

# **SPHERICAL** BEARINGS

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#### Description

G Series is a range of spherical structural bearings designed to permit angular rotations about any axis. Fixed, Free & Constrained bearings are available as standards to support loads up to 30,000kN.

The bearings fully meet the requirements of the British Department of Transport and BS5400 Section 9.

They are manufactured to meet all know quality standards throughout the world.

#### **Bearing Types**

The G range of bearings are available in three types: -

10G	Fixed
11G	Free to move in one horizontal direction
12G	Free to move in any horizontal direction

#### **Typical 11G Details - Exploded View**



#### Attachment

Fixing holes are provided in the top and base members of the bearings. This enables a variety of fixing methods to be used. Standard fixings are designed to ensure the bearings can be removed as simply as possible. See page 10.

#### **Support and Installation**

Important - See pages 11 - 13 for Installation and Maintenance.

**Spherical Bearings** 

#### **Concrete Stress**

Where suitable reinforcement of the concrete has been provided the allowable concrete stress is dependent on the relative dimensions of the bearing/structure interface, the total support area and the characteristic strength of the concrete. The stress on the structure should therefore be checked to ensure that it is acceptable.

At the **Nominal Rating** capacity tabulated the mean stress approaches 20N/mm<sup>2</sup>.

#### **Design Loads**

The designation of loadings varies depending on the design code employed. The tabulated load capacities list Nominal rating, at which load the base concrete stress is 20N/mm<sup>2</sup> maximum. The working stress / serviceability limit state maximum loads are determined by the allowable PTFE stresses. The ultimate limit state maximum load characteristics are determined by the strength characteristics of the bearing and incorporate the material and partial safety factors  $\gamma_m$  and  $\gamma_{13}$  as required by BS5400.

The practice of stating working loads, or nominal loads is inappropriate for limit state designs. The SLS and ULS capacities represent design load effects, i.e. nominal loads to which ALL the appropriate factors have been applied. Factored loads must be provided to ensure correct bearing selection.

#### Rotation

All the bearings can rotate at least 0.035 radians about any horizontal axis. The maximum for each bearing is shown in the tables.

#### Translations

The dimensions for the 11G (Constrained) and 12G (Free) bearings are shown in the tables for the following movements -

Long	itudinal	Trans	sverse
11G	100mm total	11G	NIL (see page 6)
12G	100mm total	12G	20mm total

## **G** - Series

Movements in increments of 50mm total can be supplied. The top plate dimensions and the top fixing centres should be increased accordingly.

### Note: **11G bearings should not be used where movement is** required at right angles to the constraint.

The required movements should be specified in the part number as described opposite.

#### Fig. 1 G Spherical Bearing - Free



#### Fig. 2 G Spherical Bearing - Fixed



### **Spherical Bearings**

### **Designation of Part No.**

The part number of a bearing is simply built up as below -

#### Examples:

	Туре	Maximum Working Load (kN)	Move Longitudina (mm)	ement I Transverse (mm)	Fix Top	ings Base
а	10G	5000			S	S
b	11G	5000	100		В	S
с	12G	5000	100	20	Ν	В

Full part number for  $\boldsymbol{c}$  above is 12G500/100/20/NB

This denotes a Free Spherical G bearing comprising of:

Working Load Capacity: Movement - Longitudinal: - Transverse: Fixing Method: 5000kN maximum 100mm total 20mm total No fixings in top plate Bolts in base plate

#### Fig. 3 G Spherical Bearing - Guided

![](_page_1_Picture_47.jpeg)

![](_page_2_Picture_0.jpeg)

### **10G - Fixed Spherical Bearing**

#### **Bearing Design Loads**

Bearings should be selected to suit the appropriate design code. The maximum vertical and horizontal loads shown in the tables may be taken in combination.

#### Horizontal Loading

The 10G fixed bearing will resist a horizontal force acting in any direction.

The horizontal load capacity is the lesser of two conditions -

a) 25% of the vertical load operating at the moment the horizontal force is present or

b) The loading shown in the load/dimension tables.

At ULS, the actual load combination may permit the use of a vertical load higher than that shown in the table.

We will be pleased to advise.

#### **Concrete Stress**

Where suitable reinforcement of the concrete has been provided the allowable concrete stress is dependent on the relative dimensions of the bearing/structure interface, the total support area, and the characteristic strength of the concrete. The stress on the structure should therefore be checked to ensure that it is acceptable.

At the Nominal Rating capacity tabulated the mean stress approaches 20N/mm<sup>2</sup>.

