HSS Range Horizontal Bearing Assemblies

A world of solutions to improve things moving

- Technical and design support
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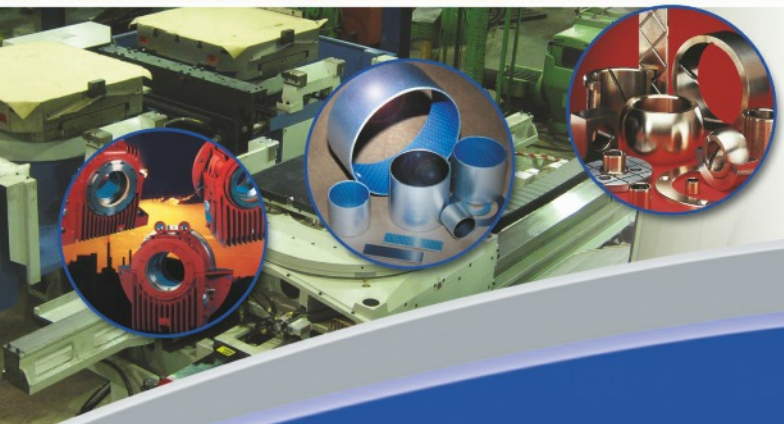


GB Bearings (Pty) Ltd
operates from a network of facilities
situated in Durban, Johannesburg and Cape Town.

GB Bearings has always been in the forefront of technological advancement in the design and manufacture of plain bearings and bearing materials for a wide variety of industrial applications. Our facilities are equipped to manufacture and repair bearings ranging in size up to bore diameters of 5500mm.

Contents

Date of Publication: September 2015

Introduction

GB Bearings HSS bearing assemblies are a range of plain bearings, for shaft sizes from 80mm to 315mm, ready for fitting to fans, blowers, pumps, horizontal water turbines and any other machinery where free standing, base mounted, bearings are required.

They incorporate the latest in GB Bearings' wide experience in designing bearings for rotating as well as plain, profile and tilting pad bearings for which they are well-known globally.

General Description
The standard GB Bearings HSSF assembly contains a horizontal plain journal bearing, of split construction, with thrust pads for shaft location.

The main feature of the HSSF range is that it can accommodate high axial loads by the use of Glacier Tilting Thrust Pads lubricated by a specially designed oil disc arrangement inside the assembly. This provides a positive oil supply to the thrust pads as well as the sleeve bearings. This design eliminates the requirement of external lubricating oil stations. Normally, the only requirement would be a cooling water supply.

For the non-thrust assembly, HSRF, the same frame size housing will be used accommodating a standard sleeve bearing, lubricated by an oil ring.

The following features may be incorporated into a customer's design to meet their particular requirements:

Water Cooling
Where safe limits for air cooling are exceeded.

Tilting Journal Pads
To achieve low vibration levels in higher speed machinery,lemon bore and four lobe profiles are also available to deal with such requirements.

Axial Thrust Features
For most installations plain or taper land thrust faces are adequate. For high thrust load levels, or where a greater safety margin is required, GB Bearings standard tilting thrust pads are incorporated in the HSSF assembly.

Instrumentation
e.g. temperature recording instruments with alarm contacts as a further option.

Shaft Size
Shaft sizes less than 80mm and greater than 315mm may be accommodated by special order.

Additional sealing
Standard assemblies are supplied with SD type seals to IP44 protection (*see page 5)*. Alternative sealing arrangements to IP55 are available.

The standard materials used in the various components are:

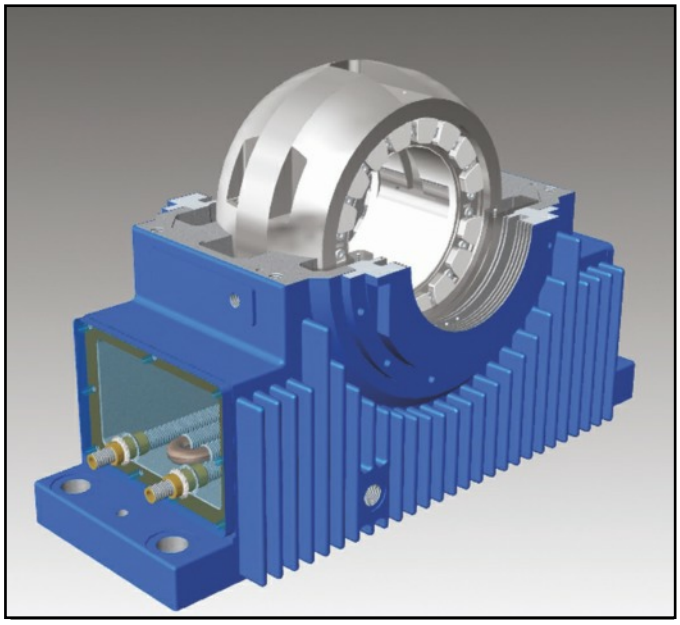
Casing
Grey cast iron to BS EN 1561:2011
or
Grade 220 (Equivalent: DIN 1691-1967 GG20/25)

Bearing
Steel to BS4360 Grade 43A
or
SG iron grade 420/12 to BS EN 1563:2011

Bearing lining
GB Bearings uses a lead-free high tin based white metal alloy.

