



Innovative Power Transmission



Type E Slide Bearings

Introducing the E Family

Series EG/ER
Journal Range 80 - 355 mm

① **Type**

E

② **Housing series**

R finned, foot-mounted

G smooth, foot-mounted

F*) finned, flange mounted

M*) finned, centrally flange mounted

③ **Heat dissipation**

N natural cooling

Z lubrication by oil circulation with external oil cooling

X lubrication by oil circulation with external oil cooling for high oil throughput

W water cooling in oil sump

U circulating pump and natural cooling

T circulating pump and water cooled oil sump

} This pump sucks cool oil from the bearing sump and delivers to the oil inlet bore.

④ **Shape of bore and type of lubrication**

C plain cylindrical bore, without oil ring

L plain cylindrical bore, with loose oil ring

F*) plain cylindrical bore, with fixed oil ring

Y two-lobe bore (lemon shape), without oil ring

V four-lobe bore (MGF profile), without oil ring

K*) journal tilting pads, without oil ring

⑤ **Thrust surface**

Q without thrust parts (non-locating bearing)

B plain sliding surfaces (locating bearing)

E taper land faces for one sense of rotation (locating bearing)

K taper land faces for both senses of rotation (locating bearing)

A elastically supported circular tilting pads (RD thrust pads) (locating bearing)

Example

for quoting a complete bearing

① ② ③ ④ ⑤

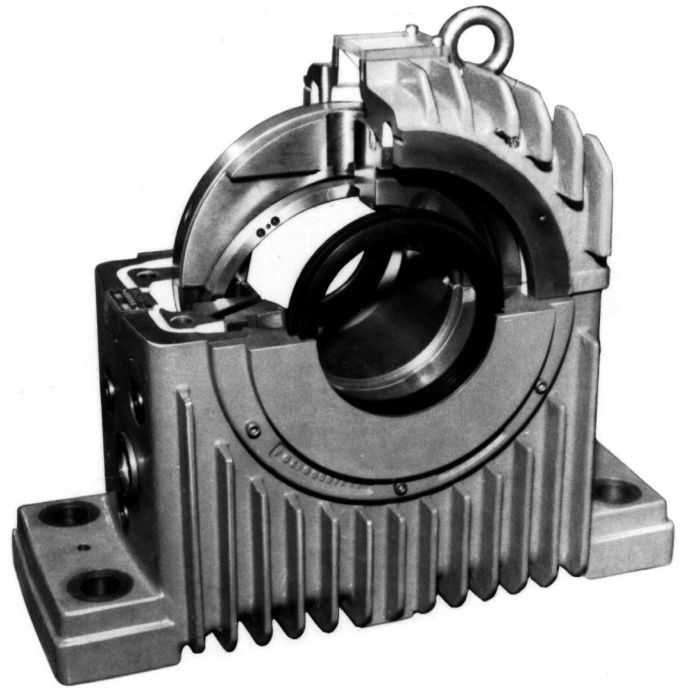
E R N L B 11 - 110

Slide bearing type E with finned housing, foot mounted, natural cooling, plain cylindrical bore with loose oil ring, as locating or non-locating bearing, plain sliding surfaces, size 11, 110 mm shaft diameter.

*) Ask for special leaflets and technical information.

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The weights given in the tables are not binding, average values and the illustrations are not strictly binding.

We reserve the right to changes made in the interests of technical improvement.

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RENK E-Type bearings are slide bearings of the most up-to-date design which can be assembled together, to suit requirements in a number of alternative ways by using pre-fabricated units.

They were developed primarily as bearings for electric machines, blowers, turbocompressors and horizontal water turbines but in view of the possibility of fitting them with different alternative components they can be used almost universally in the engineering industry.

A particular advantage of installing them in production plants (e.g. refineries, power stations, iron and steelworks) is to reduce the number of parts which have to be carried in stock as it is often possible to equip driving and driven machines with the same slide bearings.

The different design types are available from stock in the range of diameters from 80 to 355 mm.

For E-bearings with bores exceeding 355 mm diameter further technical information is available on request.

Description of the Design System

Unit composed system

The use of the unit composed principle in the planning of the E-Type series of bearings was a far-reaching accomplishment. The different combinations of slide bearings are, in case of need, assembled from stock components and sub-assemblies. This ensures that there is the quickest possible delivery of spare parts from the Hannover Works.

Interchangeability of the parts is guaranteed and a shell with plain shoulders, for example, can be replaced if necessary by one with integral taper land thrust faces.

Bearing Housing

Depending on the operating conditions, the housings are supplied either with fins or as a smooth design. (Flange bearings are finned design only).

The housing are to be considered as "main module" in the E-Type bearing unit composed system and when they are combined with different "complementary modules", such as shell, lubricating ring, thermometer and other accessories, additional machining is frequently unnecessary.

Even in special cases (e.g. the fitting of oil coolers or vibration detectors) finish machined housings are taken from stock and provided with additional connection holes. Tapped holes for thermometer, oil inlet and outlet, oil level, oil sump thermometer or circulating pump suction piping are provided on either side of the housing.

The rigid housing design is recognized for its good distribution of forces under radial and axial loading conditions resulting in a heavy-load carrying capacity. The height of the centre line is such that brackets can be attached to the end plates of electric machines for receiving the pedestal bearing. When the shells and seals have been removed the housing can be easily removed as well axially without the rotor having to be dismantled. If the housings are standing on intermediate brackets they can be lowered and withdrawn sideways after removing the brackets.

For bearings with insulated shells, the spherical seating of bearing housings is lined with synthetic material. In addition, the shaft seals are made of insulating material or an intermediate insulation will be mounted when assembling the seals (Insulated

flange-mounted bearings are available from stock).

The housing material is cast iron (EN-GJL-300); nodular cast iron (EN-GJS-400-15) or cast steel can be supplied for special applications.

Seals

Different types of seals can be provided depending on the operating conditions (see p.12).

1. For normal conditions floating labyrinth seals of high-quality fiber-reinforced synthetic material which are floating in the seal carrier (Type 10) are used with E-bearings. This type of seal has various advantages to offer:
 - it is insensitive to radial displacement of the shaft, resulting for example, from shaft bending or from lifting the rotor when taking out the shell. It conforms to the type of protection IP 44
 - for dismantling the shell (e.g. for inspection) only fastening screws in the bearing top have to be loosened, the labyrinth seal remaining on the shaft



- should the seal be damaged, only the seal itself need to be replaced (inexpensive)
 - independent of the bearing size the same labyrinth seals are used for a given shaft diameter in way of the seals. Shorter deliveries are therefore possible in view of the simpler stocks
2. Bearings which call for a high oil throughput are provided with seals with two labyrinth systems (Type 20). The first two labyrinths deflect any oil which leaves the bearing shell. Small quantities of oil which have not been wiped off by these two labyrinths are collected in an intermediate chamber and then fed back, through return holes, to the oil sump. Five further labyrinths then act as the seal proper i.e. they prevent oil from leaking and also the ingress of foreign particles into the inside of the bearing. This seal conforms to the type of protection IP 44.
 3. For operation in dusty environments the seals Type 10 or 20 will be equipped with dust flingers (see page 12), which also prevent any possible low pressure on the shaft exit side from "drawing" oil from inside the bearing. These seal combinations have the designation 11 or 21. They conform to type of protection IP 54.
 4. To conform to type of protection IP 55, seals Type 10 or 20 are equipped with additional baffles screwed in front of them. Such seal combinations have the designation 12 or 22. The additional baffle serves to protect the seal proper against dust or water jets.
 5. Special seals such as those with air ventilation and radial lip seals can be supplied for special requirements. Details are available on request.

Bearing shells

The shells are spherically seated in the housing. This means simple assembly as well as suitability for high static and also dynamic axial and radial loads. For oil ring lubricated bearings a favourable oil flow (oil circulation) is guaranteed by the

central arrangement of the oil ring. The wide spherical seating means too, that there is good heat transfer between the shell and the housing.

The shell consists of a steel body which is lined with RENK metal therm V6 (a lead based bearing metal). The shells are constructed with very thick walls to meet the requirements of the heavy engineering industries (troublefree assembly, long life, severe operating conditions). Such a shell can, in urgent cases, be relined with bearing metal even on site.

The perfect metallic bond between steel and bearing metal is guaranteed by the specified ultrasonic tests which are carried out in the course of manufacture.

Journal bearing

Radial loads can be taken up by shells with

1. plain cylindrical bore
2. two-lobe bore (lemon shape)
3. four-lobe bore (MGF profile)
4. journal tilting pads

The selection is made here on the basis of experience or of the calculated critical speed for shafts supported by slide bearings.

Three shaft diameters to DIN Series R 20 are assigned to one size of housing. Bearings for other shaft diameters can be provided as a special design. To avoid wear and high friction torques at turning speeds and when starting up and slowing down under heavy loads as well as when reversing, it is possible to install a hydrostatic jacking device as an option.

Thrust bearing

1. Small temporary loads are taken up by plain shoulders on the shell (locating bearing).
2. Thrusts of a medium size are absorbed by taper land faces integral with the shoulders and suitable for both directions of rotation.

3. High thrusts can be taken up by tilting RD thrust pads. In addition to the oil film, the cup springs supporting of the RD thrust pads have damping properties and intercept shocks elastically.

This design requires lubrication by circulating oil, e.g. the use of an oil pump.

4. In case of shells with oil-disc lubrication high axial loads will be absorbed by tilting RS pads. Up to certain speeds or power losses respectively, this type of bearing can be operated with oil disc lubrication only.

A pre-selection of the appropriate thrust part can be made with the aid of the loading table on page 9.

As additional heat is produced by thrust loads the values given in the table for natural cooling on page 14 cannot be fully utilized when, in case of higher operating speeds, the power loss created in the journal bearing alone reaches the limits for heat dissipation by radiation and convection.

Particularly if the max. loads given on page 9 are being used, or exceeded, a computer calculation should be run through by us, as many of the influencing factors cannot be considered in a table.