Nominal being Naximum (N   Working/Services/bit/y Limit State Loads Permaent   Horizonds (N   Ultimate Limit State Permaent   Horizonds (N   No.   Instantion (N   No.     0500   fold   fold <td< th=""><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th><th></th></td<>																
Hatsmann   Permannent   Al   On Lonna   Folder   Fol	Bearing	Nominal Vertical Bating	<u>Working/S</u> Vertical	erviceability Limit	State Loads Horizontal	<u>Ultimate</u> Vertical	Limit State	Bearing			Installation D	Dimensions (m	m)			
(N)   (N) <th>No.</th> <th>Maximum</th> <th>Permanent</th> <th>All</th> <th>nonzontai</th> <th>Vertical</th> <th>nonzontai</th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th> <th></th>	No.	Maximum	Permanent	All	nonzontai	Vertical	nonzontai									
005050046275011297546098106501801601601601601801801801600675750642750112975146106702451951952227871410615015001500150012002251950233106160245245245245245245245245245245107110		(kN)	(kN)	(kN)	(kN)	(kN)	(kN)		А	D	F	G	н	J	К	
00757506427501129751461007524519512627881400101501500150120130015022519502331001020210222587140020020001718200030020003900390039002950212250373302663303601301002303802752628281018003003000256130004503900585010023036535503337132180030030002870380028703800660675586087810023036035033371322800400480038003800750660097510731063046037037039401682225182200500550046665500825715010731073106500515420 <td>10G50</td> <td>500</td> <td>429</td> <td>500</td> <td>75</td> <td>650</td> <td>98</td> <th>10G50</th> <td>190</td> <td>160</td> <td>160</td> <td>14</td> <td>18</td> <td>66</td> <td>14</td> <td></td>	10G50	500	429	500	75	650	98	10G50	190	160	160	14	18	66	14	
00010100150150150195196100102802102102225871406150150015011500225195023623624524522259714062002000171820003002663003753283641062033527527526282810180630030002566300045630004563004563003653653653633733371372806400460034034000600520780780106404803953953940148220650050042665000750660975106404803853953942156220650050042665000750670177166543545252531812606600600674580012001760186017648648552551912606100700078689000135017001360196016606606655252525219126061001900780068068068068068068068068068068068068068068068	10G75	750	642	750	112	975	146	10G75	245	195	195	22	27	86	14	
00190 1001 1000 2250 1001 2000 1718 2000 300 2800 380 380 380 380 385 275 275 28 28 10 14   00200 2000 1718 2000 375 3250 486 305 305 275 285 235 38 36 612 18   00300 3000 2565 3000 450 380 563 100300 405 325 235 33 37 132 18   00300 3000 2866 4500 600 5200 780 100400 465 370 37 39 40 14 220   00400 4400 386 4500 670 780 683 780 100400 465 370 39 40 14 200 20 35 161 420 43 30 161 42 45 22 161 20 20 21 21 21 21 26 21 21	10G100	1000	851	1000	150	1300	195	10G100	260	210	210	22	25	87	14	
0c200   2000   1718   2000   300   2800   3800     06250   2500   2121   2600   375   3820   480     06260   3000   2666   3000   450   3800   683     06300   3600   2870   3500   552   4520   683     06400   460   3800   675   6850   878     06400   460   3865   4500   675   6850   878     06400   4600   3865   4500   675   6850   878     06500   5600   4666   5600   675   6850   878     06650   4600   4500   7160   1073   10850   515   420   420   43   118   22     06650   5600   4666   5600   900   7800   1170   1385   106600   575   450   450   52   53   181   28     06600   6745 <td>10G150</td> <td>1500</td> <td>1301</td> <td>1500</td> <td>225</td> <td>1950</td> <td>293</td> <th>10G150</th> <td>295</td> <td>245</td> <td>245</td> <td>22</td> <td>25</td> <td>97</td> <td>14</td> <td></td>	10G150	1500	1301	1500	225	1950	293	10G150	295	245	245	22	25	97	14	
002200   2101   2500   375   3200   488     00300   3000   2566   3000   450   3800   585     00300   3000   2570   3300   525   4500   683     00400   4000   3403   4000   600   5200   780     06460   4500   3885   4500   675   5800   780   106300   445   370   39   42   155   220     06460   5000   4266   5000   675   6800   975   1073   10630   445   435   435   42   43   42   155   220     06600   5000   4266   5500   825   620   635   430   435   435   435   43   181   260     06600   500   560   600   900   7100   1707   1707   16050   557   450   450   25   181   260   27	10G200	2000	1718	2000	300	2600	390	10G200	335	275	275	26	28	110	18	
06300 3000 2566 3000 450 3900 585   06360 3600 2970 3600 525 4560 683   06460 4500 3865 4000 6000 520 780 780   06460 4500 3865 4500 675 5860 878   06560 5500 4266 5500 750 6600 970 780	10G250	2500	2121	2500	375	3250	488	10G250	385	305	305	33	36	132	18	
06380   350   2970   3500   525   4550   683     06400   4000   3403   4000   600   5200   780     06450   4500   3865   4500   675   5806   780     06450   4500   4256   5000   770   6500   976     06600   6000   5205   7150   1073   1073   10650   430   420   420   44   162   26     06600   6000   5055   6000   970   10730   1073   10650   430   420   420   43   41   162   26     06600   6000   5050   6000   9100   1365   10070   610   455   455   52   53   111   26     06600   675   480   645   655   52   52   52   52   52   52   52   52   52   52   52   52   52   52	10G300	3000	2566	3000	450	3900	585	10G300	405	325	325	33	37	132	18	
0640040003403400060052007801064004653703703940148220646036003865440067558508781064504903653203942152220650055004666550082571501073106505154204203942152220660060005095600090078001170107310660057545045552531812606600600056967458000120010400156016606505255252522621532 </td <td>10G350</td> <td>3500</td> <td>2970</td> <td>3500</td> <td>525</td> <td>4550</td> <td>683</td> <th>10G350</th> <td>430</td> <td>350</td> <td>350</td> <td>33</td> <td>37</td> <td>137</td> <td>22</td> <td></td>	10G350	3500	2970	3500	525	4550	683	10G350	430	350	350	33	37	137	22	
06450450038654500675585087810645049039539539421522206500500042565000750650097510650515420420420394416226066006000600560009256000976011701065056045545552531812606600600509560009007000105091001365106606754554555253191260670070005891700010009100136516006605255255252525232 </td <td>10G400</td> <td>4000</td> <td>3403</td> <td>4000</td> <td>600</td> <td>5200</td> <td>780</td> <th>10G400</th> <td>465</td> <td>370</td> <td>370</td> <td>39</td> <td>40</td> <td>148</td> <td>22</td> <td></td>	10G400	4000	3403	4000	600	5200	780	10G400	465	370	370	39	40	148	22	
068005004256500075065009751065051542042039441622606500550046665500825715010731065056043543552531812606600500509560009007800117010650575450455452525319126067007005891700105091001560106700610485485525252582023206900900076569000150011700175610690066056556052<	10G450	4500	3865	4500	675	5850	878	10G450	490	395	395	39	42	155	22	
06505500466655008257150107306600600050956000900776011701170067007000589170001020910013651600575450450525318126066008006745800012001010136510070610485485525519126066009000766690001350117001750100600660525565526222215320610010008483100001500130019501950100600730580580616622732061400101010101200160013001950100100730580680617225238320320380061400101010101000100073058068069061722523838038	10G500	5000	4256	5000	750	6500	975	10G500	515	420	420	39	44	162	26	
0600509560009007800117006700700058917000105091001365060008000674580001200104001560060009000676590001300117001750061007869000130011700175006100100084831000015001170017500610010008483100001500117001950061001187914000210018002340061001800180027301061007506456456172252380616018001800210023402340210021007506456456172252380616018001800263023403100	10G550	5500	4666	5500	825	7150	1073	10G550	560	435	435	52	53	181	26	
06700700058917000105091001365068008000674580001200140015601068006505255255258202320690090007666900013601170017551068006905655655252626221521532	10G600	6000	5095	6000	900	7800	1170	10G600	575	450	450	52	53	181	26	
06800800067458000120010400160006900900076569000135011700175506100010000848310000150013000195006120012000101101200018001500234006140018791400021001800234006160018001800263023400616001800180028002730061600180018002800310006160018001800280036100616001800180028003610061600180018002800361006160018001800280036100616001800180028003610061600180018002800361006160018001800280036100616001800180028003610061600180018002800061600180018002800062001800180028000620019082000062002500190806200250026000620026003800062002600260006200260006200260006200260006200260006200260006200260006200260006200	10G700	7000	5891	7000	1050	9100	1365	10G700	610	485	485	52	55	191	26	
06909007656900135011701755061001000848310001500130019500612012001011120018001560234006140140011879140021018202730061601601156124002101820273006160160115711600240028003120061801521180026002340312006180152118002600367906200250016862200308062002500210425003303250063003000252433000383039004979	10G800	8000	6745	8000	1200	10400	1560	10G800	650	525	525	52	58	202	32	
061001000848310001500130019501000730580580616627320612001200101012000180015600234010612007956456456456172252380614001400180021001820027301061200795645645645617225238061600160013611160002400280031201061600920750505699428938061800180015271180002630234003190319010618009758058056990305380380380380380380380380380380380380380380062500250012104425000333032500432943291062500115098098069101283380063000300002524330000383039000497949791260116010901090109069118338338	10G900	9000	7656	9000	1350	11700	1755	10G900	690	565	565	52	62	215	32	
0612001200010110120001800156002340061400140001187914000210018200273006160016001361116000240020800312006180018001527118000263023400341906200020000168262000028302600036790622502250019088225003080292504004062500200002000033303250043290620003000025243300003830390004979	10G1000	10000	8483	10000	1500	13000	1950	10G1000	730	580	580	61	66	227	32	
140011879140021001820027300G16001600136111600024002080031200G18001800152711800026302340034190G220020000168262000028302600036790G225022500190882250030802925040040G250020000210442500033303250043290G30003000025243300003830390004979	10G1200	12000	10110	12000	1800	15600	2340	10G1200	795	645	645	61	72	252	38	
160013611160024002080031200G16001800152711800026302340034190G2002000168262000028302600036790G225022500190882250030802925040040G20002500210442500033303250043290G30003000025243300003830390004979	10G1400	14000	11879	14000	2100	18200	2730	10G1400	860	690	690	69	78	271	38	
1800 15271 1800 2630 23400 3419   0G200 2000 16826 2000 2830 2600 3679   0G2250 22500 19088 22500 3080 29250 4004   0G2500 2000 21044 25000 3330 32500 4329   0G3000 30000 25243 30000 3830 39000 4979	10G1600	16000	13611	16000	2400	20800	3120	10G1600	920	750	750	69	84	289	38	
062000 2000 16826 20000 2830 26000 3679   062250 22500 19088 22500 3080 29250 4004   062500 25000 21044 25000 3330 32500 4329   063000 30000 25243 30000 3830 39000 4979	10G1800	18000	15271	18000	2630	23400	3419	10G1800	975	805	805	69	90	305	38	
062250 2500 19088 22500 3080 29250 4004   062500 25000 21044 25000 3330 32500 4329   063000 30000 25243 30000 3830 39000 4979	10G2000	20000	16826	20000	2830	26000	3679	10G2000	1030	860	860	69	96	273	38	_
OG2500 25000 21044 25000 3330 32500 4329 10G2500 1150 980 980 69 107 307 38   OG3000 3000 25243 30000 3830 39000 4979 10G3000 1260 1090 1090 69 118 338 38	10G2250	22500	19088	22500	3080	29250	4004	10G2250	1090	920	920	69	101	288	38	_
<b>0G300</b> 3000 25243 3000 3830 3900 4979 <b>10G3000</b> 1260 1090 69 118 338 38	10G2500	25000	21044	25000	3330	32500	4329	10G2500	1150	980	980	69	107	307	38	
	10G3000	30000	25243	30000	3830	39000	4979	10G3000	1260	1090	1090	69	118	338	38	