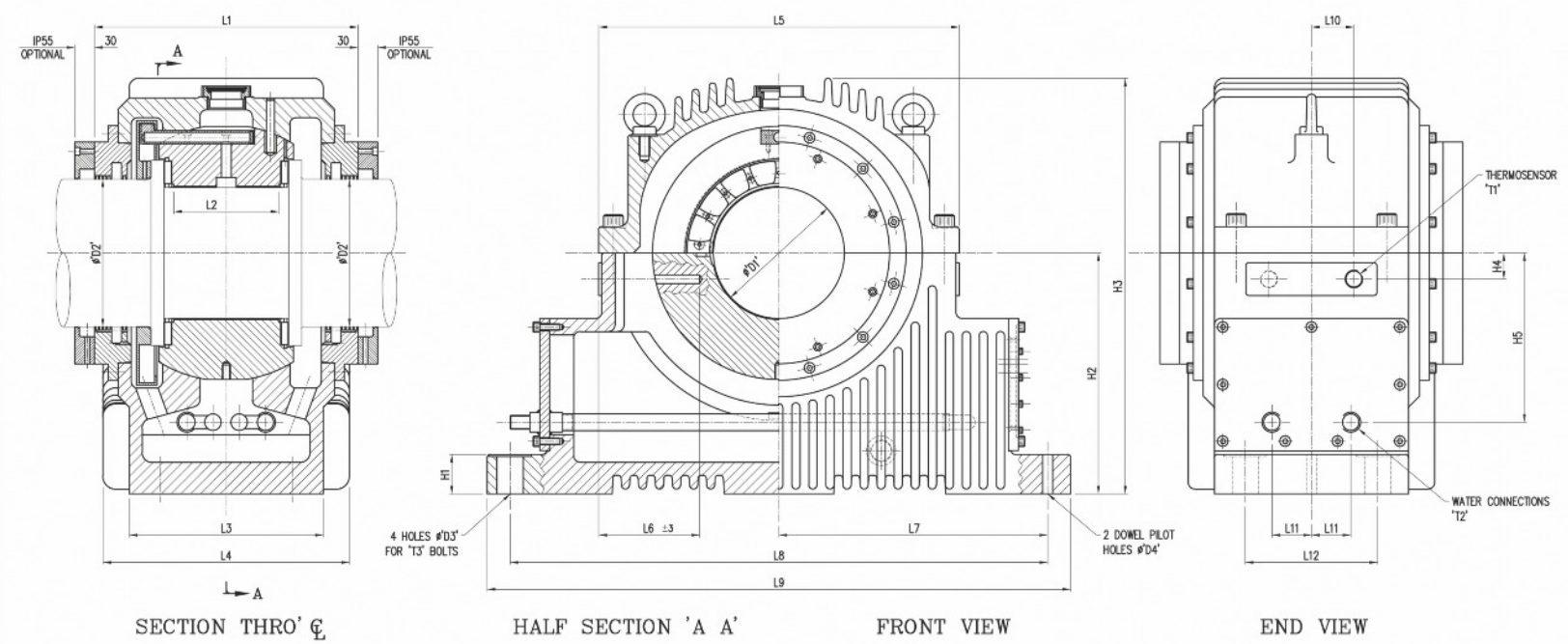
Fixed Labyrinth Seals
Aluminium material

When ordering, standard assemblies are identified by a combined bearing and seal code *(see page 12*). Options such as instrumentation are not coded and should be specified as an addition.



***Right:** HSSF Base Mount with top cover removed showing tilting thrust pad arrangement and water cooling coil.*

Size Table - Table 1 : Dimensions of HSSF base mounted unit



FRAME SIZE	FOR SHAFT DIA. D	D1	D2	D3	D4	H1	H2	H3	H4	H5	L1	L2	L3	L4	L5	L6 ±3	L7	L8	L9	L10	L11	L12	T1	T2	T3	Oil Capacity (Litres)	Approx Weight (kg's)
9	80 90	80	80	22	10	20	190	335	28.5	134.5	228	63	170	220	275	96 92	195	390	430	30	40	100	1/2" BSP	3/8" BSP	M20	2.5	60
		90	90																								
		100	100																								
		110	110																								
11	100 110	100	100	22	10	23	235	390	30	162.5	256	75	182	230	320	110 104	230	460	510	30	40	100	1/2" BSP	3/8" BSP	M20	4	90
		110	110																								
		125	125																								
		140	140																								
14	125 140 160	125	125	22	10	35	270	460	35	190	318	100	236	285	375	132 122 112	277.5	555	610	45	70	132	1/2" BSP	3/8" BSP	M20	7.5	155
		140	140																								
		160	160																								
		180	180																								
18	160 180 200	160	160	33	15.5	50	325	545	50	215	362	135	256	320	450	149 138 125	330	660	728	55	45	160	1/2" BSP	3/8" BSP	M30	10	265
		180	180																								
		200	200																								
		225	225																								
22	200 225 250	200	200	40	15.5	60	367	635	40	258	402	160	296	375	550	173 160 146	410	820	890	65	60	202	1/2" BSP	1/2" BSP	M36	15.5	460
		225	225																								
		250	250																								
		280	280																								
28	250 280 300 315	250	250	52	20	80	460	795	50	324.5	494	215	350	460	700	220 205 195	508	1016	1125	75	100	228	1/2" BSP	1/2" BSP	M46	24	860
		280	280																								
		315	315																								
		355	355																								

Notes:

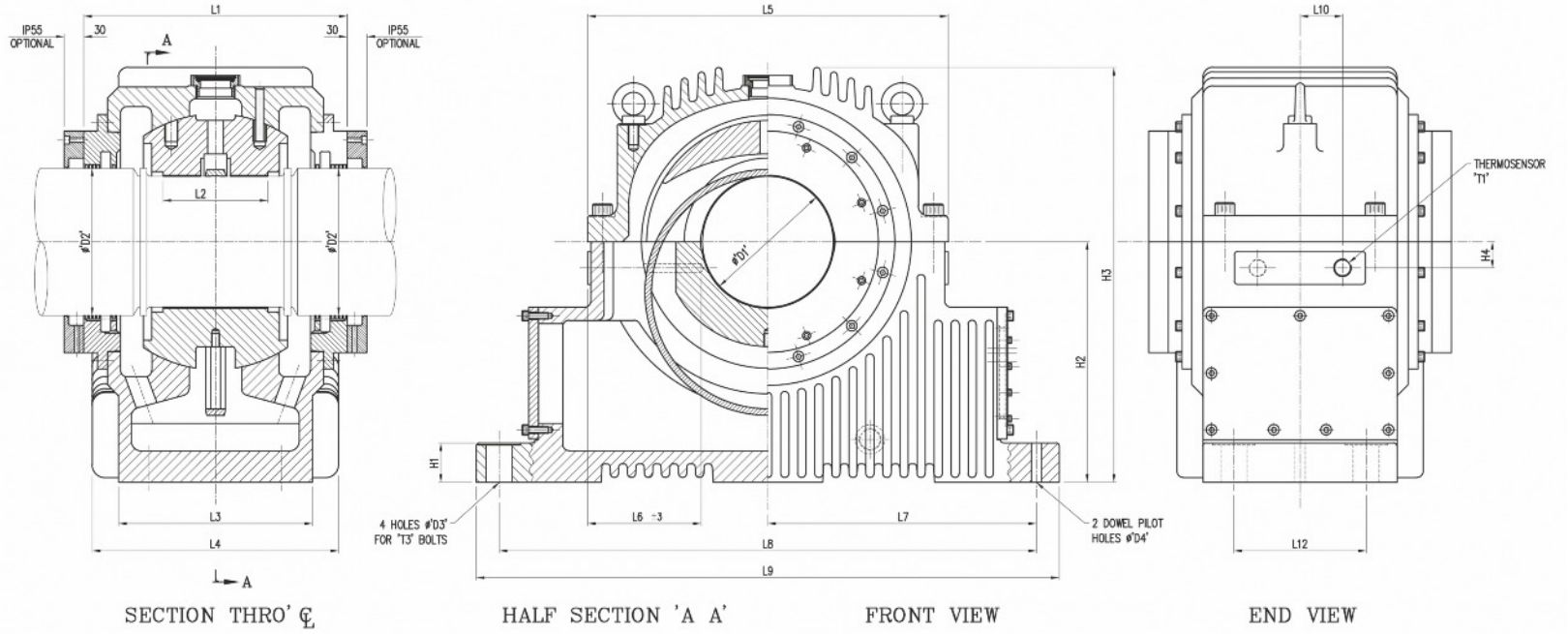
① Tapped features also in opposite side of unit identically positioned to refs L10 inclusive relative to journal bearing centre lines.

