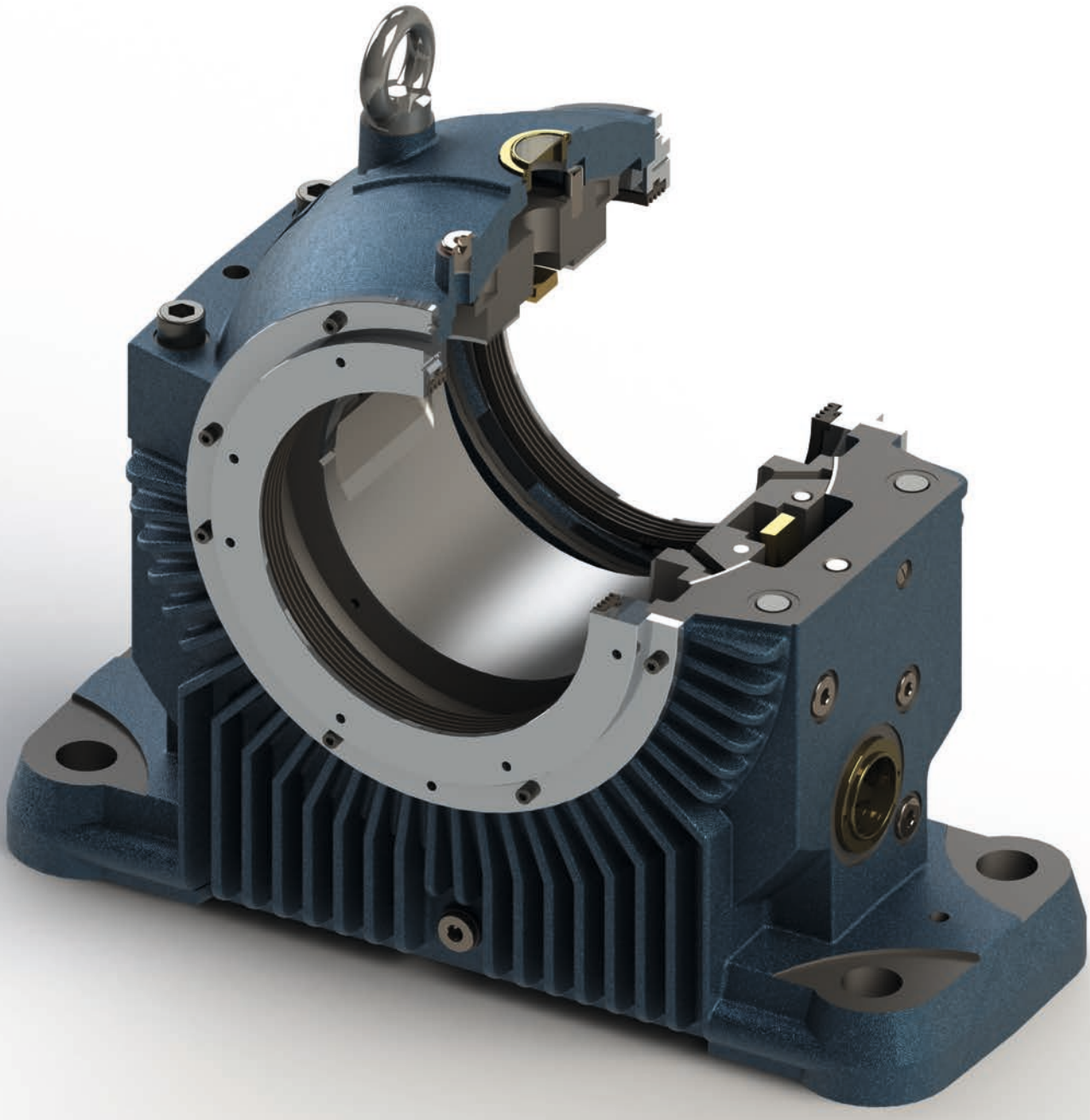
Innovation in Motion

Miba Industrial Bearings
ZR Pedestal Bearing



Miba Industrial Bearings

The Industrial Bearing Branch of the Miba Bearing Group produces hydrodynamic bearings and labyrinth seals for use in mechanical and plant engineering which are used in a wide range of high-performance applications.
Our highly inspired teams, work diligently to serve our customers the best bearing solutions for each and every application.