\* Weight excludes fixings

**G** - Series

![](_page_2_Picture_17.jpeg)

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### **10G - Fixed Spherical Bearing**

![](_page_2_Figure_22.jpeg)

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![](_page_3_Picture_0.jpeg)

### **11G - Guided Spherical Bearing**

#### **Bearing Design Loads**

Bearings should be selected to suit the appropriate design code. The maximum vertical and horizontal loads shown in the tables may be taken in combination.

#### **Horizontal Loading**

The 11G guided bearing will resist a horizontal force acting at right angles to the main direction of movement.

The horizontal load capacity is the lesser of two conditions a) 25% of the vertical load operating at the moment the horizontal force is present or

b) The loading shown in the load/dimension tables.

At ULS, the actual load combination may permit the use of a vertical load higher than that shown in the table.

We will be pleased to advise.

#### **Transverse Movement**

11G bearings are designed to accommodate movement in one direction only. Movement transverse to the guide bars is nominally zero. In practice the transverse movement is 1.5mm maximum. Standard 11G bearings should not be used where movement is required at right angles to the constraint. Special bearings can be offered for such requirements.

#### **Concrete Stress**

Where suitable reinforcement of the concrete has been provided the allowable concrete stress is dependent on the relative dimensions of the bearing/structure interface, the total support area, and the characteristic strength of the concrete. The stress on the structure should therefore be checked to ensure that it is acceptable.

At the Nominal Rating capacity tabulated the mean stress approaches 20N/mm<sup>2</sup>.