② Rp = BSP

③ Standard clearance holes for bolts D4

④ All dimensions in mm with the exception of T1 &T2

Size Table - Table 2 : Dimensions of HSRF base mounted unit



FRAME SIZE	FOR SHAFT DIA. D	D1	D2	D3	D4	H1	H2	H3	H4	H5	L1	L2	L3	L4	L5	L6 ±3	L7	L8	L9	L10	L11	L12	T1	T2	T3	Oil Capacity (Litres)	Approx Weight (kg's)
9	80 90	80	80	22	10	20	190	335	28.5	134.5	228	63	170	220	275	96 92	195	390	430	30	40	100	1/2" BSP	3/8" BSP	M20	2.5	60
		90	90																								
		100	100																								
		110	110																								
11	100 110	100	100	22	10	23	235	390	30	162.5	256	75	182	230	320	110 104	230	460	510	30	40	100	1/2" BSP	3/8" BSP	M20	4	90
		110	110																								
		125	125																								
		140	140																								
14	125 140 160	125	125	22	10	35	270	460	35	190	318	100	236	285	375	132 122 112	277.5	555	610	45	70	132	1/2" BSP	3/8" BSP	M20	7.5	155
		140	140																								
		160	160																								
		180	180																								
18	160 180 200	160	160	33	15.5	50	325	545	50	215	362	135	256	320	450	149 138 125	330	660	728	55	45	160	1/2" BSP	3/8" BSP	M30	10	265
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22	200 225 250	200	200	40	15.5	60	367	635	40	258	402	160	296	375	550	173 160 146	410	820	890	65	60	202	1/2" BSP	1/2" BSP	M36	15.5	460
		225	225																								
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28	250 280 300 315	250	250	52	20	80	460	795	50	324.5	494	215	350	460	700	220 205 195	508	1016	1125	75	100	228	1/2" BSP	1/2" BSP	M46	24	860
		280	280																								
		315	315																								
		355	355																								

Notes:

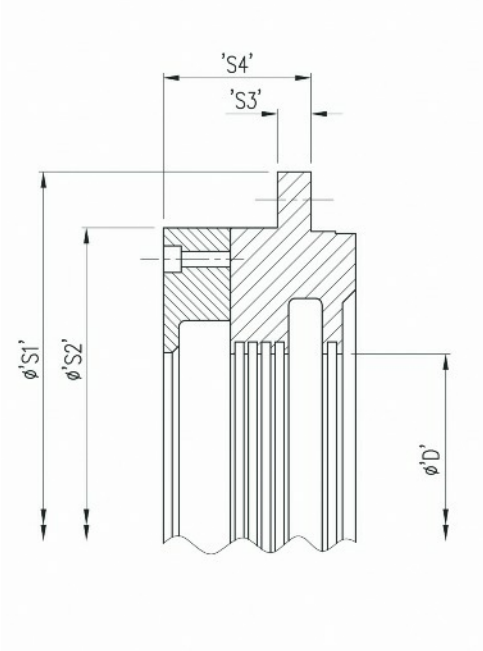
① Tapped features also in opposite side of unit identically positioned to refs L10 inclusive relative to journal bearing centre lines.

② Rp = BSP

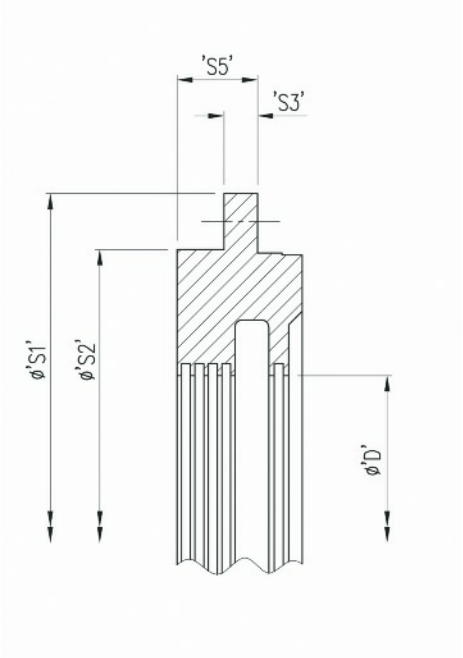
③ Standard clearance holes for bolts D4

④ All dimensions in mm with the exception of T1 &T2

Size Table - Table 3 : Dimensions of standard seals



Rigid Labyrinth Seal with baffle - Type SB Protection to IP 55



Rigid Labyrinth Seal Type SD Protection to IP 44

Frame Size	Nominal Bore	S1	S2	S3	S4	S5
9	80	200	154	10	54	24
	90					
	100					
	110					
11	100	230	198	10	65	35
	110					
	125					
	140					
14	125	295	255	10	69	39
	140					
	160					
	180					
18	160	360	310	15	66	36
	180					
	200					
	225					
22	200	388	338	15	66	36
	225					
	250					
	280					
28	250	510	420	15	65	35
	280					
	315					
	355					

