POT BEARINGS
KE
EN1337-5

www.uslekspan.com
KE - Series

Pot Bearings

Description
KE series is a range of structural bearings which meets the full requirements of BS EN1337 Parts 1, 2, and 5, and those of the British Department of Transport. They are manufactured to international quality standards. The standard range comprises multi-axis rotation bearings in Fixed, Constrained and Free configurations to support loads up to 46000 kN.

Bearing Types
The KE range of bearings are available in three forms:

- 30KE Fixed
- 31KE Guided - Free to move in one horizontal direction
- 22KE Free to move in any horizontal direction

Typical 31KE Details - Exploded View

Rotation
Maximum rotation on all our pot bearings range from 0.015 radians for KE0050 to KE1000, and 0.0125 radians for KE1200 to KE3000 respectively.

Translations
The dimensions for the 31KE (Constrained) and 22KE (Free) bearings are shown in the tables for the following movements:

- Longitudinal
  - 31KE 100mm total
  - 22KE 100mm total
- Transverse
  - 31KE NIL (see page 6)
  - 22KE 40mm total

Additional movements either in longitudinal or transverse directions, depending on bearing type whether it is restraint sliding or free sliding, top plate dimensions will increase accordingly. We will be pleased to advise.

N.B. 31KE bearings should not be used where movement is required at right angles to the constraints.

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

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.

Design Loads
The designation of loadings varies depending on the design code applicable. The tables show the capabilities determined in accordance with BS EN 1337.

Suffix Letters
By adding a two letter suffix to the bearing part number the type of fixing may be designated:

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

N - No fixings
B - Bolts and washers only
S - Bolts, washers & sockets

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

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

'c' denotes a free KE series pot bearing of:

- Working load capacity: 5000kN maximum
- Movement: Longitudinal - 100mm total
- Transverse - 40mm total

Designation of Part No.
The part number of a bearing is simply built up as below:

- Examples:

<table>
<thead>
<tr>
<th>Type</th>
<th>Maximum Working Load (kN)</th>
<th>Longitudinal Movement (mm)</th>
<th>Transverse Movement (mm)</th>
<th>Fixings Top</th>
<th>Fixings Base</th>
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<tbody>
<tr>
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<td>S</td>
<td>S</td>
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<td>100</td>
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<td>c</td>
<td>22KE</td>
<td>5000</td>
<td>100</td>
<td>N</td>
<td>B</td>
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</table>

E.g. For

- a above the full part number would be 30KE 500/SS
- b above the full part number would be 31KE 500/100/BS
- c above the full part number would be 22KE 500/100/40/NB

Fig. 1 KE Pot Bearing - Guided

Fig. 2 KE Pot Bearing - Free

Fig. 3 KE Pot Bearing - Fixed

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.
**30KE - Fixed Pot 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 30KE fixed bearing will resist a horizontal force acting in any direction. In order for the bearing to support the maximum horizontal loads stated in the tables, a minimum concurrent vertical load as shown in the table must co-exist. Where higher horizontal load capacities are required, special bearings can be offered for such requirements. 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.

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### Bearing Maximum Load Data (kN)

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**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.
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 31KE guided bearing will resist a horizontal force acting at right angles to the main direction of movement. In order for the bearing to support the maximum horizontal loads stated in the tables, a minimum concurrent vertical load as shown in the table must co-exist.

Transverse Movement

31KE bearings are designed to accommodate movement in one direction only. Movement transverse to the constraint is nominally zero. In practice the transverse movement is 1mm maximum.

Standard 31KE 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

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Note: M = Length of base screw, N = Length of top screw, O = Diameter of top/base socket (mm), P = Length of top/base socket (mm)
Bearing Design Loads

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

Concrete Stress

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<table>
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<th>Bearing Part No.</th>
<th>Max Vertical Load (kN)</th>
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With steel to steel connections bolting or welding of Ekspan sub-plates is possible.