<b>G</b> -	<b>Series</b>

![](_page_3_Figure_18.jpeg)

	Nominal	Working/Se	erviceability Limit (	State Loads	Ultimate	Limit State			Bearing	Bearing	Bearing	Bearing	Bearing Installat	Bearing Installation Dimens	Bearing Installation Dimensions (mm)	Bearing Installation Dimensions (mm)	Bearing Installation Dimensions (mm)	Bearing Installation Dimensions (mm)	Bearing Installation Dimensions (mm)
Bearing	Vertical Rating	Vertical	All	Horizontal	Vertical	Horizontal			No.	No.	No.	No.	No.	No.	No.	No.	No.	No.	No.
NO.	(kN)	(kN)	(kN)	(kN)	(kN)	(kN)				А	АВ	А В С	А В С Д	А В С Д Е			A B C D E F G H		
11G50	500	429	500	50	650	65			11G50	<b>11G50</b> 190	<b>11G50</b> 190 275	<b>11G50</b> 190 275 310	<b>11G50</b> 190 275 310 160	<b>11G50</b> 190 275 310 160 280	<b>11G50</b> 190 275 310 160 280 160	<b>11G50</b> 190 275 310 160 280 160 14	<b>11G50</b> 190 275 310 160 280 160 14 13	<b>11G50</b> 190 275 310 160 280 160 14 13 80	<b>11G50</b> 190 275 310 160 280 160 14 13 80 14
11G75	750	642	750	75	975	98		-	11G75	<b>11G75</b> 245	<b>11G75</b> 245 315	<b>11G75</b> 245 315 365	<b>11G75</b> 245 315 365 195	<b>11G75</b> 245 315 365 195 315	<b>11G75</b> 245 315 365 195 315 195	<b>11G75</b> 245 315 365 195 315 195 22	<b>11G75</b> 245 315 365 195 315 195 22 17	<b>11G75</b> 245 315 365 195 315 195 22 17 98	<b>11G75</b> 245 315 365 195 315 195 22 17 98 14
11G100	1000	851	1000	100	1300	130		-	11G100	<b>11G100</b> 260	<b>11G100</b> 260 350	<b>11G100</b> 260 350 380	<b>11G100</b> 260 350 380 210	<b>11G100</b> 260 350 380 210 330	<b>11G100</b> 260 350 380 210 330 210	<b>11G100</b> 260 350 380 210 330 210 22	<b>11G100</b> 260 350 380 210 330 210 22 17	<b>11G100</b> 260 350 380 210 330 210 22 17 102	<b>11G100</b> 260 350 380 210 330 210 22 17 102 14
11G150	1500	1301	1500	150	1950	195		-	11G150	<b>11G150</b> 295	<b>11G150</b> 295 410	<b>11G150</b> 295 410 415	<b>11G150</b> 295 410 415 245	<b>11G150</b> 295 410 415 245 365	<b>11G150</b> 295 410 415 245 365 245	<b>11G150</b> 295 410 415 245 365 245 22	<b>11G150</b> 295 410 415 245 365 245 22 22	<b>11G150</b> 295 410 415 245 365 245 22 22 120	<b>11G150</b> 295 410 415 245 365 245 22 22 120 14
11G200	2000	1718	2000	200	2600	260		-	11G200	<b>11G200</b> 335	<b>11G200</b> 335 460	<b>11G200</b> 335 460 455	<b>11G200</b> 335 460 455 275	<b>11G200</b> 335 460 455 275 395	<b>11G200</b> 335 460 455 275 395 275	<b>11G200</b> 335 460 455 275 395 275 26	<b>11G200</b> 335 460 455 275 395 275 26 27	<b>11G200</b> 335 460 455 275 395 275 26 27 136	<b>11G200</b> 335 460 455 275 395 275 26 27 136 18
11G250	2500	2121	2500	250	3250	325		-	11G250	<b>11G250</b> 385	<b>11G250</b> 385 495	<b>11G250</b> 385 495 500	<b>11G250</b> 385 495 500 305	<b>11G250</b> 385 495 500 305 420	<b>11G250</b> 385 495 500 305 420 305	<b>11G250</b> 385 495 500 305 420 305 33	<b>11G250</b> 385 495 500 305 420 305 33 27	<b>11G250</b> 385 495 500 305 420 305 33 27 147	<b>11G250</b> 385 495 500 305 420 305 33 27 147 18
11G300	3000	2566	3000	300	3900	390		-	11G300	<b>11G300</b> 405	<b>11G300</b> 405 540	<b>11G300</b> 405 540 540	<b>11G300</b> 405 540 540 325	<b>11G300</b> 405 540 540 325 460	<b>11G300</b> 405 540 540 325 460 325	<b>11G300</b> 405 540 540 325 460 325 33	<b>11G300</b> 405 540 540 325 460 325 33 32	<b>11G300</b> 405 540 540 325 460 325 33 32 161	<b>11G300</b> 405 540 540 325 460 325 33 32 161 18
11G350	3500	2970	3500	350	4550	455		_	11G350	<b>11G350</b> 430	<b>11G350</b> 430 565	<b>11G350</b> 430 565 575	<b>11G350</b> 430 565 575 350	<b>11G350</b> 430 565 575 350 495	<b>11G350</b> 430 565 575 350 495 350	<b>11G350</b> 430 565 575 350 495 350 33	<b>11G350</b> 430 565 575 350 495 350 33 32	<b>11G350</b> 430 565 575 350 495 350 33 32 168	<b>11G350</b> 430 565 575 350 495 350 33 32 168 22
11G400	4000	3403	4000	400	5200	520			11G400	<b>11G400</b> 465	<b>11G400</b> 465 610	<b>11G400</b> 465 610 605	<b>11G400</b> 465 610 605 370	<b>11G400</b> 465 610 605 370 510	<b>11G400</b> 465 610 605 370 510 370	<b>11G400</b> 465 610 605 370 510 370 39	<b>11G400</b> 465 610 605 370 510 370 39 37	<b>11G400</b> 465 610 605 370 510 370 39 37 182	<b>11G400</b> 465 610 605 370 510 370 39 37 182 22
11G450	4500	3865	4500	450	5850	585			11G450	<b>11G450</b> 490	<b>11G450</b> 490 635	<b>11G450</b> 490 635 640	<b>11G450</b> 490 635 640 395	<b>11G450</b> 490 635 640 395 545	<b>11G450</b> 490 635 640 395 545 395	<b>11G450</b> 490 635 640 395 545 395 39	<b>11G450</b> 490 635 640 395 545 395 39 37	<b>11G450</b> 490 635 640 395 545 395 39 37 189	<b>11G450</b> 490 635 640 395 545 395 39 37 189 22
11G500	5000	4256	5000	500	6500	650			11G500	<b>11G500</b> 515	<b>11G500</b> 515 660	<b>11G500</b> 515 660 665	<b>11G500</b> 515 660 665 420	<b>11G500</b> 515 660 665 420 570	<b>11G500</b> 515 660 665 420 570 420	<b>11G500</b> 515 660 665 420 570 420 39	<b>11G500</b> 515 660 665 420 570 420 39 37	<b>11G500</b> 515 660 665 420 570 420 39 37 194	<b>11G500</b> 515 660 665 420 570 420 39 37 194 26
11G550	5500	4666	5500	550	7150	715		_	11G550	<b>11G550</b> 560	<b>11G550</b> 560 695	<b>11G550</b> 560 695 695	<b>11G550</b> 560 695 695 435	<b>11G550</b> 560 695 695 435 570	<b>11G550</b> 560 695 695 435 570 435	<b>11G550</b> 560 695 695 435 570 435 52	<b>11G550</b> 560 695 695 435 570 435 52 42	<b>11G550</b> 560 695 695 435 570 435 52 42 214	<b>11G550</b> 560 695 695 435 570 435 52 42 214 26