Operating Methods

Oil supply

Self lubrication by oil rings or oil discs. Oil rings can be used with shafts having a peripheral speed of up to 20 m/s and oil discs at peripheral speed of up to 17.5 m/s measured at the outer diameter of the disc. For the emergency run down of bearings in case failure of the circulating oil lubrication, oil rings can be used up to 26 m/sec. circumferential speed of the shaft, and oil discs for circumferential speed of 20 m/sec. at the outer diameter of the lubricating disc. Both types of lubricating rings can also be used for service in ships (details on request). The central arrangement has the advantage that the immersion depth of the lubricating ring remains constant when the bearing housing is not leveled.

A further important advantage of the symmetrical design is that oil spray thrown off the lubricating ring cannot affect the tightness of the seal.

The inside of the housing is connected with the side compartments only in the bottom housing.

Checking of the oil level when using ring lubrication is by means of oil sight glass which, by choice, can be fitted on the left or the right.

A circulating oil system can be installed for lubrication not only in addition to the ring lubrication but also as a separate oil supply. For design "Z" the oil inlet and outlet connections can be fitted by choice on the left or right of the bottom housing. In such case a favourable oil level in the bearing housing is defined by the weir in the oil outlet pipe which is part of our supply. When using bearing shells of type E.ZLQ or E.ZLB the value indicated in the "Oil throughput graphs for plain bearings" may be reduced by approx. 30% as the oil ring also improves to the oil feed. Design "X" is installed when particularly large quantities of oil flow through the bearing and no ring lubrication, with a definite oil level, is provided. On request a table of dimensions giving details of the position of the enlarged oil outlet holes is available. Oil outlet

Dimensions of oil outlet in function of oil throughput

| size | design Z | | | | | |
|------|------------|---|-------|-------------|---|-------|
| | oil outlet | for oils ISO VG 32 and 46 ISO VG 68 and 100 at $t_e = 40^\circ\text{C}$ | | oil outlet | for oils ISO VG 32 and 46 ISO VG 68 and 100 at $t_e = 40^\circ\text{C}$ | |
| | | l/min | l/min | | l/min | l/min |
| 9 | G 1 1/4 | 9 | 7 | 2 x G 1 1/4 | 18 | 14 |
| 11 | G 1 1/4 | 9 | 7 | 2 x G 1 1/4 | 18 | 14 |
| 14 | G 1 1/2 | 11 | 9 | 2 x G 1 1/2 | 22 | 18 |
| 18 | G 1 1/2 | 11 | 9 | 2 x G 1 1/2 | 22 | 18 |
| 22 | G 2 | 18 | 16 | 2 x G 2 | 36 | 32 |
| 28 | G 2 1/2 | 28 | 25 | 2 x G 2 1/2 | 56 | 50 |

Larger oil quantities with special outlets on request

G = B.S.P.

speed is 0.15m/s max. (referred to the total cross section). With favourable flow conditions in the piping system outlet speeds, up to 0.25 m/s max. can be permitted.

Arrangements for checking the oil pressure, temperature and circulating oil flow are the responsibility of the customers but we can submit proposals on request.

Circulating pumps for the oil supply can be installed, when for example, large quantities of lubricating oil must be available for continuous changes in the direction of rotation or when taper land sections or RD thrust bearings are being used and yet external oil cooling is still not required for removal of the heat. Circulating pumps suck the oil from the oil sump through a tapped hole below the oil level, and feed it directly to the shell. An oil cooler can also be connected into this closed circuit, if the permissible bearing temperature is slightly exceeded.

The grade of oil viscosity necessary for satisfactory operation of the bearing is either proposed by the user or recommended by us, and selected from the range ISO VG 32 to VG 220.

Heat dissipation

Because of the considerable increase in the heat dissipating surface with a finned housing the operating range with natural cooling (by radiation and convection) is extended. The fins produce a further improvement in the heat dissipation also when there is forced convection cooling (e.g. by a shaft-connected fan).

A design with water cooling by means

of a cooler with smooth or finned tubes in the oil sump is also available.

A table giving the sizes and positions of the cooling water connections is obtainable on request.

If the heat generated in the bearing exceeds certain values, a circulating oil system with external oil cooling must be installed.

For temperature control two temperature probes of commercial size, and operating independently of each other, can be inserted in holes provided for them in the bottom shell. We recommend for this purpose the RENK screw-in resistance thermometer.

Bearing calculation

When the operating conditions are given by the customer, each bearing supplied by us is designed and checked on the basis of hydrodynamic and thermal calculations with the aid of a computer. The values to be used e.g. speed, size and direction of load, grade of oil viscosity and ambient temperature are standard factors for calculating the behaviour. We must therefore ask for correct information for the values listed in our "Enquiry for Slide Bearings" form.

The bearing temperature and minimum thickness of oil film determine the reliability of a slide bearing.

To make it possible for users to select a bearing in the project stage, graphs are given on pages 14 and 15 showing, for lubrication with oil rings, the dependence of the average bearing temperature on the speed.

With oil ring lubrication, an ISO VG 32 lubricating oil is chosen as a parameter in order to show the widening of the range of application at high speeds.

Uncompleted curves in the low speed range show that the minimum thickness of oil film is not reached here (the remedy is to select an oil with higher viscosity).

If the graph shows that the allowable bearing temperature is already exceeded as a result of the heat generated in the journal bearing, then one of the alternatives listed under the section "Heat dissipation" is to be used.

As the majority of slide bearings used in the heavy machine building industry operate at speeds up to 3600 RPM with a specific load pressure of approx. $0.5\text{--}2.5\text{ N/mm}^2$, the temperature curves have been plotted for 1.0 N/mm^2 , and 2.0 N/mm^2 .

With a specific load of more than 2.5 N/mm^2 , a computer calculation

should be carried out in order to determine the grade of oil required (higher viscosity). Higher speeds and/or smaller specific loads could require bearing shells with two- or four-lobe bores, or radial tilting segments to be installed.

The graphs on pages 16 and 17 give the oil throughput for lubrication by a circulating oil system or by means of a circulating pump for:

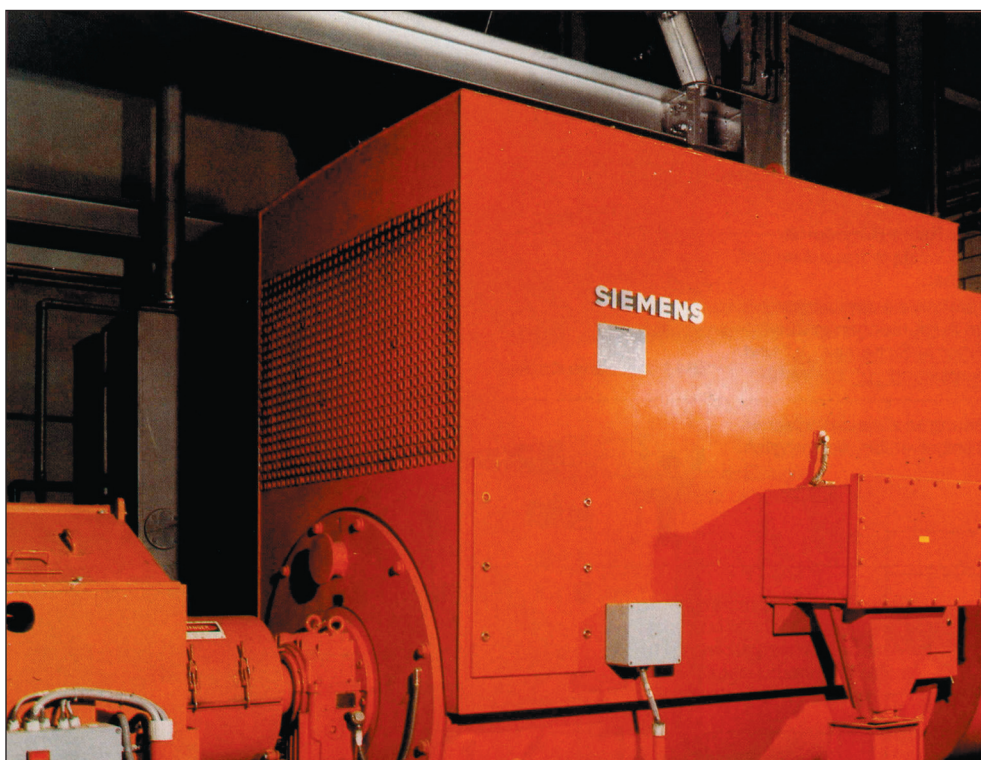
- a) E-Type bearing with shells with plain cylindrical bore
- b) E-Type bearing with shells with two- or four-lobe bore, journal tilting pads
- c) additional throughput for E-Type bearing with taper land faces in the thrust part
- d) additional throughput for E-Type bearing with RD thrust pads.

Stability

In order to be able to judge the influence of slide bearings on the stability of high-speed rotors, the anisotropy of the lubricating film is taken into consideration by specifying 4 elasticity and 4 damping values and the quasi-orthotropy of the bearing housing by specifying the horizontal and vertical elasticity constants. RENK-Hannover can, on request, calculate the critical speed of the shaft taking into account the properties of the oil film, the mass and stiffness of the housing and the foundations.

With electric machines the magnetic elasticity constant may be included.

When using the E-bearings, please also consult our "Manual for the application of RENK Slide Bearings" as well as our "Instructions for assembly, operation and maintenance" available for every special design.



High-voltage threephase generator Siemens - H - modul with RENK - Slide Bearing EF. (Photo : Siemens AG, Erlangen)

Technical Indications

① Type

E slide bearing for electric machines, fans, turbocompressors, water turbines, etc.