KE Series Fixings - With Socket

KE Series Fixings - With Studs

Notations To Dimensional References For Bearing Diagrams

A - Base plate square dimension - length or breadth of base plate (square dimension - mm)
B - Width of top plate (mm)
C - Length of top plate (mm)
D - Transverse width between the fixings on top plate (mm)
E - Longitudinal length between the fixings on top plate (mm)
F - Longitudinal / transverse distance between the fixings on base plate (square dimension - mm)
G - Lug thickness of base plate (mm)
H - Lug thickness of top plate (mm)
J - Overall height of the nominal bearing (mm)
K - Hole diameter of the fixings on top and base plate
L - No. of fixings on top and base plate
M - Length and breadth of base sub plate (square dimension - mm)
N - Thickness of base or top sub plate (mm)
O - Diameter of top/base socket (mm)
P - Length of top/base socket (mm)

Good Installation
Mechanical guide bearing and upper adaptor plate correctly installed.
All bearing interfacing surfaces are horizontal.
All surfaces are free from contaminants.

Bad Installation
No tapered plate installed inducing additional rotations over maximum allowable.
Incorrect fixings utilised.
Welding completed with bearing in situ.
Dirt and debris in and around bearing slide area.

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.

Bearing 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.

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.
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.

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 Bearings to Concrete Using Permanent Anchor Plates

Fixing Cast-In-Situ Structures ensure that the bearing working surfaces are protected and supported to prevent distortion and rotation.

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.

Fixing Cast-In-Situ Structures

Fixing cast-in-situ structures ensure that the bearing working surfaces are protected and supported to prevent distortion and rotation.

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 re-inspected 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.
5. Fixing bolts must be checked for tightness.
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.
Sample Quality Bearing Specification Clauses

1.01 The bearings should be designed in accordance with EN1337 and be constructed from steel grade EN10025 S355 J2. (HIGH QUALITY STEEL GOOD LOADING CAPACITIES)

1.02 Bearings should be designed to allow for combination load effects.

1.03 The sliding surface of the bearing must be fully welded to the top plate of the bearing. This prevents crevice corrosion de-lamination of the stainless steel ensuring bearing longevity. The stainless steel sliding surface should be in accordance with EN 10088-2 1.4401 + 2B or 1.4404 + 2B. Surface treatment roughness Ry5i shall not exceed 1 μm in accordance with EN ISO 4287, and the hardness shall be in the range 150 HV1 to 220 HV1, according to EN ISO 6507-2. Paint will be applied to overlap the welded area of the sliding surface so as to protect the area from the risk of corrosion. (REDUCES CORROSION IN UNLOADED AREAS WHICH IS THE CAUSE OF MOST BEARING FAILURES)

1.04 PTFE bearing surfaces shall be Virgin material with a dimpled surface and lubricated with silicon grease in accordance with EN1337-2. The PTFE shall be retained in the bearing by a machined recess. (FRICITION IS AT A MINIMUM, LIFE IS EXTENSIVE AND THIS ALSO REDUCES AIR ENTRAPMENT)

1.05 Guide sliding surfaces should also be fully welded and mirror polished. The wear surface of the guide shall be a mechanically restrained high load resistant material DU(B) in accordance with EN1337-2. (THE LIFE OF BEARINGS IS EXTENDED WITH USE OF GOOD WEAR MATERIALS)

1.06 Pot bearing pistons are machined with a tightly controlled tolerance between the pot and the piston. (REDUCE EDGE PRESSURE EFFECTS ON RUBBER)

1.07 The rubber pad in a pot bearing is to have a minimum of 2 brass rings, which should be sized to meet and fit tight to the pot wall. EN1337-5. (THIS IS KEY TO ENSURE THAT THE RUBBER IS RETAINED IN THE POT, IF NOT THEN THE RUBBER MAY EXTRUDE UNDER LOAD)

1.08 The rubber pad shall meet EN 1337-5 and be natural rubber or poly chloroprene rubber in accordance with ISO 6446. It will be preformed with a recess on the surface which allows the retaining rings to finish flush with the rubber. (THIS MEANS THAT WHEN THE BEARING IS LOADED THERE ARE NO GAP ARES TO CLOSE ENSURING THAT DATUMS ARE MAINTAINED)

1.09 The rubber pad shall fit in the pot without need for deflection. Corners should be moulded in such a way as to ensure that the pad fits to the machined pot base. (THIS ALSO REDUCES AIR ENTRAPMENT)

1.10 The outer surfaces of the bearing will be blasted to SA 2½ and have the contract specified paint system applied.

1.11 Bearings to be supplied with Ekspan plates. Bearings will be supplied with base and top sockets.

USL Ekspan advise that the specification clauses above demonstrate good practice to ensure good quality bearings.
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