11G 600	6000	5095	6000	600	7800	780		_	11G600	<b>11G600</b> 575	<b>11G600</b> 575 715	<b>11G600</b> 575 715 720	<b>11G600</b> 575 715 720 450	<b>11G600</b> 575 715 720 450 595	<b>11G600</b> 575 715 720 450 595 450	<b>11G600</b> 575 715 720 450 595 450 52	<b>11G600</b> 575 715 720 450 595 450 52 42	<b>11G600</b> 575 715 720 450 595 450 52 42 215	<b>11G600</b> 575 715 720 450 595 450 52 42 215 26
11G700	7000	5891	7000	700	9100	910	l	_	11G700	<b>11G700</b> 610	<b>11G700</b> 610 765	<b>11G700</b> 610 765 770	<b>11G700</b> 610 765 770 485	<b>11G700</b> 610 765 770 485 645	<b>11G700</b> 610 765 770 485 645 485	<b>11G700</b> 610 765 770 485 645 485 52	<b>11G700</b> 610 765 770 485 645 485 52 47	<b>11G700</b> 610 765 770 485 645 485 52 47 230	<b>11G700</b> 610 765 770 485 645 485 52 47 230 26
11G800	8000	6745	8000	800	10400	1040		_	11G800	<b>11G800</b> 650	<b>11G800</b> 650 805	<b>11G800</b> 650 805 815	<b>11G800</b> 650 805 815 525	<b>11G800</b> 650 805 815 525 690	<b>11G800</b> 650 805 815 525 690 525	<b>11G800</b> 650 805 815 525 690 525 52	<b>11G800</b> 650 805 815 525 690 525 52 47	<b>11G800</b> 650 805 815 525 690 525 52 47 239	<b>11G800</b> 650 805 815 525 690 525 52 47 239 32
11G900	9000	7656	9000	900	11700	1170		_	11G900	<b>11G900</b> 690	<b>11G900</b> 690 840	<b>11G900</b> 690 840 860	<b>11G900</b> 690 840 860 565	<b>11G900</b> 690 840 860 565 735	<b>11G900</b> 690 840 860 565 735 565	<b>11G900</b> 690 840 860 565 735 565 52	<b>11G900</b> 690 840 860 565 735 565 52 52	<b>11G900</b> 690 840 860 565 735 565 52 52 253	<b>11G900</b> 690 840 860 565 735 565 52 52 253 32
11G1000	10000	8483	10000	1000	13000	1300			11G1000	<b>11G1000</b> 730	<b>11G1000</b> 730 890	<b>11G1000</b> 730 890 900	<b>11G1000</b> 730 890 900 580	<b>11G1000</b> 730 890 900 580 750	<b>11G1000</b> 730 890 900 580 750 580	<b>11G1000</b> 730 890 900 580 750 580 61	<b>11G1000</b> 730 890 900 580 750 580 61 52	<b>11G1000</b> 730 890 900 580 750 580 61 52 265	<b>11G1000</b> 730 890 900 580 750 580 61 52 265 32
11G1200	12000	10110	12000	1100	15600	1430			11G1200	<b>11G1200</b> 795	<b>11G1200</b> 795 960	<b>11G1200</b> 795 960 975	<b>11G1200</b> 795 960 975 645	<b>11G1200</b> 795 960 975 645 825	<b>11G1200</b> 795 960 975 645 825 645	<b>11G1200</b> 795 960 975 645 825 645 61	<b>11G1200</b> 795 960 975 645 825 645 61 57	<b>11G1200</b> 795 960 975 645 825 645 61 57 289	<b>11G1200</b> 795 960 975 645 825 645 61 57 289 38
11G1400	14000	11879	14000	1330	18200	1729			11G1400	<b>11G1400</b> 860	<b>11G1400</b> 860 1025	<b>11G1400</b> 860 1025 1045	<b>11G1400</b> 860 1025 1045 690	<b>11G1400</b> 860 1025 1045 690 875	<b>11G1400</b> 860 1025 1045 690 875 690	<b>11G1400</b> 860 1025 1045 690 875 690 69	<b>11G1400</b> 860 1025 1045 690 875 690 69 62	<b>11G1400</b> 860 1025 1045 690 875 690 69 62 310	<b>11G1400</b> 860 1025 1045 690 875 690 69 62 310 38
11G1600	16000	13611	16000	1480	20800	1924			11G1600	<b>11G1600</b> 920	<b>11G1600</b> 920 1075	<b>11G1600</b> 920 1075 1110	<b>11G1600</b> 920 1075 1110 750	<b>11G1600</b> 920 1075 1110 750 940	<b>11G1600</b> 920 1075 1110 750 940 750	<b>11G1600</b> 920 1075 1110 750 940 750 69	<b>11G1600</b> 920 1075 1110 750 940 750 69 67	<b>11G1600</b> 920 1075 1110 750 940 750 69 67 327	<b>11G1600</b> 920 1075 1110 750 940 750 69 67 327 38
11G1800	18000	15271	18000	1620	23400	2106			11G1800	<b>11G1800</b> 975	<b>11G1800</b> 975 1120	<b>11G1800</b> 975 1120 1175	<b>11G1800</b> 975 1120 1175 805	<b>11G1800</b> 975 1120 1175 805 1005	<b>11G1800</b> 975 1120 1175 805 1005 805	<b>11G1800</b> 975 1120 1175 805 1005 805 69	<b>11G1800</b> 975 1120 1175 805 1005 805 69 72	<b>11G1800</b> 975 1120 1175 805 1005 805 69 72 343	<b>11G1800</b> 975 1120 1175 805 1005 805 69 72 343 38
11IG2000	20000	16826	20000	1750	26000	2275			11G2000	<b>11G2000</b> 1030	<b>11G2000</b> 1030 1165	<b>11G2000</b> 1030 1165 1230	<b>11G2000</b> 1030 1165 1230 860	<b>11G2000</b> 1030 1165 1230 860 1060	<b>11G2000</b> 1030 1165 1230 860 1060 860	<b>11G2000</b> 1030 1165 1230 860 1060 860 69	<b>11G2000</b> 1030 1165 1230 860 1060 860 69 72	<b>11G2000</b> 1030 1165 1230 860 1060 860 69 72 304	<b>11G2000</b> 1030 1165 1230 860 1060 860 69 72 304 38
11G2250	22500	19088	22500	1898	29250	2467			11G2250	<b>11G2250</b> 1090	<b>11G2250</b> 1090 1225	<b>11G2250</b> 1090 1225 1300	<b>11G2250</b> 1090 1225 1300 920	<b>11G2250</b> 1090 1225 1300 920 1130	<b>11G2250</b> 1090 1225 1300 920 1130 920	<b>11G2250</b> 1090 1225 1300 920 1130 920 69	<b>11G2250</b> 1090 1225 1300 920 1130 920 69 77	<b>11G2250</b> 1090 1225 1300 920 1130 920 69 77 319	<b>11G2250</b> 1090 1225 1300 920 1130 920 69 77 319 38
11IG2500	25000	21044	25000	2031	32500	2640		_	11G2500	<b>11G2500</b> 1150	<b>11G2500</b> 1150 1285	<b>11G2500</b> 1150 1285 1365	<b>11G2500</b> 1150 1285 1365 980	<b>11G2500</b> 1150 1285 1365 980 1195	<b>11G2500</b> 1150 1285 1365 980 1195 980	<b>11G2500</b> 1150 1285 1365 980 1195 980 69	<b>11G2500</b> 1150 1285 1365 980 1195 980 69 82	<b>11G2500</b> 1150 1285 1365 980 1195 980 69 82 336	<b>11G2500</b> 1150 1285 1365 980 1195 980 69 82 336 38
11G3000	30000	25243	30000	2250	39000	2925			11G3000	<b>11G3000</b> 1260	<b>11G3000</b> 1260 1405	<b>11G3000</b> 1260 1405 1485	<b>11G3000</b> 1260 1405 1485 1090	<b>11G3000</b> 1260 1405 1485 1090 1315	<b>11G3000</b> 1260 1405 1485 1090 1315 1090	<b>11G3000</b> 1260 1405 1485 1090 1315 1090 69	<b>11G3000</b> 1260 1405 1485 1090 1315 1090 69 92	<b>11G3000</b> 1260 1405 1485 1090 1315 1090 69 92 365	<b>11G3000</b> 1260 1405 1485 1090 1315 1090 69 92 365 38