Content

Description of the ZR design

The type Miba ZR horizontal bearing is designed according to DIN 31690 norm specifications for a wide range of heavy duty applications (electrical machines, turbines, blowers and test rigs). The modular system applies to the different types of bearings (pedestal, end flange and center flange), i.e. it is always possible to combine different modules of this system such as shell, lubricating ring and other equipment. Thus, assembly is simple and mistakes due to the positioning of screws and pins are avoided during installation, commissioning and maintenance procedures.

Housing
The bearing housings are finned and manufactured from nodular cast iron EN-GJS-400-15 (formerly GGG 40) giving high strength. Upon request, they can be supplied in gray cast iron EN-GJL-300 (formerly GG 30) or in nodular cast iron EN-GJS-400-18-LT (formerly GGG 40.3).

The spherical seat in the housing ensures easy alignment during assembly and the loads are evenly distributed into the lower part of the housing. Therefore these bearings are designed for highest stress applications. Thread holes for monitoring the temperature, for oil inlet and outlet, as well as for oil level, are provided on both sides of the housing as standard. The housing comes with an oil sight glass on one side. The opposite side is supplied plugged and may be used as an oil outlet. If needed, their positions can be exchanged by reversing these parts.

In the top half of the housing, a sight glass, which permits the loose oil ring to be viewed, and a plugged manual oil feeder are provided. The basic design can be easily amended, if required, to incorporate water cooling tubes, oil sump heater, vibration detectors (angled at 45°), horizontal, vertical and axial vibration sensors and earthing devices. Upon request, thread holes can be provided in the ZR housing to meet all 541 and 546 requirements for API norms.

Bearing shells
The shell is supplied in halves and spherically seated in the housing, ensuring easy self-alignment during assembly. The material is low carbon steel, lined with high tin-based white metal. This construction ensures an easy assembly and a long life cycle. Bearing shells with plain cylindrical bore and loose oil ring are used in most cases, but other shapes of bore are possible. When the specific load on start-up is too high, or for very slow-speed applications, a hydrostatic jacking system can be incorporated. Bearing shells can be provided with or without thrust faces.

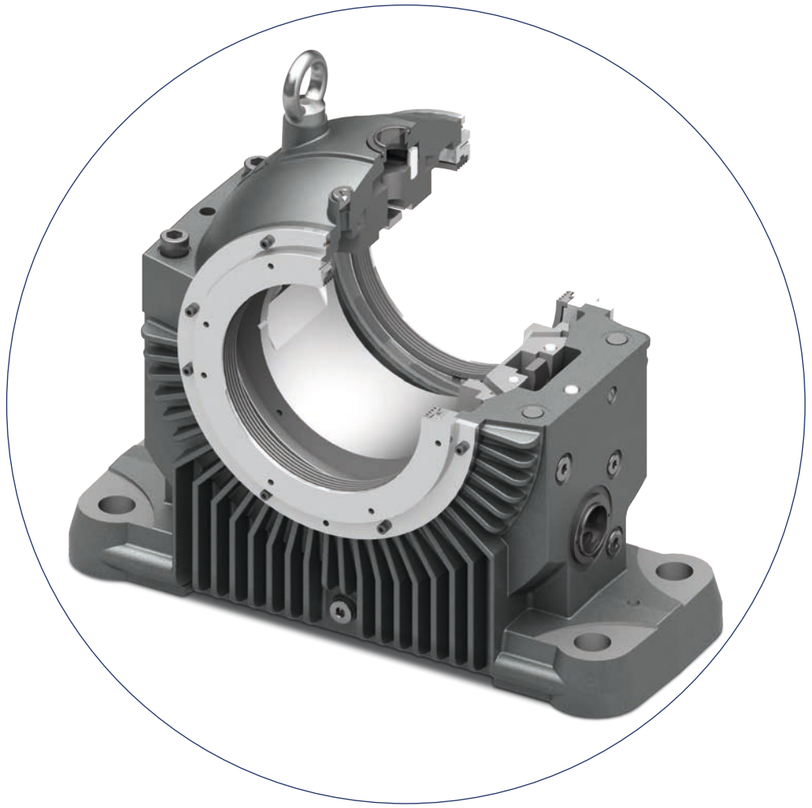
Q-type shells have no thrust capability for non-locating bearings.