All dimensions in mm

Drawing - HSSF Disc and Scoop Arrangement

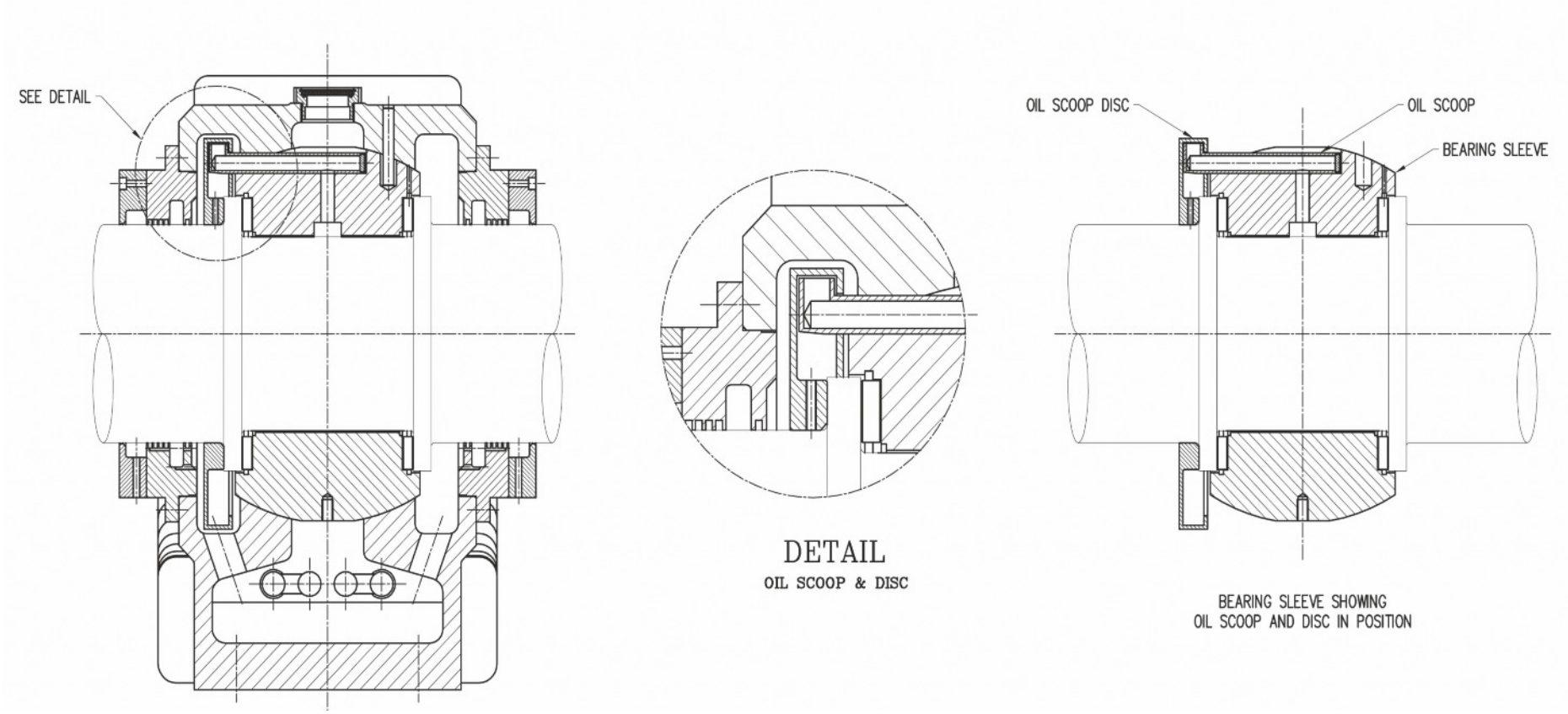
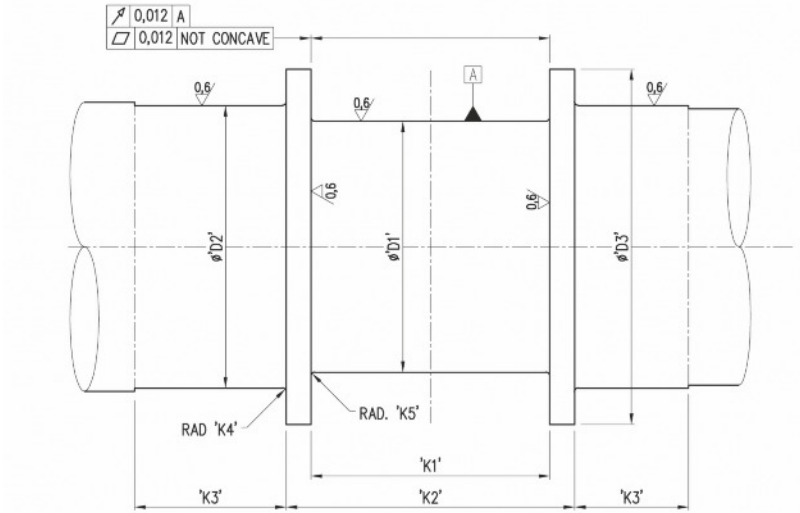
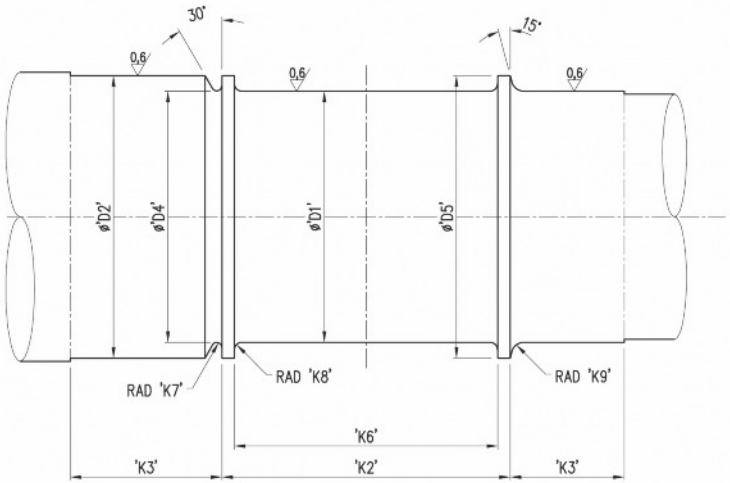