\* Weight excludes fixings

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### **11G - Guided Spherical Bearing**

\* Top plate dimensions are for the movements shown. For designating increased movements the dimensions marked thus \* must be increased accordingly. See page 3

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![](_page_4_Picture_0.jpeg)

### 12G - Free Spherical Bearing

**Concrete Stress** 

### **G** - Series

#### **Bearing Design Loads**

Bearings should be selected to suit the appropriate design code. If in doubt please ask our advice.

#### Where suitable reinforcement of the concrete has been provided the allowable concrete stress is dependent on the relative dimensions of the bearing/structure interface, the total support area, and the characteristic strength of the concrete. The stress on the structure should therefore be checked to ensure that it is acceptable.

At the Nominal Rating capacity tabulated the mean stress approaches 20N/mm<sup>2</sup>.

	Nominal	Working/Serviceability Limit State Loads	Ultimate Limit State	Be	earing			Installa	tion Dimensi	ons (mm)					Total
Bearing No.	Vertical Rating Maximum	Vertical Permanent	Vertical	No	<b>).</b>		<b>^</b>	P	E	E	c	ы		K	Approx Weight
(0050	(KIN)	((()))					000		E	F	G	п	J	ĸ	(rty)
12G50	500	429	650	120	G50 19	200	280	160	250	160	14	13	/4	14	24
12G75	/50	642	975	12	G75 24	5 240	320	195	270	195	22	1/	90	14	46
12G100	1000	851	1300	12	GI00 26	60 275	355	210	305	210	22	17	93	14	55
12G150	1500	1301	1950	120	<b>G150</b> 29	95 330	410	245	360	245	22	22	109	14	85
12G200	2000	1718	2600	12	<b>G200</b> 33	35 380	460	275	400	275	26	27	124	14	125
12G250	2500	2121	3250	12	<b>G250</b> 38	35 420	500	305	420	305	33	27	132	14	170
12G300	3000	2566	3900	12	<b>G300</b> 40	95 460	540	325	460	325	33	32	145	14	212
12G350	3500	2970	4550	12	<b>G350</b> 43	80 495	575	350	495	350	33	32	151	14	249
12G400	4000	3403	5200	12	<b>G400</b> 46	55 525	605	370	510	370	39	37	164	14	314
12G450	4500	3865	5850	120	<b>G450</b> 49	0 560	640	395	545	395	39	37	169	14	360
12G500	5000	4256	6500	120	<b>G500</b> 5	5 585	665	420	570	420	39	37	174	14	406
12G550	5500	4666	7150	12	<b>G550</b> 56	615	695	435	570	435	52	42	191	14	518
12G 600	6000	5095	7800	12	<b>G600</b> 57	640	720	450	595	450	52	42	191	14	549
12G700	7000	5891	9100	12	<b>G700</b> 6 <sup>-</sup>	0 690	770	485	645	485	52	47	205	18	671
12G800	8000	6745	10400	120	<b>G800</b> 65	60 735	815	525	690	525	52	47	214	18	790
12G900	9000	7656	11700	12	<b>G900</b> 69	0 780	860	565	735	565	52	52	229	18	954
12G1000	10000	8483	13000	12	<b>G1000</b> 73	80 820	900	580	750	580	61	52	237	22	1096
12G1200	12000	10110	15600	12	<b>G1200</b> 79	95 895	975	645	825	645	61	57	262	22	1435
12G1400	14000	11879	18200	12	G1400 86	0 965	1045	690	875	690	69	62	281	22	1796
12G1600	16000	13611	20800	12	G1600 92	20 1030	1110	750	940	750	69	67	300	22	2191
12G1800	18000	15271	23400	12	G1800 97	75 1095	1175	805	1005	805	69	72	316	26	2597
12G2000	20000	16826	26000	12	<b>G2000</b> 103	30 1150	1230	860	1060	860	69	72	278	26	2564
12G2250	22500	19088	29250	12	G2250 109	0 1220	1300	920	1130	920	69	77	295	26	3050
12G2500	25000	21044	32500	12	G2500 115	i0 1285	1365	980	1195	980	69	82	313	26	3595
12G3000	30000	25243	39000	12	G3000 126	0 1405	1485	1090	1315	1090	69	92	346	26	4762