B-type shells with plain white metal lined shoulders with oil grooves are suitable for small, temporary thrust loads.

K-type shells have taper land faces for medium thrust loads and both directions of rotation.

D-type shells, with taper land faces suitable for only one direction of rotation, are capable of absorbing higher thrust loads.

A-type shells, for the highest loads, are equipped with thrust tilting pads.



Oil supply
Fully self-contained lubrication is achieved by using a loose oil ring. Alternatively, where bearings are lubricated by an external oil circulation system, this loose oil ring can be used to permit an emergency shutdown without damage in case an oil system failure occurs. Z-bearings can be used for marine applications, where an oil ring guide assures proper lubrication even if extreme vessel motions occur.

Electrical insulation
To prevent stray currents conducted by the shaft, Z-bearings can be supplied electrically insulated as an option. In this case, the spherical seat of the housing is coated with a wear-resistant and temperature-resistant synthetic material. Upon request, a grounding wire is provided to short out this insulation, passing through a thread hole (PG 7) in the housing.

Sealing
The seals are selected for the different operation conditions and environments and for the requested protection level. The standard arrangement is the floating labyrinth seal (IP 44) made of high heat resistant, fiber-reinforced synthetic material. Bearings for high oil throughput are equipped with adjustable rigid seals (IP 44) made of aluminium alloy. Both types of seals can be equipped with bolt-on baffles (IP 55) or dust flingers (IP 54) if the bearing is operating in a dusty or a wet environment, or if rotating parts (clutches, couplings, fans etc.) are fitted close to the bearing. Special seals offering higher protection, or pressurized seals etc., can be supplied for special applications upon request. An end cover is used when the end of the shaft is inside the bearing housing.

Temperature control
Provisions for the fitting of thermo sensors in the journal bush and oil sump are provided as standard. The type of sensor to be used depends on the type required by the readout equipment used (direct reading, centralized control system, recording instrument, etc.). For bearings with high thrust loads, additional thermometers for the thrust part can be integrated.

Selection of oil
It is recommended that any branded mineral oil which is inhibited against foaming, ageing and oxidation is used as lubricant. The viscosity is suggested by Miba Industrial Bearings if the customer doesn`t have preferences.

Bearing calculation
Miba Industrial Bearings uses a state of the art calculation program which can provide the following outputs:

- Minimum oil film thickness
- Maximum hydrodynamic pressure
- Maximum bearing temperature
- Oil outlet temperature
- Minimum permissible oil flow
- Frictional power loss
- Stiffness and damping coefficients
- Clearance for bearing / shaft seat

Radial bore profile selection

The radial bore profile type selection depends on several conditions. Among them we have the circumferential speed and the specific pressure. The following table should help in a preliminary selection.

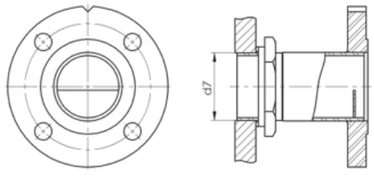
1 // Type of radial bearing bore profile

Type of bore	Circumferential speed U (m/s)	Specific load p (MPa)
C/L/F Cylindrical	0 … 30	0 … 4
Y Two-lobe	25 … 75	0 … 3
V Four-lobe	25 … 125	0 … 2
K Radial tilting pads	15 … 150	0 … 2

Oil flow

Z-bearings are supplied without oil inlet or outlet flanges. Upon request, as additional items, Miba Industrial Bearings can supply these flanges according to DIN 2573 or ANSI B16.5 norms. Oil outlet flanges with weir are to be mounted with the weir horizontal at the bottom. The mark on the flange will then be visible in the center of the top side.

Larger oil quantities with special outlets on request.