② Housing

R foot-mounted, with cooling fins

G foot-mounted, without fins

F flange-mounted, with cooling fins

M centrally flange-mounted, with cooling fins

③ Heat dissipation

N natural cooling by radiation and convection

Z oil circulating system with external oil cooling (with supplementary ring lubrication)

X oil circulating system with external oil cooling for high oil throughput

W water cooling by finned tube cooler incorporated into the oil sump

U circulating pump (with natural cooling) (where large oil quantities are required, e.g. shells with taper land faces or RD thrust pads)

T circulating pump (with water cooled oil sump) The increased flow speed intensifies the heat dissipation, and larger quantities of lubricant are available for the lubrication of e.g. taper land faces and RD thrust pads

④ Shape of bore and type of lubrication

C plain cylindrical bore, without lubricating ring, e.g. for high sliding velocity or with radial load direction upwards

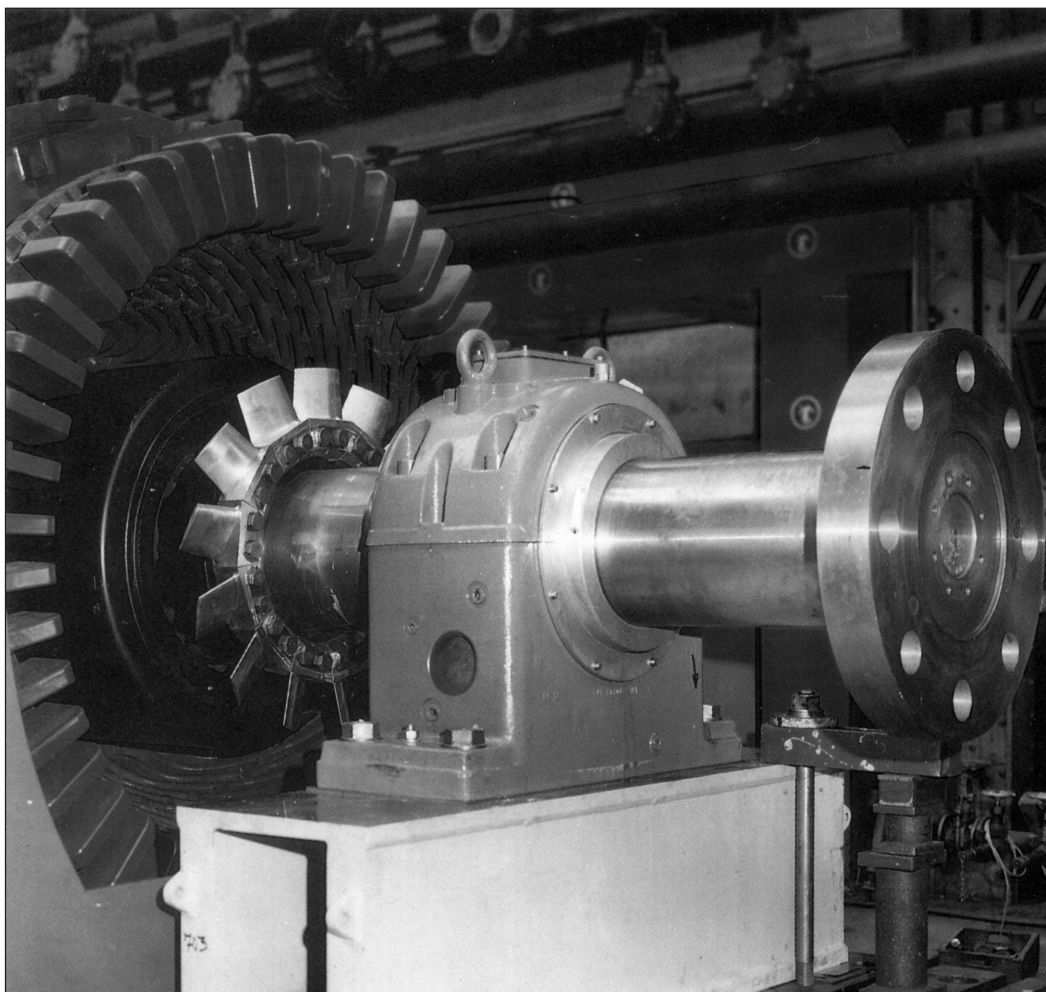
L plain cylindrical bore, oil ring (basic design)

F plain cylindrical bore, oil disc

Y two-lobe bore (lemon shape), without lubricating ring for high sliding velocity and small loads

V four-lobe bore, without lubricating ring for very high sliding velocity and very small loads

K bearing with journal tilting pads, for very high sliding velocity and very small loads



Alternator equipped with RENK - Slide Bearing EGXYQ 28-300 for shaft speed $n = 3600$ rpm (Photo: GEC Alstom, F - Belfort)

⑥ Thrust surface

B axial load absorbed by plain white-metal lined thrust faces

These shells are designed as "locating bearings" for limited non- continuous thrust loads. In combination with the non-locating shaft design (see page 13) they can be used as "non-locating bearings" as well.

K axial load absorbed by taper lands incorporated in the white-metal lined faces of the shell, suitable for both directions of rotation

A axial load absorbed by pivoting RD thrust pads for high also transient axial loads

Q shell identical to A, but without thrust pads. It can be converted to design A

Admissible axial loads F_A for design B (temporary loads), K and A.

| Size | Diameter D [mm] | F_A [N] | | |
|------|--------------------|--------------|-------|--------|
| | | B | K | A |
| 9 | 80 | 900 | 3000 | 8800 |
| | 90 | 1000 | 3500 | 10000 |
| | 100 | 1100 | 3500 | 6000 |
| 11 | 100 | 1300 | 4000 | 10000 |
| | 110 | 1700 | 5500 | 11300 |
| | 125 | 1550 | 4950 | 6600 |
| 14 | 125 | 2100 | 6250 | 22100 |
| | 140 | 2700 | 8950 | 24550 |
| | 160 | 2150 | 6950 | 15000 |
| 18 | 160 | 3250 | 11000 | 42100 |
| | 180 | 4050 | 12100 | 46750 |
| | 200 | 3400 | 11000 | 29400 |
| 22 | 200 | 4800 | 15000 | 67850 |
| | 225 | 5300 | 17250 | 75400 |
| | 250 | 5700 | 18500 | 56100 |
| 28 | 250 | 6850 | 22000 | 106000 |
| | 280 | 7550 | 24500 | 117800 |
| | 300 | 8000 | 26500 | 90400 |

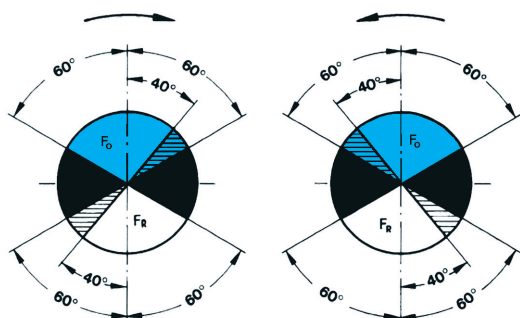
⑥ Admissible upward loads

If there are loads (static or dynamic) directed to the housing top (within the blue section) the following loads as per margin apply, depending on the different shapes of bore.

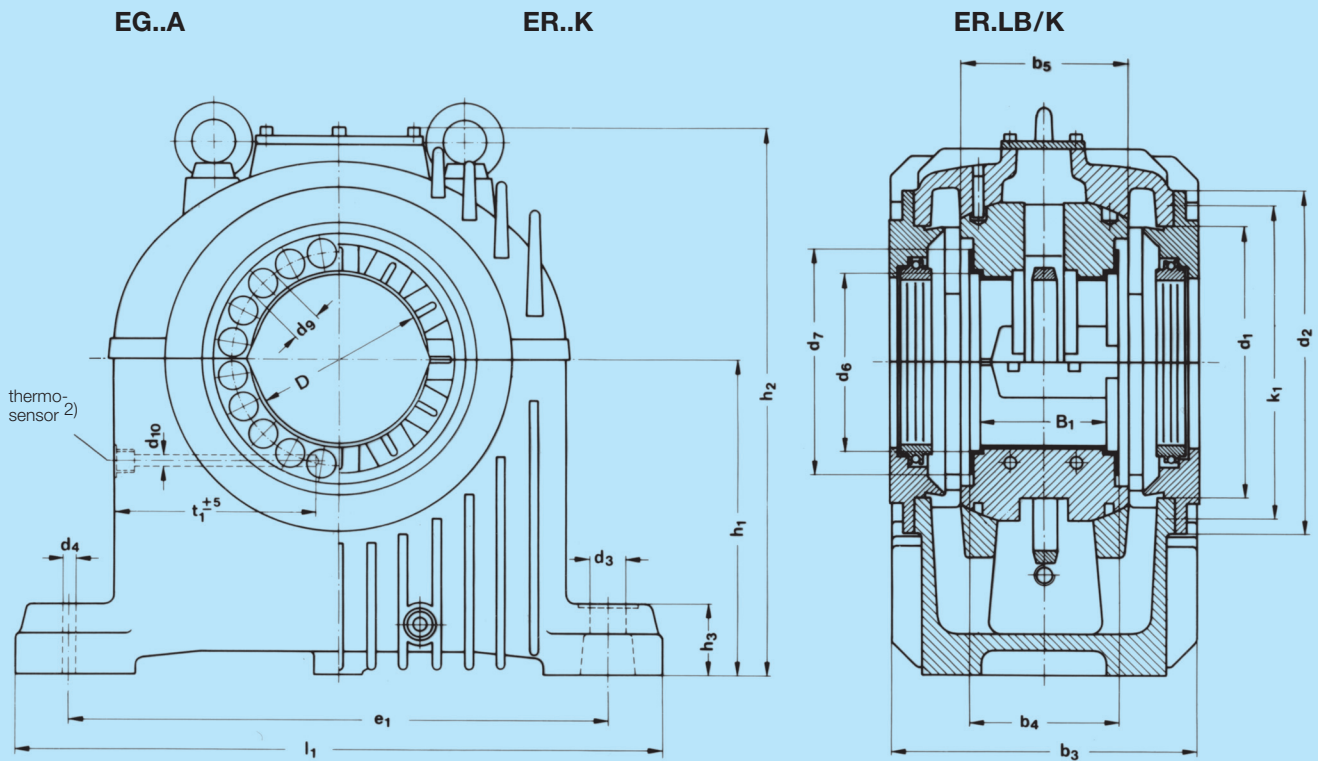
For loads directed to the lower half of shell (within the white section) the values indicated in the diagrams of page 14 and 15 apply.