\* Weight excludes fixings

![](_page_4_Picture_13.jpeg)

### **12G - Free Spherical Bearing**

Movement ± 10 mm

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D\*

G

С\*

4 holes K diamete

![](_page_4_Figure_16.jpeg)

4 holes K diameter

\* Top plate dimensions are for the movements shown. For designating increased movements the dimensions marked thus \* must be increased accordingly. See page 3

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![](_page_5_Picture_0.jpeg)

### **Standard G Bearing Fixings**

### **Standard G Bearing Fixings**

By adding a two letter suffix to the bearing part number the type of fixingmay be designated -

First letter - Top plate fixing Second letter - Base plate fixing

N - No fixings **B** - Bolts and washers only

S - Bolts, washers & sockets

/BS signifies e.g. B (top plate fixing) Bolts & washers S (base plate fixing) Bolts, washers & sockets

N.B. If standard G series fixings are not used, care should be taken to ensure that bolts can be fitted without dismantling the bearing.

Bolts are Hexagon Head to BS 3692 grade 8.8

![](_page_5_Figure_11.jpeg)

	Bearing Type														
			10G					11G	ì				12G		
Bearing	So	cket	Bolt	Base	Тор	So	cket	Bolt	Base	Тор	So	cket	Bolt	Base	Тор
Size	В	Α	D	С	E	В	Α	D	С	E	В	Α	D	С	E
0050	35	110	12	35	40	35	110	12	35	30	35	110	12	35	30
0075	35	110	12	45	50	35	110	12	45	35	35	110	12	45	35
0100	35	110	12	45	45	35	110	12	45	35	35	110	12	45	35
0150	35	110	12	45	45	35	110	12	45	40	35	110	12	45	40
0200	40	140	16	50	55	40	140	16	50	50	35	110	12	45	45
0250	40	140	16	60	60	40	140	16	60	50	35	110	12	55	45
0300	40	140	16	60	65	40	140	16	60	55	35	110	12	55	50
0350	50	170	20	65	65	50	170	20	65	60	35	110	12	55	50
0400	50	170	20	70	70	50	170	20	70	65	35	110	12	60	55
0450	50	170	20	70	70	50	170	20	70	65	35	110	12	60	55
0500	55	200	24	75	80	55	200	24	75	70	35	110	12	60	55
0550	55	200	24	85	90	55	200	24	85	75	35	110	12	75	60
0600	55	200	24	85	90	55	200	24	85	75	35	110	12	75	60
0700	55	200	24	85	90	55	200	24	85	80	40	140	16	80	70
0800	70	240	30	95	100	70	240	30	95	85	40	140	16	80	70
0900	70	240	30	95	105	70	240	30	95	90	40	140	16	80	75
1000	70	240	30	100	105	70	240	30	100	90	50	170	20	90	80
1200	80	300	36	110	120	80	300	36	110	100	50	170	20	90	85
1400	80	300	36	115	125	80	300	36	115	105	50	170	20	100	90
1600	80	300	36	115	130	80	300	36	115	110	50	170	20	100	95
1800	80	300	36	115	140	80	300	36	115	115	55	200	24	105	105
2000	80	300	36	115	145	80	300	36	115	115	55	200	24	105	105
2250	80	300	36	115	150	80	300	36	115	120	55	200	24	105	110
2500	80	300	36	115	155	80	300	36	115	125	55	200	24	105	115
3000	80	300	36	115	165	80	300	36	115	135	55	200	24	105	125

### HANDLING, STORAGE, **INSTALLATION & MAINTENANCE**

#### Installation

#### CONSIDER THE EFFECTS IF BEARINGS ARE NOT CORRECTLY INSTALLED

Our structural bearings are manufactured to close tolerances by skilled technicians working in clean conditions. To obtain the requisite performance from bearings it is imperative that they are properly handled at the work 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.

Please note that Ekspan are able to provide installation and supervision.

Bearings must be installed with precision to meet the bridge and bearing design criteria.

#### Storage

Our structural 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.

![](_page_5_Figure_21.jpeg)

![](_page_5_Figure_22.jpeg)

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### Handling

Robust transportation devices are fitted to all bearings to ensure that the components are maintained in their correct relative positions before and during installation. The devices are normally finished in red paint. Unless special devices have been specified, they should not be used for slinging or suspending the bearings beneath beams.

Due to unpredictable conditions, which may occur during transportation or handling on site, the alignment and presetting (if applicable) of the assembled bearing should be checked against the drawing. Do not endeavour to rectify any discrepancies on site. The bearing should either be returned to Ekspan or, where practical, an Ekspan engineer should be called in to inspect and reassemble. Bearings too heavy to be lifted by hand should be properly slung using lifting equipment.

![](_page_5_Figure_31.jpeg)

![](_page_5_Picture_32.jpeg)

![](_page_6_Picture_0.jpeg)

### HANDLING, STORAGE, **INSTALLATION & MAINTENANCE**

#### Presetting

If bearings are required to be preset eg where once only large movements may occur during stressing operations, this should be specified as a requirement and should only be carried out in our works prior to despatch. Do not attempt this operation on site.

#### Bedding

Bearings must be supported on a flat rigid bed. Steel spreader plates must be machined flat and smooth to mate exactly with the bearings' upper and lower faces. Bearings may also be bedded on epoxy or cement mortar or by dry packing. Whichever system is preferred for the particular structure it is of extreme importance that the final bedding is free from high or hard spots, shrinkage, voids, etc.

Unless there is a specific design requirement, the planar surfaces must be installed in a horizontal plane. The correct installation of bearings is vital for the bearing performance. Costly repairs become necessary all too often due to inadequate specification or poor site supervision. The bearings should not be loaded until the bedding mortar has cured.

![](_page_6_Figure_7.jpeg)

#### **Cast-In-Situ Structures**

Care must be taken to ensure that the bearings are not damaged by the formwork or contaminated by concrete seepage. The interface between the top plate and the formwork should be protected and sealed.