1 // Oil flow

Size	Oil outlet thread Std	Maximum flow for oil ISO VG 32 and 46 at 40°C (l/min)	Maximum flow for oil ISO VG 68 and 100 at 40°C (l/min)	Oil outlet thread enlarged*	Maximum flow for oil ISO VG 32 and 46 at 40°C (l/min)	Maximum flow for oil ISO VG 68 and 100 at 40°C (l/min)
9	G1 ¼ (DN 32)	9	7	-	-	-
11	G1 ½ (DN 40)	11	9	-	-	-
14	G2 (DN 50)	18	16	G2 ½ (DN 65)	28	25
18	G2 (DN 50)	18	16	G2 ½ (DN 65)	28	25
22	G2 ½ (DN 65)	28	25	G3 (DN 80)	42	35
28	G2 ½ (DN 65)	28	25	G3 (DN 80)	42	35

* nonstandard enlarged oil outlet threads for bigger oil quantity applications, upon request. Additional cost will be applied.

Radial and axial loads

1 // Radial and axial loads

Size	Diameter (mm)	F_{Radial} (N) - Type			F_{Axial} (N) - Type			
		L, C, F	Y	V/K	B	K	D	A
9	80	19.648	14.736	9.824	860	3.430	4.940	9.680
	90	22.104	16.578	11.052	950	3.840	5.600	11.060
	100	26.000	19.500	13.000	1.050	4.110	6.250	6.840
11	100	32.560	24.420	16.280	1.190	4.740	7.320	11.060
	110	35.816	26.862	17.908	1.570	6.220	9.750	12.450
	125	42.500	31.875	21.250	1.460	5.730	9.190	7.520
14	125	52.700	39.525	26.350	1.940	7.650	11.760	23.860
	140	59.024	44.268	29.512	2.500	10.040	15.380	26.510
	160	68.096	51.072	34.048	2.050	7.970	12.730	16.590
	180	76.608	57.456	38.304	2.290	9.680	14.370	-
18	160	86.848	65.136	43.424	3.080	12.420	18.340	46.300
	180	97.704	73.278	48.852	3.860	15.580	23.490	51.440
	200	112.320	84.240	56.160	3.280	12.890	20.110	32.990
	225	126.360	94.770	63.180	3.650	15.570	22.750	-
22	200	134.800	101.100	67.400	4.500	17.410	27.210	79.170
	225	151.650	113.738	75.825	5.000	19.280	30.640	87.970
	250	175.700	131.775	87.850	5.500	22.280	34.170	65.470
	280	196.784	147.588	98.392	6.100	26.570	38.350	54.980
	300	210.840	158.130	105.420	4.300	18.230	26.320	-
28	250	213.200	159.900	106.600	6.500	26.770	39.280	123.710
	280	238.784	179.088	119.392	7.190	30.050	44.110	137.450
	300	262.200	196.650	131.100	7.660	31.720	47.330	105.560
	315	275.310	206.483	137.655	8.000	34.080	49.810	96.510
	335	292.790	219.593	146.395	8.470	30.860	53.030	74.820
	355	310.270	232.703	155.135	5.750	20.890	28.050	40.220

Please note: The loads presented within the table are values for a preliminary dimensioning of the bearing size. We recommend a specific bearing calculation to review the bearing dimensions selected.

