/20/*	14000	840	965	965	965	1070	750	750	39	187	920
BTU1600/20/*	16000	880	1030	1030	1030	1135	815	815	39	193	1075
BTU1800/20/*	18000	900	1091	1091	1091	1195	875	875	39	200	1248
BTU2000/20/*	20000	1000	1149	1149	1149	1255	935	935	39	209	1440

The average bearing pressure on the concrete is 20Mpa.

All dimensions are for bearings with +/-10mm movement . For larger movements dimensions C & AE are increased accordingly. The suffix //* in the Reference No. indicates required +/- movement in longitudinal direction.

+ The maximum horizontal load can only be applied if it is less than 33 % of the simultaneous vertical load.
Beyond this limit and for higher horizontal loads special designs are available.

BEARING TECHNOLOGIES

POT BEARINGS-FIXED Type BTF

8 holes for G dia bolts
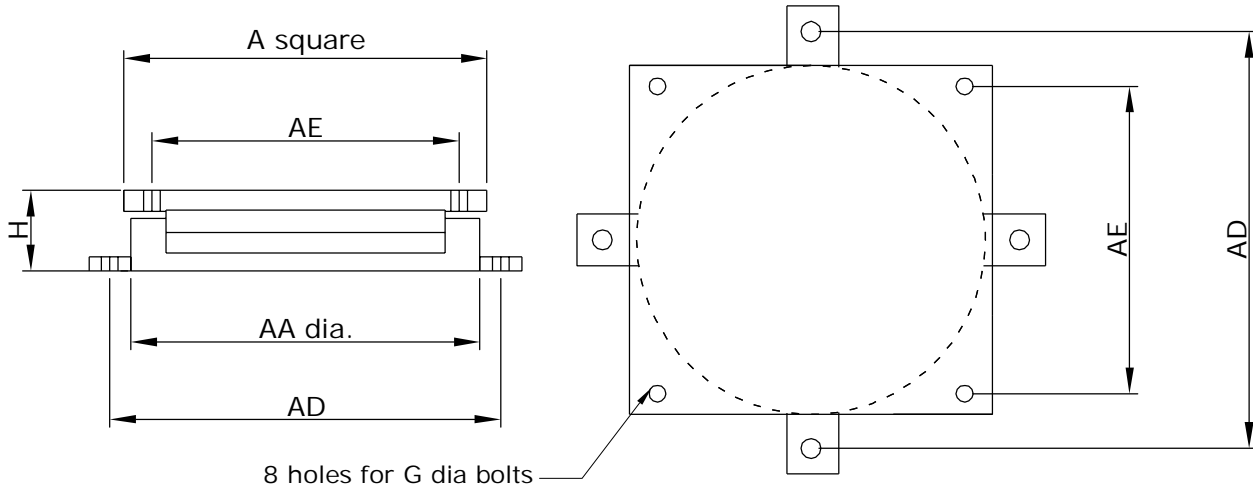
Bearing Reference No.	Max.Vert. Load kN	Max.Tran. Load kN	Base dia. AA mm	T/P sq B mm	Hole ctrs AD mm	Hole ctrs AE mm	Hole dia G mm	Height H mm	Mass kg
BTF50/20	500	100	209	179	265	145	14	49	12
BTF75/20	750	150	248	219	310	170	18	51	18
BTF100/20	1000	190	281	253	345	205	18	56	25
BTF125/20	1250	230	309	282	370	220	18	64	34
BTF150/20	1500	270	333	309	400	230	22	70	44
BTF175/20	1750	310	358	334	425	255	22	73	53
BTF200/20	2000	350	384	357	455	275	22	79	65
BTF250/20	2500	390	425	399	500	305	26	84	85
BTF300/20	3000	440	466	437	540	340	26	88	106
BTF350/20	3500	480	492	472	570	375	26	102	141
BTF400/20	4000	520	525	505	605	410	27	107	168
BTF450/20	4500	560	556	536	645	415	33	113	200
BTF500/20	5000	600	585	565	675	385	33	116	225
BTF550/20	5500	700	612	592	700	410	33	120	255
BTF600/20	6000	800	639	619	730	440	33	124	288
BTF700/20	7000	900	688	668	790	450	39	131	352
BTF800/20	8000	980	734	714	835	500	39	143	440
BTF900/20	9000	1060	778	758	885	540	39	147	503
BTF1000/20	10000	1140	819	799	925	585	39	156	597
BTF1200/20	12000	1220	895	875	1000	660	39	163	735
BTF1400/20	14000	1300	965	945	1080	695	45	176	915
BTF1600/20	16000	1400	1030	1010	1145	760	45	185	1097
BTF1800/20	18000	1500	1091	1071	1210	820	45	194	1288
BTF2000/20	20000	1600	1149	1129	1265	875	45	203	1489

The average bearing pressure on the concrete is 20 MPa.
The maximum horizontal load can only be applied if it is less than 33% of the simultaneous vertical load.