Figure 1: HSSF Disc and Scoop Arrangement

Shaft Dimensions - Table 4 : Shaft dimensions



Locating Shaft



Non Locating Shaft

FRAME SIZE	D1	D2 (e8)	D3	D4 (with D2)	D5	K1	K2	K3		K4	K5	K6	K7	K8	K9
9	80 90	80 90 100 110	120 123	80 (90) 90 (100) 100 (110)	90 100	80.4	100	69	99	4	2.5	90	1.6	2.5	4
11	100 110	100 110 125 140	148.6 162.6	100 (110) 110 (125) 125 (140)	110 125	97.56	118	74	104	2	2.5	108	1.6	2.5	4
14	125 140 160	125 140 160 180	175 200 200	125 (140) 140 (160) 160 (180)	140 160 180	125.4	150	89	119	6	4	135	2.5	4	6
18	160 180 200	160 180 200 225	223 238 258	160 (180) 180 (200) 200 (220)	180 200 225	165	195	89	119	5	4	180	2.5	4	6
22	200 225 250	200 225 250 280	283 295 315	200 (225) 225 (250) 250 (280)	225 250 280	190.4	230	91	121	3	3	210	4	6	10
28	250 280 300 315	250 280 315 355	343 365 380	250 (280) 280 (315) 315 (355)	280 315 355	250.4	300	102	132	2	3	280	6	6	10

Bearing Selection

By following the sequence laid down in the succeeding sections, and making technical choices at each stage, someone new to specifying GB Bearings HSSF bearings can rapidly make a final selection.

Load Capacity

The initial selection is dependent on the load to be carried. As the bearing is normally limited to a maximum specific load (equivalent to bearing pressure) of 2.5Mpa, this dictates the shaft diameter and the bearing frame size. Figure 2 shows the maximum recommended running load in Newtons for bearings in the standard range of HSS frame sizes and shaft diameters.

In certain circumstances it may be possible to increase the maximum allowable specific load, and GB Bearings should be consulted if this is required.

Maximum loads at start-up are lower than those for normal running because, at low speeds, the rotation of the shaft will not maintain a film of oil adequate for supporting a high load. Where machinery is to be started frequently, and start-up loads exceed these values, then GB Bearings should be consulted to discuss possible alternative solutions.

Where specific loads in excess of 2 Mpa are to be carried by bearing assemblies of Frame size 22 and 28, careful selection of bearing clearance and oil type may be required to maintain adequate oil film thickness.

GB Bearings can, at all times, assist clients with this very important selection process through the use of GB's specialised design programme.

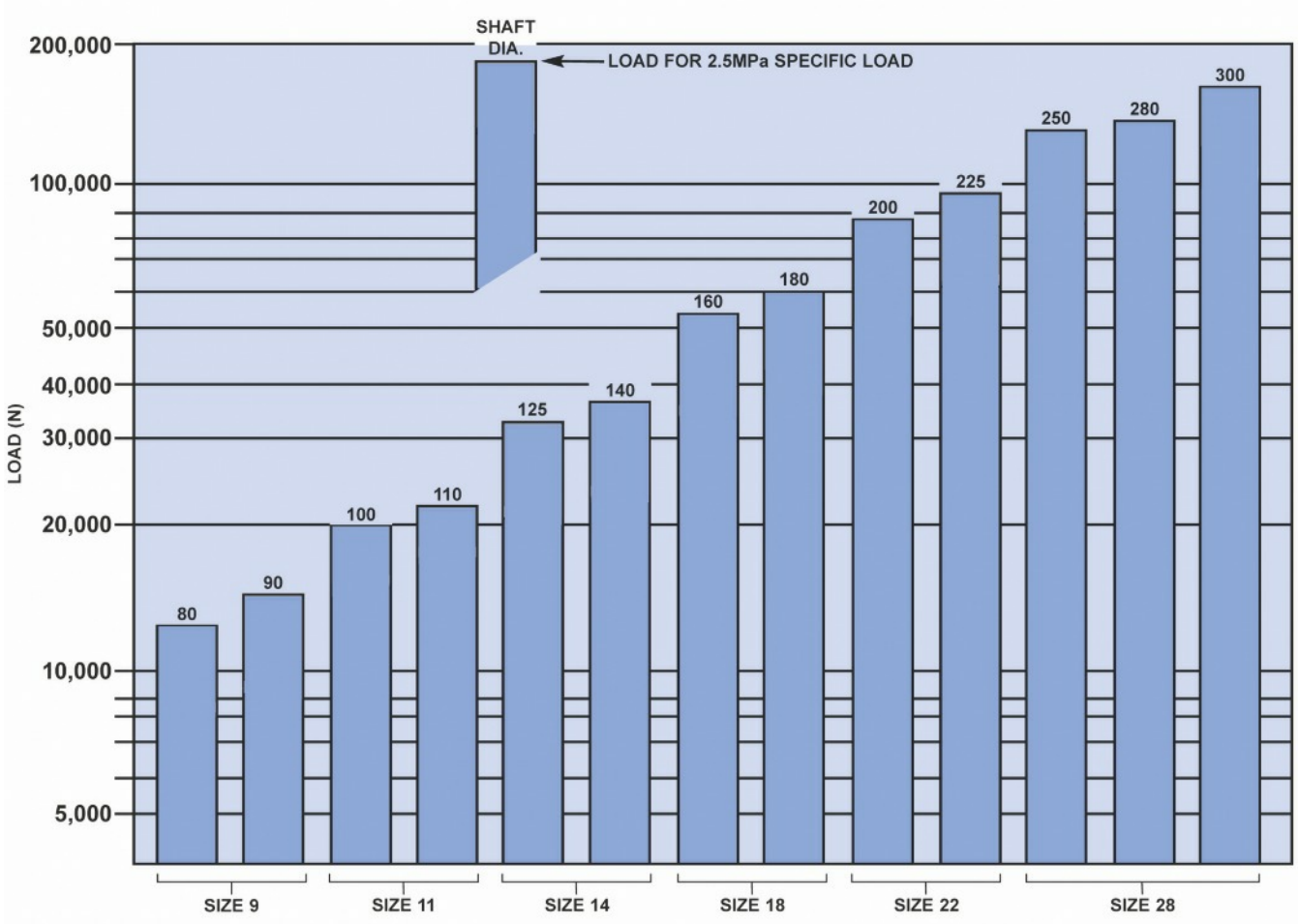


Figure 2: Journal bearing load capacity

Bearing Selection

Speeds and Clearances
For speeds below 200 rev/min the load carrying capacity of the bearing is limited and GB Bearings should be consulted for information on bearing clearance and oil for such applications.