Owing to the loading effects of a wet concrete mass, the top plates should be propped to prevent rotation and plate distortion. Fixing cast-in-situ structures ensure that the bearing working surfaces are protected and supported to prevent distortion and rotation.

![](_page_6_Figure_12.jpeg)

#### **Bearing Removability**

Where possible, bearings should be fixed in such a manner as to facilitate removal. Our bearings have generally been designed with this in mind. However, when selecting the bearing type preferred, the removability feature should be highlighted in your enquiry.

#### **Removal of Transport Brackets**

These brackets, normally painted red should only be removed once the bearing is properly installed and ready for operation.

#### **Bearing Installation Check List**

#### DO -

- 1. Handle carefully and where necessary with adequate craneage.
- 2. Store in a clean dry place.
- З. Ensure that the bearings are installed in the correct location and orientation
- 4 Ensure that the bearings are installed on a flat rigid bed before the design loads are applied.
- Ensure that the fixings are uniformly tightened. 5.
- Complete any site coatings and make good paint damaged during handling and installation.
- 7. Protect working surfaces during the placing of in-situ concrete
- 8. Keep the bearings and surrounding areas clean.
- Remove any temporary transit clamps etc. before the bearings are required to operate.
- 10. Take special care to support top plates when casting in-situ concrete.

### HANDLING, STORAGE, **INSTALLATION & MAINTENANCE**

#### DO NOT -

- Dismantle the bearing on site. 1.
- 2. Leave bearings uncovered.
- З. Attempt to modify without our approval.
- Install without qualified supervision. 4.

#### Site Coating

Care should be taken to ensure that working surfaces are not damaged in any site coating operation. After installation damaged coatings must be repaired irrespective of any call for site coatings. Exposed fixing bolts should be protected after final tightening. Any tapped holes exposed after removal of transportation brackets etc. (coloured red) should be sealed with self-vulcanizing silicone sealant.

#### **Routine Maintenance of Bearings**

- 1. Immediately following installation bearings shall be inspected to ensure that all aspects of 'Installation of bearings' have been adhered to and bearings shall subsequently be reinspected not less frequently than every two years after their installation.
- 2. Paint and /or other specified protective coatings must be maintained in good and efficient condition and free from scratches or chips. Any areas of the protective coating showing damage or distress must be rectified.
- 3. Areas surrounding the bearings must be kept clean and dry and free from the adverse effects of external influences such as airborne debris or water/salt (for example emanating from leaking joints).
- 4. The wearing surfaces of the bearing must be checked to ensure that they are continuing to operate efficiently.
- Fixing bolts must be checked for tightness. 5.
- 6. Any bedding material showing signs of distress or ineffectiveness must be replaced and the reason for its failure investigated and corrected.
- 7. Routine inspections shall include a check that translational and rotational capacities of the bearing have not been exceeded and show no sign of being likely to exceed the requirements specified at the design stage.

![](_page_7_Picture_0.jpeg)

### NOTES

CONVER	SION	17	ABLE
METRIC			
Length	1 mm 1 m 1 m	= = =	0.03937 in 3.281 ft 1.094 yd
Area	1 mm <sup>2</sup> 1 m <sup>2</sup> 1 m <sup>2</sup>	= = =	0.00153 in <sup>2</sup> 10.764 ft <sup>2</sup> 1.196 yd <sup>2</sup>
Force	1 N 1 kN	=	0.2248 lbf 0.1004 tonf
Stress and pressure	1N/mm <sup>2</sup> 1 N/mm <sup>2</sup> 1 N/m <sup>2</sup> 1 kN/m <sup>2</sup>	=	145 lbf/in <sup>2</sup> = 0.0647 tonf/in <sup>2</sup> 0.0208 lbf/ft <sup>2</sup> 0.0093 tonf/ft <sup>2</sup>
IMPERIAL			
Length	1in 1 ft 1 yd	= = =	25.4 mm 0.3048 m 0.9144 m
Area	1 in² 1 ft² 1 yd²	= = =	645.2 mm <sup>2</sup> 0.0929 m <sup>2</sup> 0.8361 m <sup>2</sup>
Force	1 lbf 1 tonf	=	4.448 N 9.964 kN
Stress and pressure	1 lbf/in <sup>2</sup> 1 tonf/in <sup>2</sup> 1 lbf/in <sup>2</sup> 1 tonf/ft <sup>2</sup>	= = =	0.0068 N/mm <sup>2</sup> 15.44 N/mm <sup>2</sup> 47.88 N/m <sup>2</sup> 107.3 kN/m <sup>2</sup>

# USL EKSPAN - PRODUCT RANGE

![](_page_7_Picture_5.jpeg)

#### **EXPANSION JOINTS - CD 357**

Uniflex - Buried BP1 - Buried FEBA - Flexible Plug Britflex NJ - Nosing EC & EW - Joint Seal Transflex & Transflex HM - Mat

#### STRUCTURAL BEARINGS

- **EKE** Elastomeric (EN1337-3)
- DE Linear Rocker (EN1337-6)
- FE Restraint & Guide

#### **STRUCTURAL WATERPROOFING - CD 358**

### Pitchmastic PmB Polyurethane (Pu)

Waterproofing System Britdex MDP

Methyl Methacrylate (MMA)

#### SUB-SURFACE BRIDGE DRAINAGE

![](_page_7_Picture_21.jpeg)

![](_page_7_Picture_24.jpeg)

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## Inspection • Design • Manufacture • Supply • Installation • Commissioning • Planned Maintenance

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![](_page_7_Picture_32.jpeg)

![](_page_7_Picture_33.jpeg)

T-MAT - Mat Britflex BEJ - Modular Britflex MEJS - Modular LJ - Longitudinal Joint ES - Joint Seal Aqueduct/Immersed Joint

**Open Type Joint** - Rail Joint Britflex UCP - Footbridge Joint Finger Joint **Roller Shutter Joint** 

- Link Bearing (BS5400-9)
- Britdex CPM Tredseal Combined Waterproofing and Anti Skid Surfacing (MMA)
- Uradeck BC

![](_page_7_Picture_46.jpeg)

Bespoke Bearings

#### SURFACE BRIDGE DRAINAGE

Issue 01 - June 2020

![](_page_8_Picture_0.jpeg)

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![](_page_8_Picture_9.jpeg)