When directed to the hatched section special adaption of the bearing shell is required. For loads directed to the split line of the bearing (black section), please contact us.

| Size | Diameter D [mm] | $F_{O \text{ adm.}}$ [N] for shape of bore | | |
|------|--------------------|---|-------|---------|
| | | L | F | C, V, Y |
| 9 | 80 | 2000 | 3550 | 9600 |
| | 90 | 2250 | 4000 | 10800 |
| | 100 | 2500 | 4450 | 12000 |
| 11 | 100 | 4000 | 6400 | 16000 |
| | 110 | 4400 | 7000 | 17600 |
| | 125 | 5000 | 8000 | 20100 |
| 14 | 125 | 6250 | 14300 | 26250 |
| | 140 | 7000 | 16000 | 29400 |
| | 160 | 8000 | 18300 | 33500 |
| 18 | 160 | 10400 | 26000 | 43200 |
| | 180 | 11700 | 29000 | 48600 |
| | 200 | 13000 | 32500 | 53000 |
| 22 | 200 | 18000 | 42000 | 68000 |
| | 225 | 20250 | 48000 | 76500 |
| | 250 | 22500 | 53000 | 85000 |
| 28 | 250 | 31250 | 65000 | 107500 |
| | 280 | 35000 | 73000 | 120400 |
| | 300 | 37500 | 78000 | 129000 |



Dimensions of Bearings (DIN 31690)



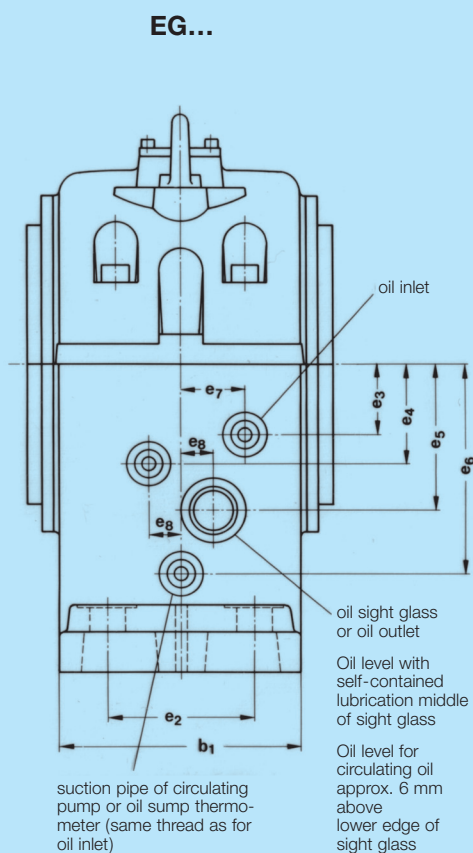
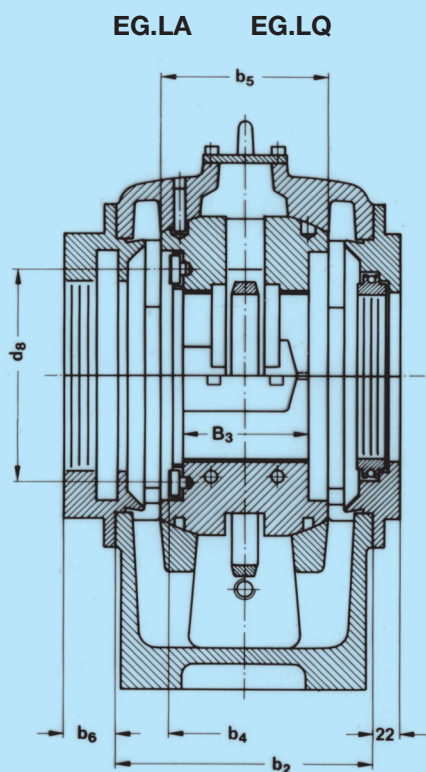
Dimensions in mm

| size | Shaft- Ø D | B ₁ | B ₃ | b ₁ | b ₂ | b ₃ | b ₄ | b ₅ | b ₆ | d ₁ | d ₂ | d ₃ | d ₄ ¹⁾ | d ₅ | d ₆ | d ₇ | d ₈ | d ₉ | d ₁₀ |
|-----------|------------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|------------------------------|----------------|----------------|----------------|----------------|----------------|-----------------|
| 9 | 80 | | 61,4 | | | | 80 | | | | | 22 | | | 86 | 110 | 110 | 20 | |
| | 90 | 60 | 61,4 | 145 | 150 | 190 | -0,22 | 95 | 39 | 150 | 190 | for | 10,4 | 120 | 96 | 120 | 120 | 20 | 11 |
| | 100 | | 65 | | | | | | | | | M 16 | | | 106 | 130 | 125 | 16 | |
| 11 | 100 | | 81,4 | | | | 100 | | | | | 26 | | | 108 | 135 | 135 | 20 | |
| | 110 | 80 | 81,4 | 165 | 170 | 205 | -0,22 | 110 | 41 | 180 | 215 | for | 10,4 | 120 | 118 | 150 | 140 | 20 | 11 |
| | 125 | | 85 | | | | | | | | | M 20 | | | 133 | 160 | 150 | 16 | |
| 14 | 125 | | 105,4 | | | | 125 | | | | | 30 | | | 135 | 170 | 165 | 25 | |
| | 140 | 105 | 105,4 | 205 | 215 | 255 | -0,22 | 140 | 43 | 230 | 290 | for | 10,4 | 130 | 150 | 190 | 180 | 25 | 11 |
| | 160 | | 106,4 | | | | | | | | | M 24 | | | 170 | 200 | 195 | 20 | |
| | 180 | 106,4 | 106,4 | | | | | | | | | | | | 190 | 220 | - | - | |
| 18 | 160 | | 135,7 | | | | 160 | | | | | 40 | | | 172 | 215 | 210 | 31,5 | |
| | 180 | 135 | 135,7 | 245 | 255 | 300 | -0,22 | 170 | 46 | 275 | 340 | for | 15,5 | 130 | 192 | 240 | 230 | 31,5 | 13 |
| | 200 | | 140,4 | | | | | | | | | M 30 | | | 212 | 250 | 245 | 25 | |
| | 225 | 140,4 | 140,4 | | | | | | | | | | | | 237 | 275 | - | - | |
| 22 | 200 | | 168,5 | | | | 200 | | | | | 46 | | | 214 | 265 | 265 | 40 | |
| | 225 | 170 | 168,5 | 310 | 320 | 380 | -0,22 | 212 | 49 | 340 | 400 | for | 15,5 | 140 | 239 | 290 | 285 | 40 | |
| | 250 | | 175,7 | | | | | | | | | M 36 | | | 264 | 315 | 305 | 31,5 | 13 |
| | 280 | 175,7 | 175,7 | | | | | | | | | | | | 294 | 345 | - | - | |
| 28 | 300 | | 175,7 | | | | | | | | | | | | 310 | 345 | - | - | |
| | 250 | | 213,2 | | | | 250 | | | | | 55 | | | 266 | 325 | 325 | 50 | |
| | 280 | 215 | 213,2 | 370 | 380 | 450 | -0,24 | 262 | 53 | 440 | 525 | for | 20,6 | 160 | 296 | 355 | 355 | 50 | 13 |
| | 300 | | 218,5 | | | | | | | | | M 42 | | | 316 | 375 | 365 | 40 | |
| | 315 | | 218,5 | | | | | | | | | | | | 331 | 390 | 380 | 40 | |
| | 335 | 218,5 | 218,5 | | | | | | | | | | | | 351 | 410 | - | - | |
| 355 | | 218,5 | | | | | | | | | | | | 371 | 430 | - | - | | |

1) Rough bore d₄ for later fitting of cylindrical or taper pins.

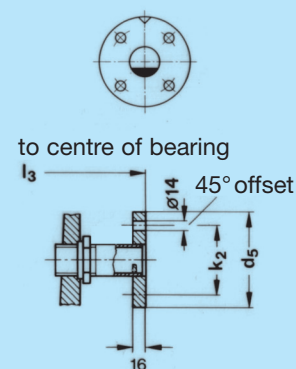
*) per side

2) Threaded hole 1/2" for thermometer on both sides.



oil outlet

As for bearing types E.ZL., the oil outlet with weir is to be mounted horizontally at the bottom. The mark at the flange will then be visible centrally at the top.