Figure 3 shows, for each shaft diameter, the minimum diametral clearances for oil disc and oil ring lubrication over a range of maximum continuous operating speeds. However, **this is for guidance only**, as the choice of bearing clearance is influenced by many other factors including:

- load
- variable operating speeds
- ambient conditions
- choice of lubricant
- site environment
- method of cooling

Shaft Diameter
The manufacturing diameters of the shaft with the upper and lower limits, may be obtained from the information in Figure 3 and Table 5, and calculated as follows:

Shaft max. dia. = nominal shaft diameter – min. diametral clearance

Shaft min. dia. = shaft max dia – shaft diametral tolerance.

Example:
For a 100mm shaft operating at 3000 rev/min
D max. = 100 – 0.140 = 99.860
D min. = 99.860 – 0.022 = 99.838

Frame Size	Shaft Diameter (mm)	Shaft tolerances Shaft dimateral tolerance
9	80	0.019
	90	0.022
11	100	0.022
	110	0.022
14	125	0.025
	140	0.025
18	160	0.025
	180	0.025
22	200	0.029
	225	0.029
28	250	0.029
	280	0.032
	300	0.032
	315	0.032

Table 5: Manufacturing tolerances

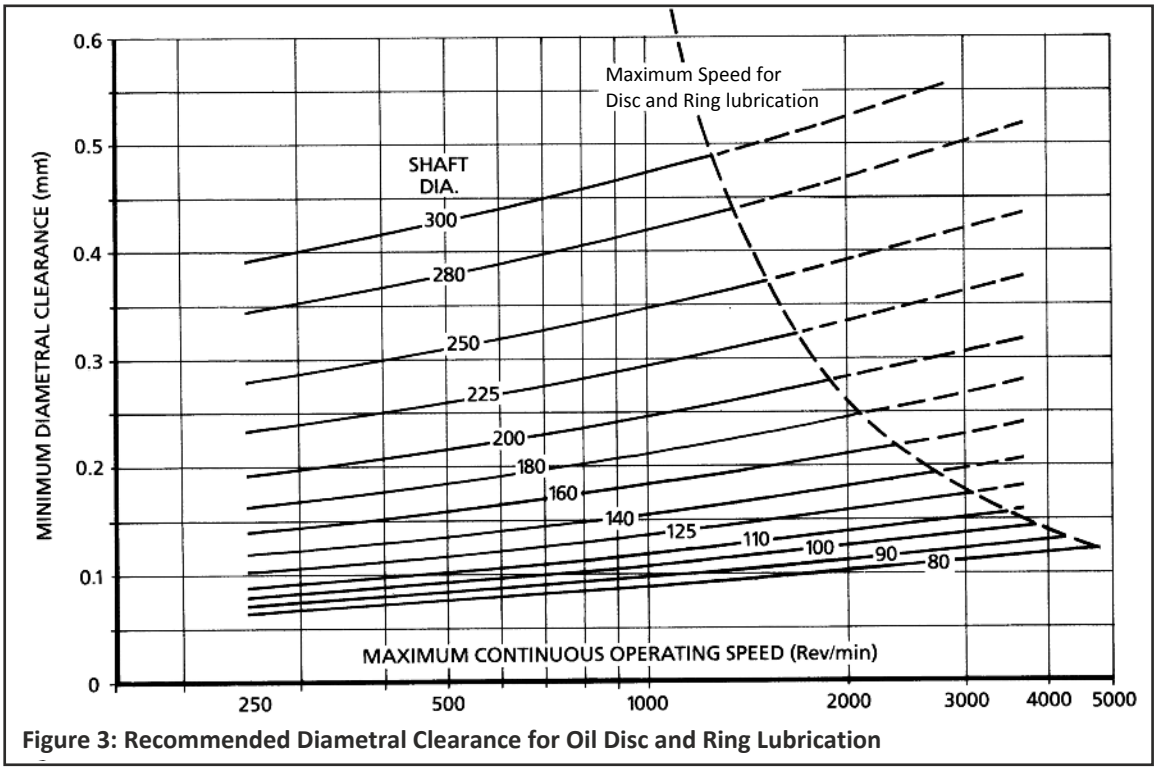


Figure 3: Recommended Diametral Clearance for Oil Disc and Ring Lubrication

Bearing Selection

Thrust Loading
The HSSF range of assemblies consist of an oil disc which transfers oil from the sump, through an oil scoop/scraper, directly into the bearing shell. This creates a positive oil feed system not only to the bearing sleeve but to the thrusting arrangement designed to accommodate high axial loads. The assembly units are usually water cooled. In addition, **this design eliminates the need for an external lubricating oil station.**

For high axial loads, tilting pad thrust bearings are used. All HSSF assemblies can be fitted with thrust pads from the standard range of GB Bearings Tilting Pad Thrust bearings. Details available on request.

Table 6 gives some guidance only on their specified axial load capacity. In addition, this table gives comparative thrust loadings for plain thrust and taper land thrust facings.

Confirmation of Selection
Even where the selection of a bearing appears to fall within all the design criteria, GB Bearings recommends that customers confirm their selection by completing the ordering details given in page 13 of this handbook.
GB Bearings bearing design computer program will then be used to predict the operating conditions of the bearing, and the customer will be supplied with this data including stiffness and damping coefficients for the journal bearing.

Special Designs

Manufactured to Customer Requirements
GB Bearings offers a range of assembly bearings and a service which is among the most comprehensive and versatile world-wide.

GB Bearings is able to meet virtually any specification. Our standard designs can be readily adapted or we can manufacture bearings to customer designs.

Our customers enjoy the benefits of close liaison and expertise at every stage and the quality of our technical assistance is well known.