CONCRETE PRESSURES

BEARING TECHNOLOGIES Pot Bearings are designed for average structure interface pressures approaching 20Mpa. Where concrete strengths are inadequate to support this locally applied pressure a layer of higher strength concrete or epoxy mortar can be used to reduce the pressure to lower values. This is more economic than the use of larger bearings.

FIXING ARRANGEMENTS

Type BTA

Although free bearings require no provision for the transfer of horizontal forces to the structure other than by the friction, it is prudent to use fixing bolts as means of ensuring correct location and bearings are provided with bolt holes for this purpose.

Types BTU and BTF

Bolt holes in the top and base plates are provided to assist the transfer of horizontal forces to the structure as well as for location purposes.

In concrete structures it is convenenient to provide screwed sockets (anchor bars) which are embedded into the concrete to transfer horizontal forces. This system enables bearings to be removed relatively simply if ever required. The sockets are bolted to the bearing before installation and grouted into pre-formed pockets in the sub-structure before casting of the superstructure. Recommended dimensions of these anchor bars are shown below.
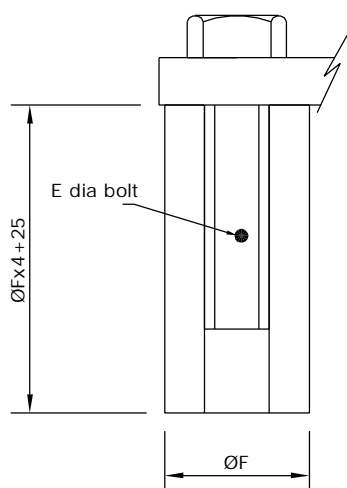
Bearing size ref.	BTA type		BTU type		BTF type	
	Bolt size E mm	anchor ØF mm	Bolt size E mm	anchor ØF mm	Bolt size E mm	anchor ØF mm
50	12	20	12	20	12	20
75	12	20	12	20	16	25
100	12	20	12	20	16	25
125	12	25	16	25	16	25
150	12	25	16	25	20	30
175	12	25	16	25	20	30
200	12	25	16	30	20	30
250	16	30	20	30	24	40
300	16	30	20	30	24	40
350	16	30	20	30	24	40
400	16	30	24	35	24	40
450	16	30	24	35	30	45
500	16	30	24	35	30	45
550	16	30	24	35	30	45
600	16	30	24	35	30	45
700	16	30	30	45	36	50
800	16	30	30	45	36	50
900	16	30	30	45	36	50
1000	16	30	30	45	36	50
1200	16	30	30	45	36	50
1400	16	30	36	50	42	60
1600	16	30	36	50	42	60
1800	16	30	36	50	42	60
2000	16	30	36	50	42	60

E dia bolt

ØFx4+25

ØF

INSTALLATION

Correct installation of all types of structural bearings is critical to their performance. The most important aspects of installation are:

- Ensuring intimate surface contact with the structure-there must be absolutely no voids above or below the bearings.
- Cementatious or epoxy grout must be properly mixed and must be of adequate strength.
- Bearing orientation and presets must be carefully checked and adjusted where necessary.
- Horizontal and vertical alignment.
- Where applicable, anchor bars must be substantially encased within the steel reinforcement of concrete members.
- Prevention of contamination, especially slurry, of the exposed stainless steel sliding surfaces.
- Preventing mechanical damage to the corrosion protection system.

SUPPLEMENTARY INFORMATION

ROTATION

BT Pot Bearings are designed for 0.01 radians rotation about any axis. When rotation occurs the moment of resistance from the rubber disc is transferred to the structure. The value of this moment at 20°C :

$$Mr = 4.5 \times 10^{-7} \times AA^3 \text{ kN-m} \quad \text{where AA is from the tables pages 3-5}$$

This moment results in an increase in concrete pressure at one edge of the bearing and a corresponding decrease at the opposite edge:

The maximum value is Δ_{fc} = 4.8 Mpa. This value is reduced proportionately with lower rotation angles.

FRICTION

The coefficient of friction of the sliding surfaces can be assumed to vary between 0.015 to 0.05 depending on a number of operating variables. The most important is specific pressure. The graph below illustrates this relationship. It is safe, however, to assume a C of F of 0.03 under maximum load conditions.