flange DIN 2573

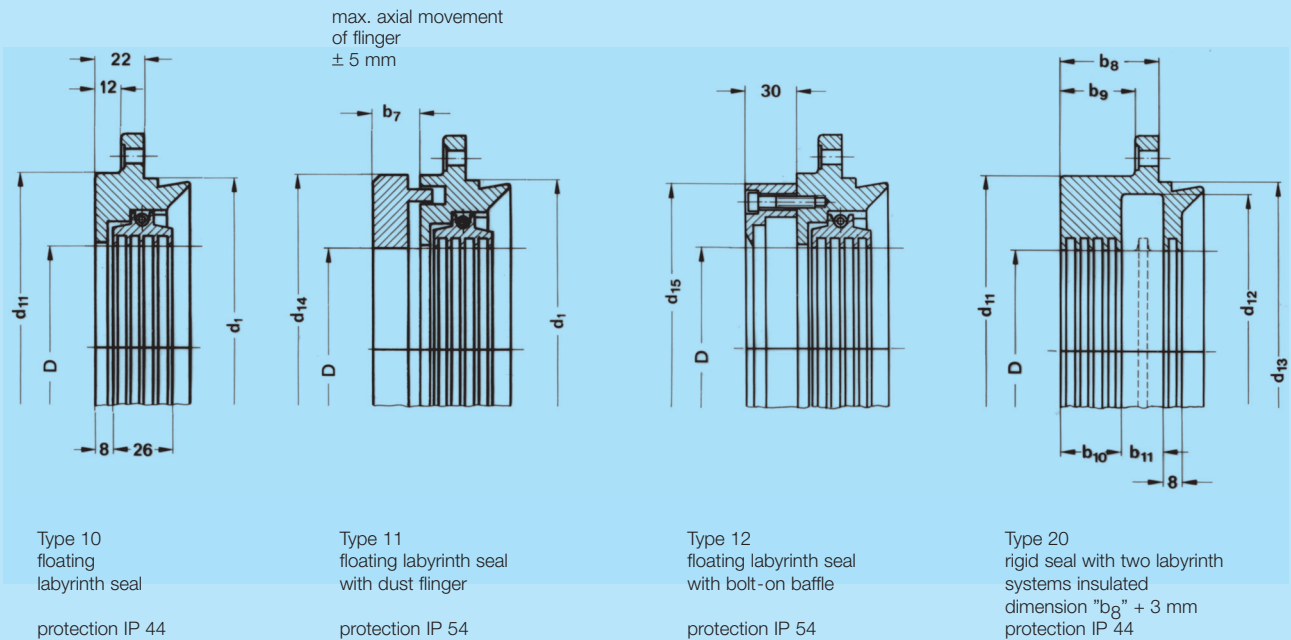
| e ₁ | e ₂ | e ₃ | e ₄ | e ₅ | e ₆ | e ₇ | e ₈ | h ₁ | h ₂ | h ₃ | k ₁ Threads | k ₂ | l ₁ | l ₃ approx. | t ₁ | RD-*) thrust pads [Stck] | circulating oil | | Oil- content [l] | Weight [kg] |
|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|---------------------------|----------------|----------------|---------------------------|----------------|-----------------------------------|-----------------|---------------|------------------------|----------------|
| | | | | | | | | | | | | | | | | | oil inlet | oil outlet | | |
| 300 | 90 | 30 | 60 | 85 | 135 | 35,5 | 20 | 190 | 325 | 35 | 170 6xM6 | 90 | 355 | 205 | 105 | 14 | G 3/8 | G 1 1/4 | 1,8 | 45 |
| | | | | | | | | | | | | | | | 105 | 16 | | | | |
| | | | | | | | | | | | | | | | 105 | 20 | | | | |
| 375 | 100 | 40 | 70 | 100 | 150 | 42 | 22,5 | 225 | 380 | 50 | 195 6xM6 | 90 | 450 | 235 | 138 | 16 | G 3/8 | G 1 1/4 | 3,8 | 70 |
| | | | | | | | | | | | | | | | 138 | 18 | | | | |
| | | | | | | | | | | | | | | | 130 | 22 | | | | |
| 450 | 125 | 60 | 85 | 125 | 180 | 55 | 27,5 | 265 | 460 | 60 | 270 6xM6 | 100 | 540 | 280 | 170 | 18 | G 3/8 | G 1 1/2 | 5,4 | 135 |
| | | | | | | | | | | | | | | | 170 | 20 | | | | |
| | | | | | | | | | | | | | | | 148 | 24 | | | | |
| | | | | | | | | | | | | | | | 128 | - | | | | |
| | | | | | | | | | | | | | | | 210 | 18 | | | | |
| 560 | 150 | 70 | 105 | 155 | 215 | 68 | 30 | 315 | 565 | 70 | 320 8xM8 | 100 | 660 | 330 | 210 | 20 | G 1/2 | G 1 1/2 | 9,2 | 240 |
| | | | | | | | | | | | | | | | 210 | 20 | | | | |
| | | | | | | | | | | | | | | | 190 | 24 | | | | |
| | | | | | | | | | | | | | | | 165 | - | | | | |
| | | | | | | | | | | | | | | | 260 | 18 | | | | |
| 670 | 200 | 80 | 135 | 175 | 245 | 83 | 40 | 375 | 680 | 80 | 380 8xM8 | 110 | 800 | 400 | 248 | 24 | G 3/4 | G 2 | 17,5 | 430 |
| | | | | | | | | | | | | | | | 202 | - | | | | |
| | | | | | | | | | | | | | | | 187 | - | | | | |
| | | | | | | | | | | | | | | | 315 | 18 | | | | |
| | | | | | | | | | | | | | | | 315 | 20 | | | | |
| | | | | | | | | | | | | | | | 265 | 24 | | | | |
| 800 | 250 | 95 | 155 | 220 | 310 | 106 | 50 | 450 | 830 | 90 | 500 8xM8 | 130 | 950 | 470 | 260 | 24 | G 3/4 | G 2 1/2 | 28,6 | 780 |
| | | | | | | | | | | | | | | | 260 | 24 | | | | |
| | | | | | | | | | | | | | | | 235 | - | | | | |
| | | | | | | | | | | | | | | | 222 | - | | | | |
| | | | | | | | | | | | | | | | 222 | - | | | | |

Shell with cylindrical bore (E.ZC.), four-lobe bore (E.ZY), two-lobe bore (E.ZV) have the same main dimension as oil ring lubricated shells (E..L.).

Dimension sheets for shells with radial tilting pads is available on request.

G=B.S.P

Dimensions of Seals



Type 21 rigid seal with two labyrinth systems and dust flinger + dimension "b₇"
protection IP 54

Type 22 rigid seal with two labyrinth systems and bolt-on baffle + 30 mm
protection IP 55

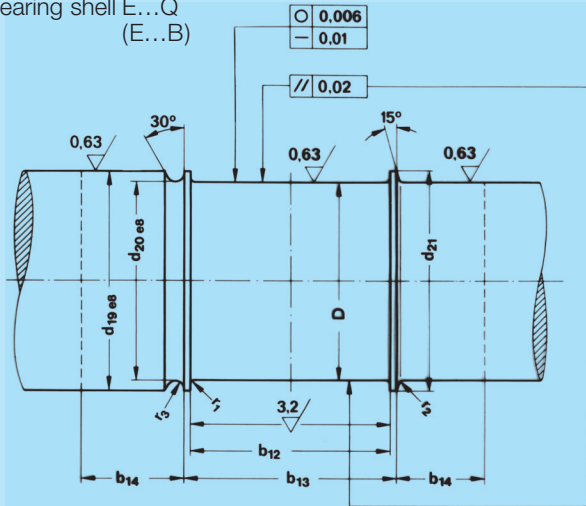
Seals conforming to protection grade IP 56 are available. Information upon request.

Dimensions in mm

| size | D | b ₇ | b ₈ | b ₉ | b ₁₀ | b ₁₁ | d ₁ | d ₁₁ | d ₁₂ | d ₁₃ | d ₁₄ | d ₁₅ |
|------|-----|----------------|----------------|----------------|-----------------|-----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| 9 | 80 | 21 | | | | | | | | | 155 | 135 |
| | 90 | 21 | 39 | 29 | 27 | 14 | 150 | 155 | 140 | 148 | 155 | 145 |
| | 100 | 21 | | | | | | | | | 155 | 155 |
| | 110 | 21 | | | | | | | | | 155 | 155 |
| 11 | 100 | 21 | | | | | | | | | 155 | 155 |
| | 110 | 21 | 41 | 31 | 27 | 16 | 180 | 180 | 170 | 178 | 155 | 155 |
| | 125 | 21 | | | | | | | | | 180 | 180 |
| | 140 | 21 | | | | | | | | | 180 | 186 |
| 14 | 125 | 21 | | | | | | | | | 180 | 180 |
| | 140 | 21 | 43 | 33 | 27 | 18 | 230 | 240 | 212 | 226 | 186 | 186 |
| | 160 | 26 | | | | | | | | | 240 | 240 |
| | 180 | 26 | | | | | | | | | 240 | 240 |
| 18 | 160 | 26 | | | | | | | | | 240 | 240 |
| | 180 | 26 | 46 | 36 | 27 | 21 | 275 | 280 | 260 | 273 | 240 | 240 |
| | 200 | 26 | | | | | | | | | 280 | 270 |
| | 225 | 26 | | | | | | | | | 280 | 280 |
| 22 | 200 | 26 | | | | | | | | | 280 | 270 |
| | 225 | 26 | 49 | 39 | 27 | 24 | 340 | 340 | 316 | 338 | 280 | 280 |
| | 250 | 33 | | | | | | | | | 340 | 320 |
| | 280 | 33 | | | | | | | | | 340 | 340 |
| 28 | 250 | 33 | | | | | | | | | 340 | 320 |
| | 280 | 33 | 53 | 43 | 28 | 27 | 440 | 410 | 390 | 438 | 340 | 340 |
| | 315 | 33 | | | | | | | | | 410 | 385 |
| | 355 | 33 | | | | | | | | | 410 | 410 |

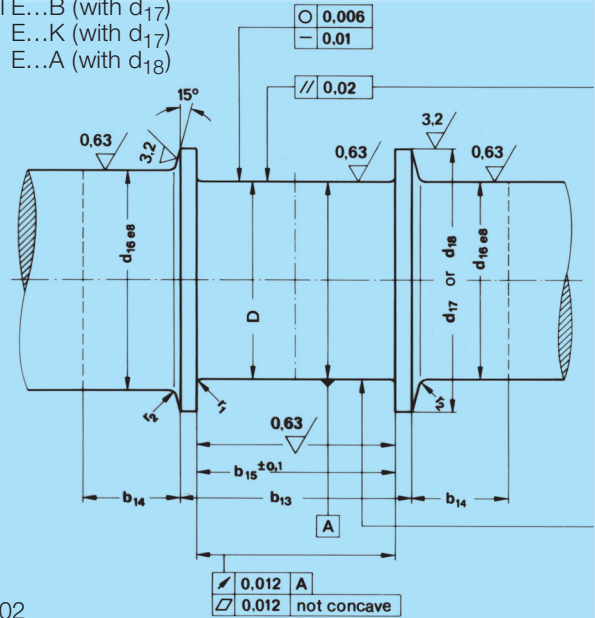
Non-locating bearing

Type of bearing shell E...Q (E...B)



Locating bearing

Type of bearing shell E...B (with d₁₇)
E...K (with d₁₇)
E...A (with d₁₈)