Frame Size	Shaft Diameter (mm)	Plain Thrust load (N)	Taper thrust Load (N)	Thrust Pads Load (N)
9	80	1 100	2 500	9 381
	90	1 200	3 000	7 752
11	100	1 550	3 800	19 200
	110	2 000	5 000	22 243
14	125	2 550	6 250	16 494
	140	3 200	8 000	25 950
18	160	3 900	10 000	13 566
	180	4 900	12 000	36 300
22	200	5 750	14 500	33 365
	225	6 350	16 500	64 750
28	250	8 250	20 500	60 159
	280	9 050	23 000	94 320
	300	9 600	25 000	89 031
	315	9 600	25 000	89 031

Table 6: Maximum thrust (axial) loads at optimum speeds
FOR GUIDANCE ONLY

Optional features

Profile Bore Journal Bearings
Profiled bores provide improved shaft damping and greater oil film stability than the standard cylindrical bearing in higher speed applications. For these situations, HSSF bearings fitted with lemon bore, offset halves, or 3 and 4 lobe bore profiles can be supplied.

Tilting Journal Pad Bearings
For higher speed machines, and where vibration levels need to be reduced, tilting pad journal bearings offer the most stable running conditions under a wide range of loads and speeds. As they can accept loads from any radial direction, tilting pad journal bearings offer special advantages for electric motors where the influence of magnetic fields may not be precisely known.

All HSSF assemblies can be fitted with tilting pad journal bearings, using journal pads from GB Bearings (in HSSF assemblies, the length/diameter ratio of these bearings will normally be 0.7). Details available on request.

Instrumentation
Whatever instrumentation may be needed by a customer, it should be discussed with GB Bearings as early as possible. Many of these are proprietary items, so where a customer has a particular preference, he should state it.

Materials
The casing and bearing housing can be made from special materials when this is required. However, price and delivery may be affected.

Rotor Dynamics

A Valuable Analysis Service
Excessive rotor vibration can damage machinery, and shorten its life. Therefore, GB Bearings operates a rotor dynamics analysis service so that a machine's rotor dynamics can be evaluated at the design stage.

This includes detailed interactive computer studies of complete shaft systems to avoid costly rotor dynamic problems.

Techniques employed to investigate the dynamic interaction between journal bearings and rotor include:

- undamped natural frequency analysis
- damped natural frequency (stability) analysis
- synchronous response to unbalanced analysis

Computer studies of entire shaft systems are carried out at agreed fees. Alternatively, GB Bearings will supply bearing operating data and dynamic coefficients as part of its normal service to enable customers to conduct their own analysis.

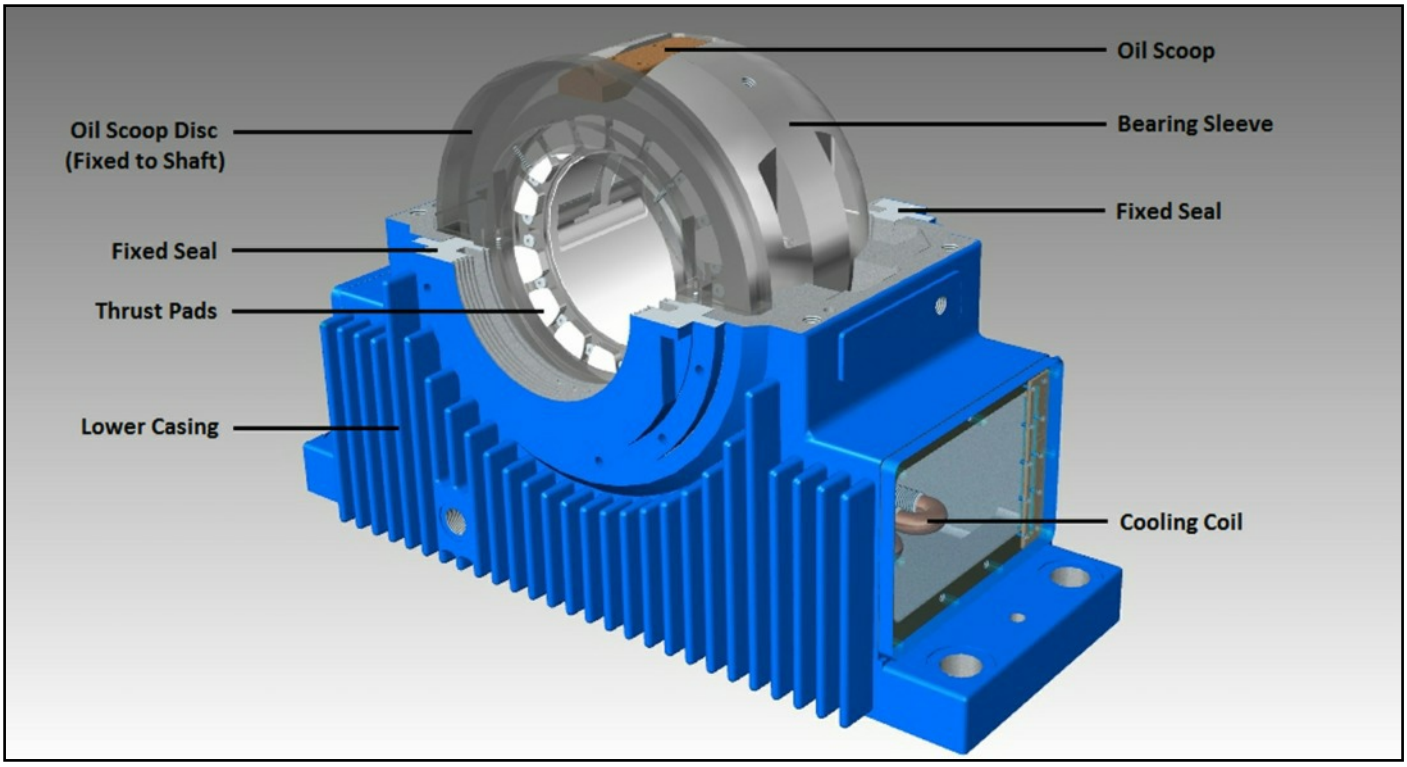
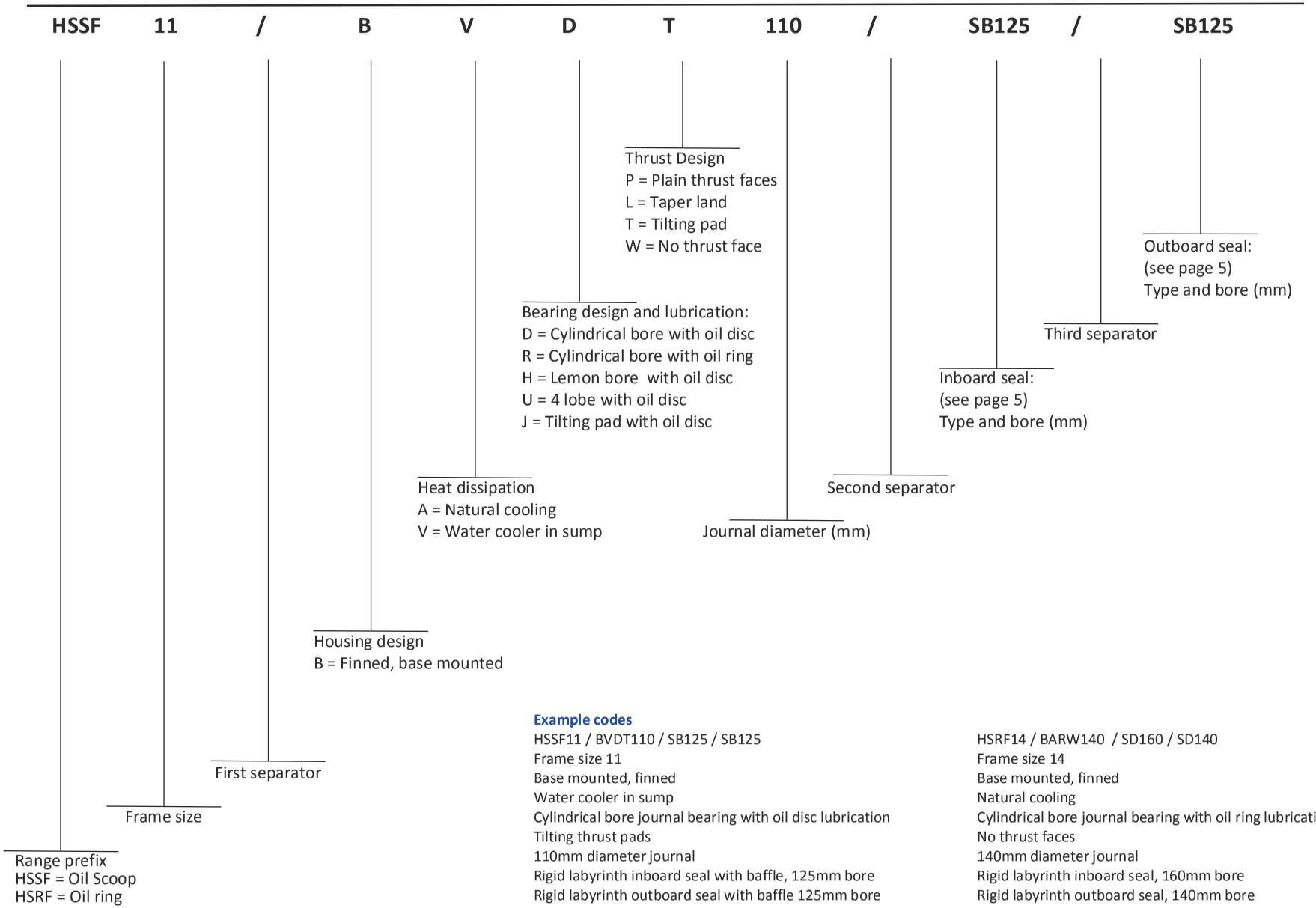