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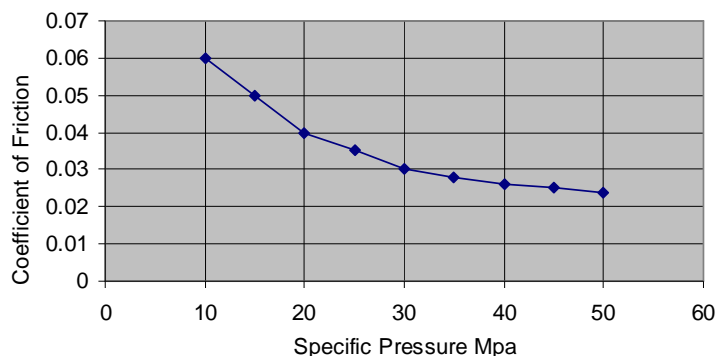
HORIZONTAL FORCES

Horizontal forces can result from vehicle braking, wind force, centrifugal forces, earth movements and friction. The bearing configuration in the structure has an important influence on how these forces are distributed. The clearances between bearing components, although generally less than 1mm, may exceed the local elasticity of the structure and thus the horizontal forces may not be shared evenly between adjacent fixed or guided bearings. Typical bearing layouts are shown below.


Type BTU

Type BTA

Type BTF
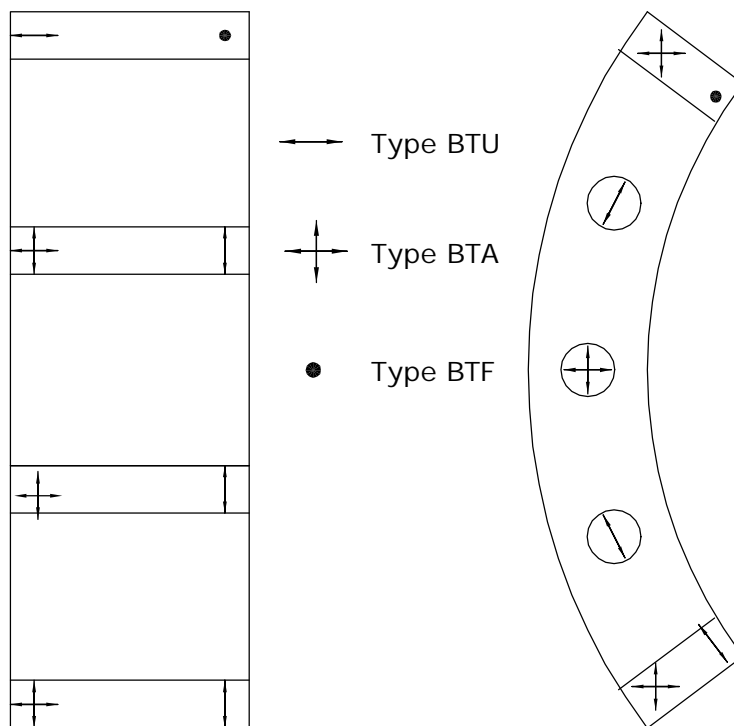
The maximum horizontal forces that can be safely accomodated by BTU and BTF type bearings are shown in the tables. It must be emhasised, however, that these forces can only be applied with a simultaneous vertical load of at least 3 times the horizontal force. When the vertical load is less than this the horizontal load capacity is reduced proportionately in the interests of stability.

SPECIAL DESIGNS

Where loading parameters are outside the limits of these Standard Pot Bearings, special designs can be produced to accomodate virtually any combination of loadings and movements.

OTHER STRUCTURAL BEARING TYPES AVAILABLE

BD series
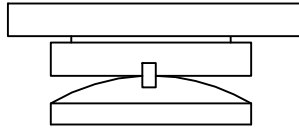
Sliding
High rotation about 1 axis
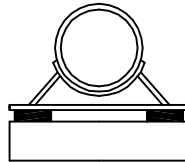Up to 5000kN

BT series

Sliding
Rotation about all axes
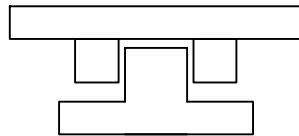Up to 20000kN

BA series
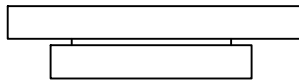
Plain sliding
No rotation
Up to 2000kN

BP series

Pipe support bearings
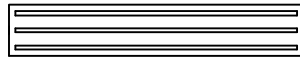Rotation up to 0,04 radians
Up to 60kN
Unlimited movement

BV series

Horizontal guide
No transverse rotation
No vertical load capacity

BK series

Strip bearings
Up to 350kN/meter
Movement <10mm

BR series

Laminated rubber bearings
Limited rotation and movement
Up to 4000kN