Chamfered edges 0,5x45°
Surface condition DIN ISO 1302

Dimensions in mm

| size | D ¹⁾ | b ₁₂ ²⁾ | b ₁₃ | b ₁₄ seal-type | | b ₁₅ ³⁾ | d ₁₆ | d ₁₇ | d ₁₈ | d ₁₉ /d ₂₀ ⁴⁾ | | | d ₂₁ | r ₁ | r ₂ | r ₃ | |
|------|-----------------|-------------------------------|-----------------|------------------------------|-----|-------------------------------|------------------|-----------------|-----------------|--|---------|---------|-----------------|----------------|----------------|----------------|-----|
| | | | | 10 | 20 | | | | | | | | | | | | |
| 9 | 80 | | | | | | | 110 | 132 | | | | 90 | | | | |
| | 90 | 90 | 100 | 50 | 75 | 80,4 | 80/ 90/100/ 110 | 120 | 142 | 80/- | 90/80 | 100/90 | 110/100 | 100 | 2,5 | 4 | 1,6 |
| | 100 | | | | | | | 130 | 143 | | | | 110 | | | | |
| 11 | 110 | 110 | 120 | 50 | 75 | 100,4 | 100/110/125/ 140 | 150 | 162 | 100/- | 110/100 | 125/110 | 140/125 | 125 | 2,5 | 4 | 1,6 |
| | 125 | | | | | | | 160 | 168 | | | | 140 | | | | |
| | 140 | | | | | | | 170 | 192 | | | | 140 | | | | |
| 14 | 140 | 140 | 150 | 60 | 85 | 125,4 | 125/140/160/ 180 | 190 | 207 | 125/- | 140/125 | 160/140 | 180/160 | 160 | 4 | 6 | 2,5 |
| | 160 | | | | | | | 200 | 217 | | | | 180 | | | | |
| | 180 | | | | | | | 220 | - | | | | 200 | | | | |
| 18 | 160 | | | | | | | 215 | 244 | | | | 180 | | | | |
| | 180 | 180 | 190 | 60 | 85 | 160,4 | 160/180/200/ 225 | 240 | 264 | 160/- | 180/160 | 200/180 | 225/200 | 200 | 4 | 6 | 2,5 |
| | 200 | | | | | | | 250 | 273 | | | | 225 | | | | |
| 22 | 225 | | | | | | | 275 | - | | | | 250 | | | | |
| | 200 | | | | | | | 265 | 308 | | | | 225 | | | | |
| | 225 | | | | | | | 290 | 328 | | | | 250 | | | | |
| 28 | 250 | 220 | 240 | 70 | 105 | 200,4 | 200/225/250/ 280 | 315 | 339 | 200/- | 225/200 | 250/225 | 280/250 | 280 | 6 | 10 | 4 |
| | 280 | | | | | | | 345 | - | | | | 315 | | | | |
| | 300 | | | | | | | 345 | - | | | | 330 | | | | |
| 28 | 250 | | | | | | | 325 | 378 | | | | 280 | | | | |
| | 280 | | | | | | | 355 | 408 | | | | 315 | | | | |
| | 300 | 280 | 300 | 70 | 105 | 150,4 | 250/280/315/ 355 | 375 | 408 | 250/- | 280/250 | 315/280 | 355/315 | 315 | 6 | 10 | 6 |
| | 315 | | | | | | | 390 | 423 | | | | 345 | | | | |
| | 335 | | | | | | | 410 | | | | | 365 | | | | |
| 355 | | | | | | | 430 | | | | | 385 | | | | | |

¹⁾ see page 18 „Clearances“ and our “Manual for the application of RENK Slide Bearings“

²⁾ If the locating bearing has to cope with considerable axial expansion (for example due to heat transfer) distance b₁₂ between the collars can be increased.

³⁾ The normal axial clearance considered is approx. 0,5 mm. For changing direction of thrust or shock loads, dimensions b₁₅ may be reduced by further 0,2 mm. If the locating bearing is used for test run only, dimension b₁₅ may be increased by 3...6 mm, depending on the bearing size.

⁴⁾ Omit recess d₂₀ if d₁₉ is equal or smaller than shaft diameter D.

In case the shaft ends within the bearing, the length of journal corresponds to dimension b₁₂
Tolerances of form and position follow DIN 31 699.
Degree of accuracy B 10 (radial).
Degree of accuracy B 20 (axial); others upon request.

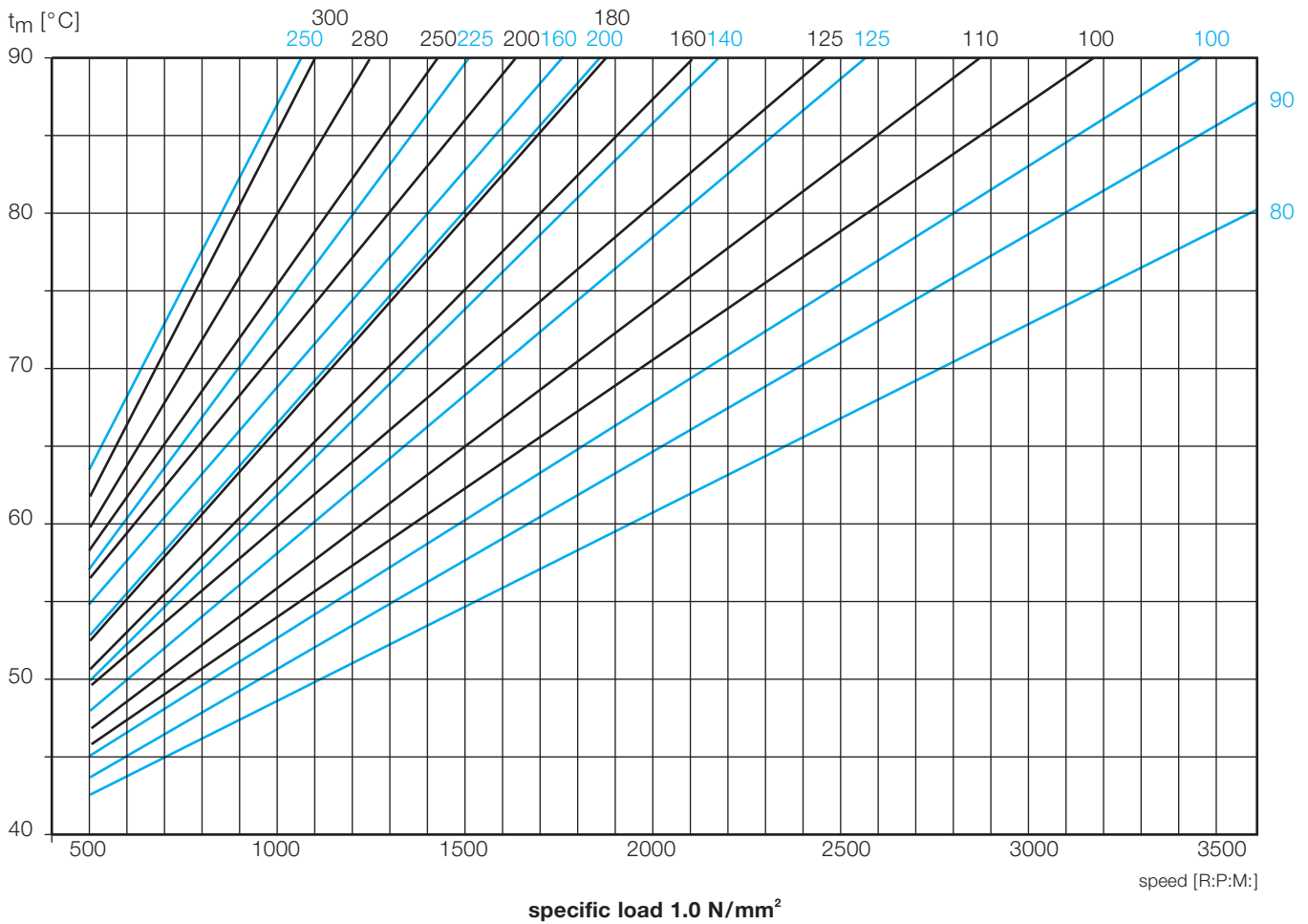
Bearing Temperature/Speed Graph

To pre-determine the resulting bearing temperature in the planning stage, bearing temperatures of E-Type bearings with finned housings and oil lubrication, mean specific load of 1.0 and 2.0 N/mm², diameters 80...300 mm and speeds up to 3600 R.P.M. are shown.

These graphs are valid for the following operating conditions:

- oil viscosity ISO VG 32
- ambient temperature 40° C
- calm air

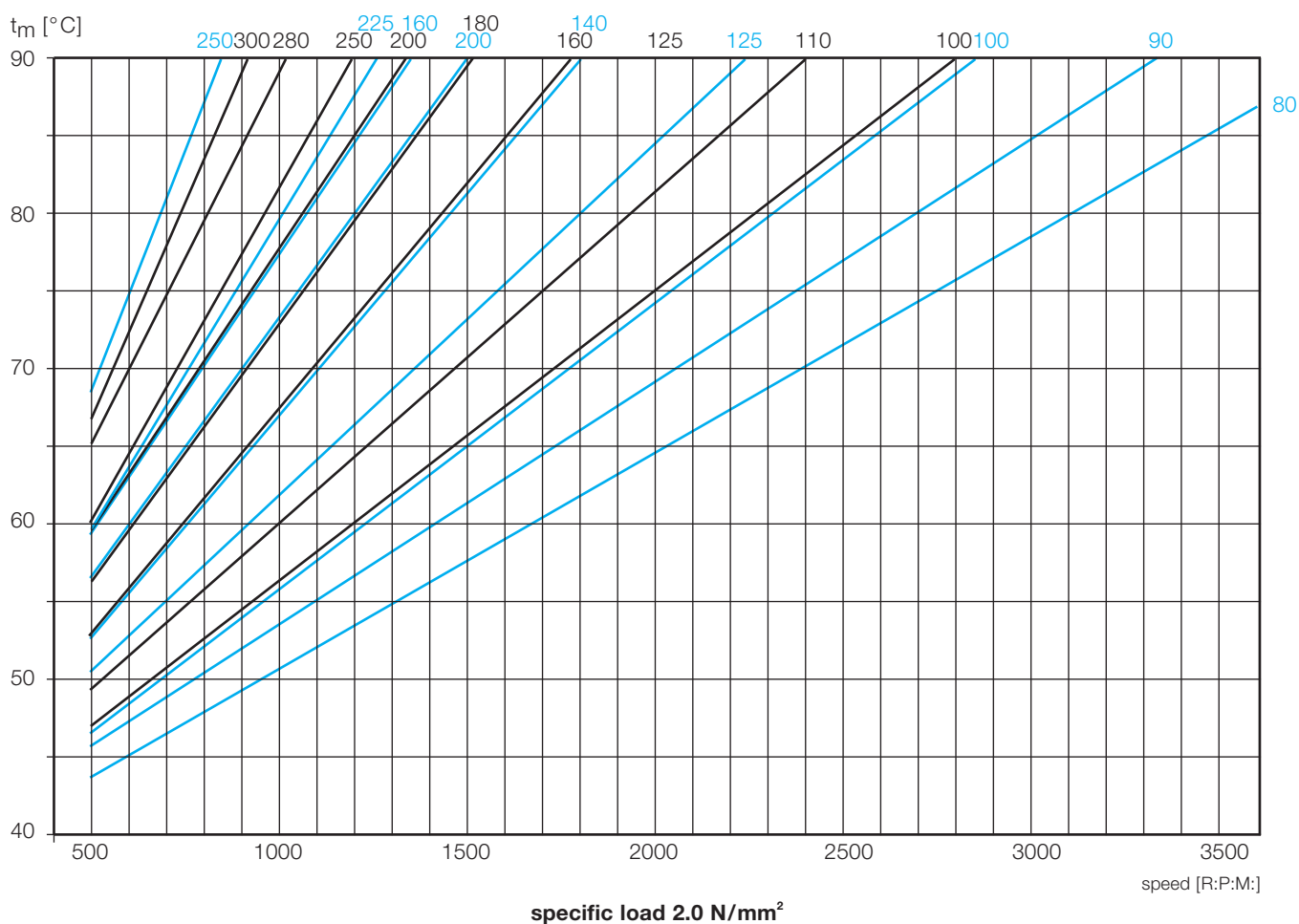
bearing temperature



| | | | | | | | | | |
|----------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| size | 9 | | | 11 | | | 14 | | |
| Ø D [mm] | 80 | 90 | 100 | 100 | 110 | 125 | 125 | 140 | 160 |
| FR [N] | 4900 | 5500 | 6000 | 8000 | 8800 | 10000 | 13000 | 14500 | 16800 |
| size | 18 | | | 22 | | | 28 | | |
| Ø D [mm] | 160 | 180 | 200 | 200 | 225 | 250 | 250 | 280 | 300 |
| FR [N] | 21800 | 24500 | 27000 | 33500 | 38000 | 42500 | 53000 | 59400 | 65500 |

For specific load between 0.5 and 2.5 N/mm², bearing temperatures can be interpolated or extrapolated.

bearing temperature

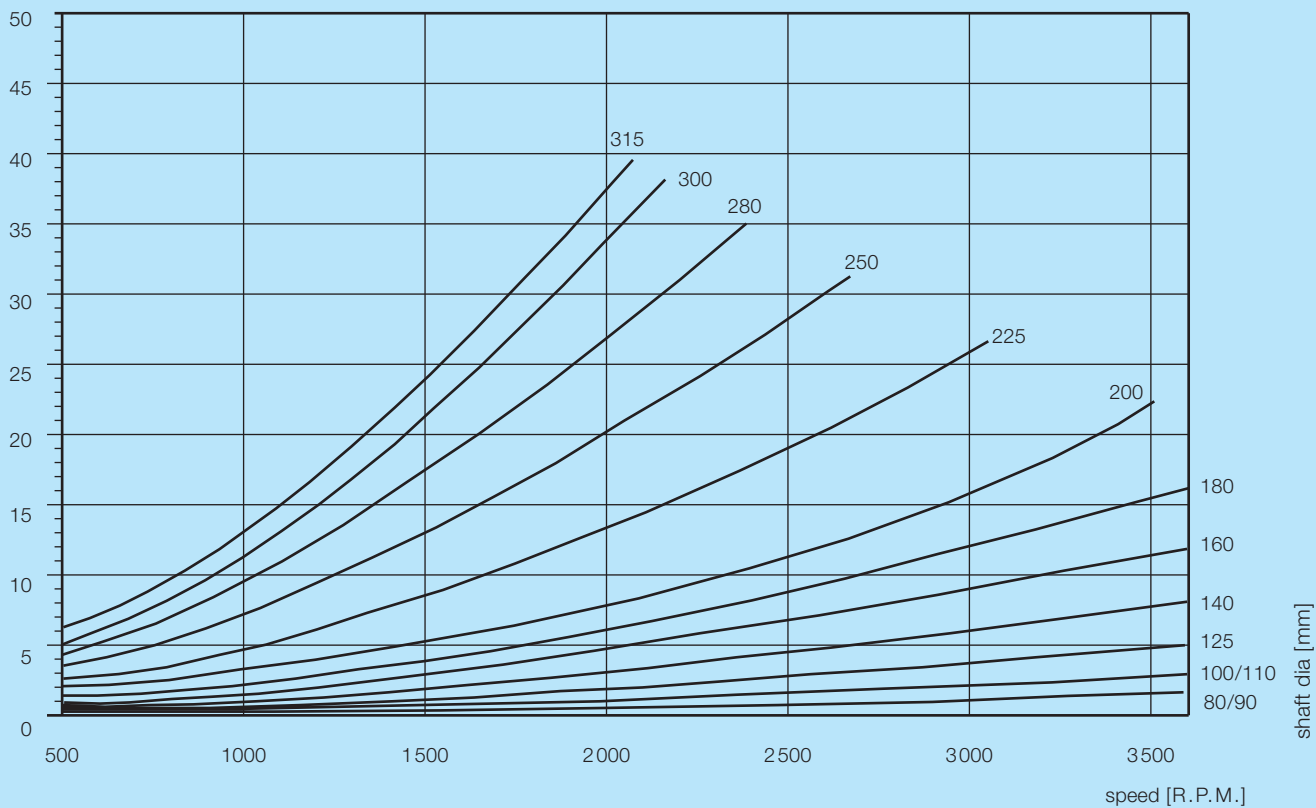


| | | | | | | | | | |
|----------|-------|-------|-------|-------|-------|-------|--------|--------|--------|
| size | 9 | | | 11 | | | 14 | | |
| Ø D [mm] | 80 | 90 | 100 | 100 | 110 | 125 | 125 | 140 | 160 |
| FR [N] | 9800 | 11000 | 12000 | 16000 | 17600 | 20000 | 26000 | 29000 | 33600 |
| size | 18 | | | 22 | | | 28 | | |
| Ø D [mm] | 160 | 180 | 200 | 200 | 225 | 250 | 250 | 280 | 300 |
| FR [N] | 43600 | 49000 | 54000 | 67000 | 76000 | 85000 | 106000 | 118800 | 131000 |

Oil throughput V_R for cyl. journal bearing and plain-white metal lined shoulder eventually

$V_{total} = V_R$

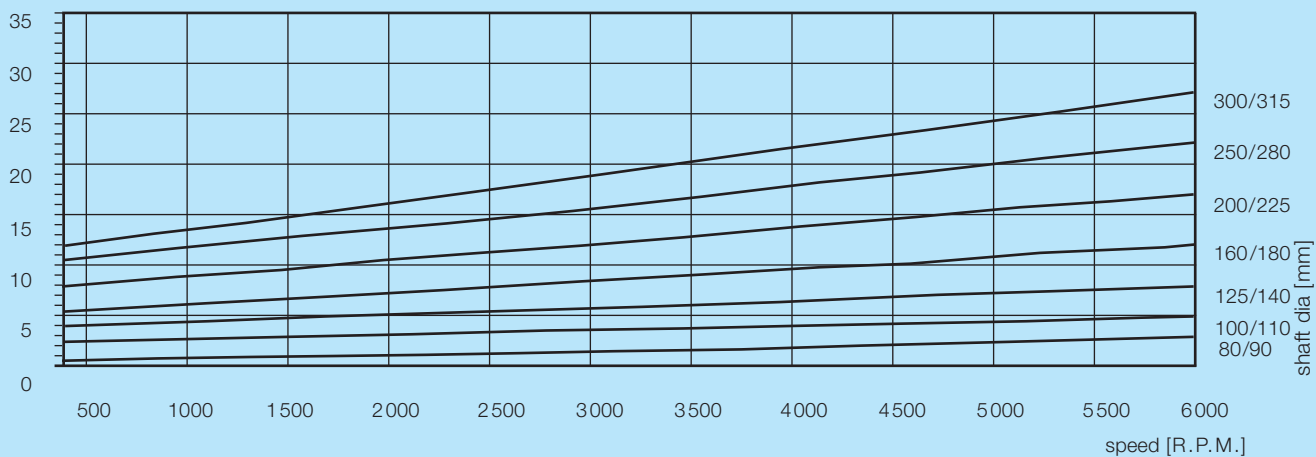
V_R [l/min]