Figure 4: 3D view of typical HSSF unit with top casing cover removed

Reference Codes

Assembly Order Codes



Example codes

HSSF11 / BVDT110 / SB125 / SB125
Frame size 11
Base mounted, finned
Water cooler in sump
Cylindrical bore journal bearing with oil disc lubrication
Tilting thrust pads
110mm diameter journal
Rigid labyrinth inboard seal with baffle, 125mm bore
Rigid labyrinth outboard seal with baffle 125mm bore

HSRF14 / BARW140 / SD160 / SD140
Frame size 14
Base mounted, finned
Natural cooling
Cylindrical bore journal bearing with oil ring lubrication
No thrust faces
140mm diameter journal
Rigid labyrinth inboard seal, 160mm bore
Rigid labyrinth outboard seal, 140mm bore

Ordering Details

Durban Office
PO Box 2121
Pinetown, 3600
South Africa
Tel: +27 (0) 31 792 5900
Fax: +27 (0) 31 700 3613
www.gbbearings.co.za

Johannesburg Office
PO Box 8066
Elandsfontein, 1406
South Africa
Tel: +27 (0) 11 974 1291
Fax: +27 (0) 11 974 1468
info@gbbearings.co.za

Please complete this page, photocopy and return to GB Bearings by post or fax. Alternatively, you can complete and submit a form from our website.

HSSF/HSRF enquiry data sheet

Customer:

Contact Person:

Telephone No:

Fax No:

Mobile No:

Email address:

Customer Reference No:

Site Location:

Application: Fan ☐ Pump ☐ Other ☐

State:

Number of assemblies required:

Delivery required:

The following information is required:

1. **Reference code of HSSF/HSRF selected from Page 12 of this handbook is**:

   HS

2. **Shaft speed**

   Normal: rev/min

   Overspeed: rev/min

   Maximum: rev/min

3. **Radial load**

   Normal: N

   Maximum: N

   Start-up: N

   Load direction: Steady ☐ Rotating ☐

   Vertically downwards: Yes ☐ No ☐

4. **Axial (Thrust) Load (Main direction)**

   Normal: N

   Maximum: N

   Start-up: N

   Axial (Thrust) Load (Reverse direction)

   Normal: N

   Maximum: N

   Start-up: N

5. **Oil grade to be used:**

6. **Shaft diameter: mm** (with tolerance if not IT6)

7. **Ambient air temperature**

   Normal: °C Max: °C

8. **External air velocity**

   Normal: m/s Max: m/s

Additional information required to describe optional features (page 11)

Durban
Pinemead Industrial Park
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Fax: +27 (0) 11 974 1468

Cape Town
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Paarden Eiland
Western Cape
South Africa
PO Box 6192
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info@gbbearings.co.za