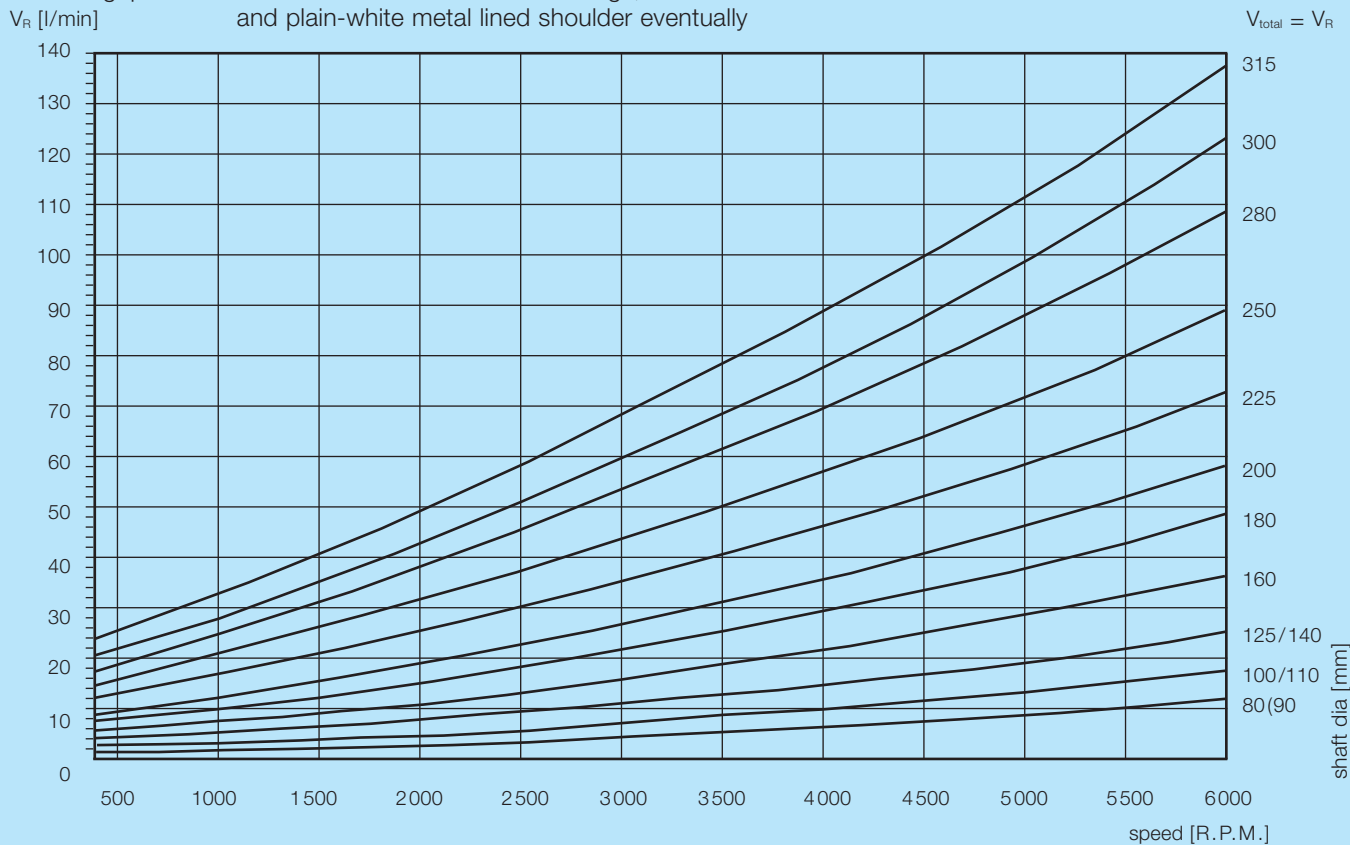
Additional oil throughput V_A for shoulders with integral taper land faces

$V_{total} = V_R + V_A$

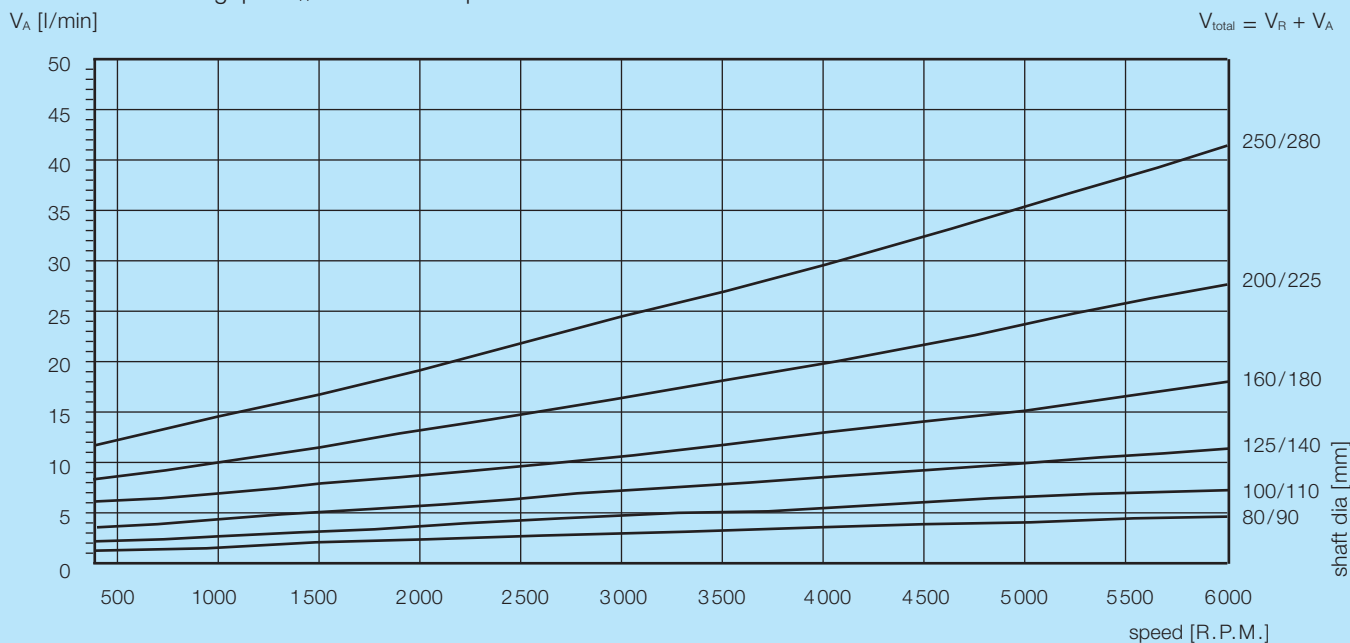
V_A [l/min]



Oil throughput V_R for two-lobe or bore four-lobe bearings,
and plain-white metal lined shoulder eventually



Additional oil throughput V_A for RD thrust pads



Bearing Clearances

The bearing bores are made according to the basic bore system specified in DIN 7161, with tolerance field H 7. The bearing clearance has to be considered within the shaft tolerance. The shaft tolerances for 5 different relative bearing clearances Ψ_m can be obtained from DIN 31698 (see extract on the right).

For normal operating conditions, the following recommendation applies for the choice of mean bearing clearance Ψ_m , in relation to peripheral velocity v :

This table does not take into account any extraordinary factors, such as, for example:

- high shaft temperature within the bearing in case of heat transfer through the shaft
- considerable elastic deformation through loading of the bearing
- particularly high or low viscosity lubricants - thermal deformation or greatly varying expansion of journal and bearing shells.

| v [m/s] | Ψ_m [%] cyl. bearing \varnothing ... 100 | D [mm] | |
|-----------|--|-------------|------|
| | | > 100...250 | >250 |
| ... 3 | 1,32 | 1,12 | 1,12 |
| > 3...10 | 1,6 | 1,32 | 1,12 |
| >10...25 | 1,9 | 1,6 | 1,32 |
| >25...50 | 2,24 | 1,9 | 1,6 |

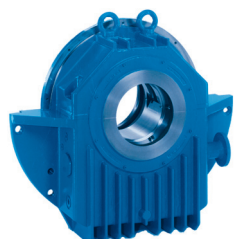
| nominal shaft range [mm] | | Permissible deviations of the shaft in μm for Ψ_m [%] | | | | |
|--------------------------|-------|---|----------------|----------------|----------------|----------------|
| over | up to | 1,12 | 1,12 | 1,6 | 1,9 | 2,24 |
| 70 | 80 | - 60 - 79 | - 75 - 94 | - 96 - 115 | - 118 - 137 | - 144 - 163 |
| 80 | 90 | - 67 - 89 | - 84 - 106 | - 108 - 130 | - 133 - 155 | - 162 - 184 |
| 90 | 100 | - 78 - 100 | - 97 - 119 | - 124 - 146 | - 152 - 174 | - 184 - 206 |
| 100 | 110 | - 89 - 111 | - 110 - 132 | - 140 - 162 | - 171 - 193 | - 207 - 229 |
| 110 | 120 | - 100 - 122 | - 122 - 145 | - 156 - 178 | - 190 - 212 | - 229 - 251 |
| 120 | 140 | - 113 - 138 | - 139 - 164 | - 176 - 201 | - 215 - 240 | - 259 - 284 |
| 140 | 160 | - 136 - 161 | - 166 - 191 | - 208 - 233 | - 253 - 278 | - 304 - 329 |
| 160 | 180 | - 158 - 183 | - 192 - 217 | - 240 - 265 | - 291 - 316 | - 348 - 373 |
| 180 | 200 | - 175 - 204 | - 213 - 242 | - 267 - 296 | - 324 - 353 | - 388 - 417 |
| 200 | 225 | - 201 - 230 | - 243 - 272 | - 303 - 332 | - 366 - 395 | - 439 - 468 |
| 225 | 250 | - 229 - 258 | - 276 - 305 | - 343 - 372 | - 414 - 443 | - 495 - 524 |
| 250 | 280 | - 255 - 287 | - 308 - 340 | - 382 - 414 | - 462 - 494 | - 552 - 584 |
| 280 | 315 | - 291 - 323 | - 351 - 383 | - 434 - 466 | - 523 - 555 | - 624 - 656 |

Shaft tolerances to DIN 31698



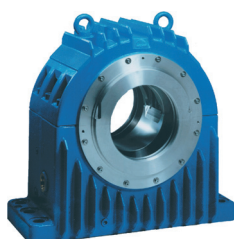
Series EF

| | | |
|---------------|--------------|------------------|
| Journal Range | 80 – 355 mm | brochure RH 1085 |
| Journal Range | 300 – 560 mm | brochure RH 1182 |



Series EM

| | | |
|---------------|--------------|------------------|
| Journal Range | 80 – 355 mm | brochure RH 1046 |
| Journal Range | 300 – 560 mm | brochure RH 1184 |



**Series EG
ER**

| | | |
|---------------|---------------|------------------|
| Journal Range | 300 – 560 mm | brochure RH 1180 |
| Journal Range | 475 – 1250 mm | brochure RH 1178 |

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