ZR bearing dimensions

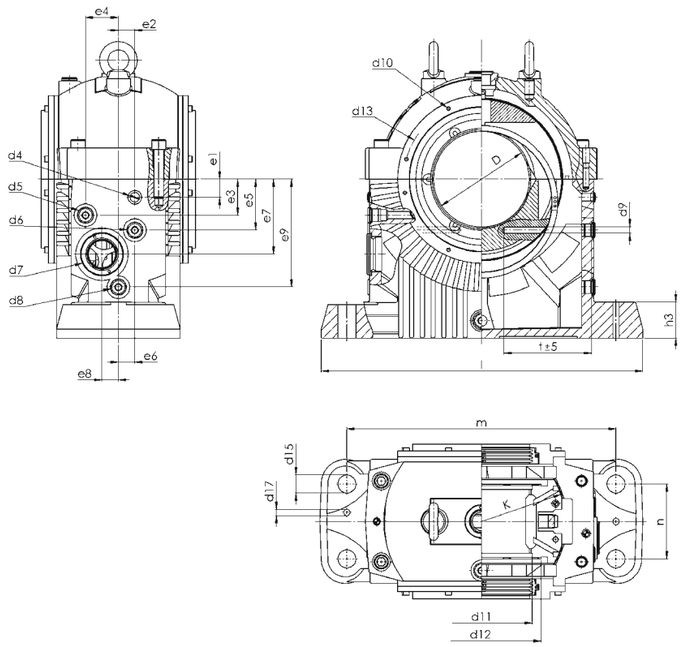
1 // ZR bearing dimensions

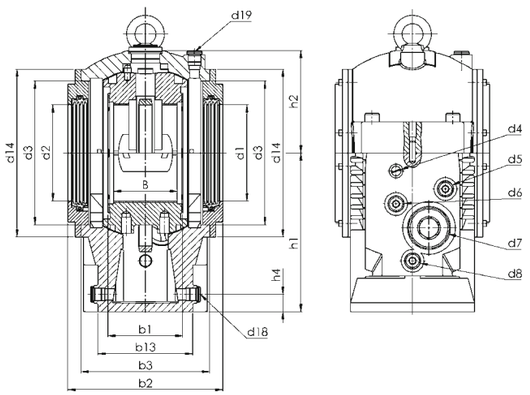
Size	D (H7)	B	b1	b2	b3	b13	d1/d2	d3	d5	d7	d8	d9	d10	d11	d12	d13	d14	d15	d17 [1]	d51	d52	e1	e2	e3	e4	e5	e6	e7	e8	e9	h1	h2	h3	h4	l	m	n	t ±5	dia. Ø K	ZD tilting pads per side	appr. weight (kg)	appr. oil content (l)
9	80	61,4	80	194	150	104	80/90 100/110	160	G3/8	G11/4	G1/2	11	8 x M6	86	110	180	200	22	10,4	110	20	20	15	35	37	60	20	85	15	135	190	123	35	23	355	300	90	117,5	190	14	45	1,8
	90	61,4												96	120					120	20																		117,5		16		
	100	65,0												106	130					125	16																		117,5		20		
11	100	81,4	100	214	170	122	100/110 125/140	190	G3/8	G11/2	G1/2	11	8 x M6	108	135	210	230	26	10,4	135	20	35	15	40	42	70	22,5	100	20	145	225	141	50	24	450	375	100	138	212	16	70	3
	110	81,4												118	150					140	20																		138		18		
	125	85,0												133	160					150	16																		128		22		
14	125	105,4	125	259	215	158	125/140 160/180	240	G1/2	G2	G1/2	11	8 x M6	135	170	260	280	30	10,4	165	25	30	27,5	60	55	85	27,5	125	27,5	180	265	168	60	29	540	450	125	168	280	18	135	4,5
	140	105,4												150	190					180	25																		168		20		
	160	106,4												170	200					195	20																		146		24		
	180	106,4												190	220					-	-																		134		-		
18	160	135,7	160	299	255	188	160/180 200/225	285	G1/2	G2	G1/2	13	8 x M8	172	215	320	350	40	15	210	31,5	30	30	70	68	105	30	155	30	215	315	208	70	29	660	560	150	209	335	18	240	8
	180	135,7												192	240					230	31,5																		209		20		
	200	140,4												212	250					245	25																		188		24		
	225	140,4												237	275					-	-																		163		-		
22	200	168,5	200	364	320	244	200/225 250/280 300	350	G3/4	G21/2	G3/4	13	8 x M8	214	265	390	420	46	15	265	40	35	35	80	83	135	40	175	40	245	375	254	80	37	800	670	200	259	425	18	430	16,5
	225	168,5												239	290					285	40																		259		20		
	250	175,7												264	315					305	31,5																		243		24		
	280	175,7												294	345					320	25																		201		32		
	300	175,7												310	345					-	-																		179		-		
28	250	213,2	250	424	380	302	250/280 300 315/355	450	G3/4	G21/2	G3/4	13	8 x M8	266	325	510	540	55	20	325	50	45	45	95	106	155	50	220	50	310	450	320	90	42	950	800	250	323	530	18	780	27,5
	280	213,2												296	355					355	50																		323		20		
	300	218,5												316	375					365	40																		273,5		24		
	315	218,5												331	390					380	40																		268,5		24		
	335	218,5*												351	410					380	31,5																		245		30		
	355	218,5												371	430					-	-																		231		-		

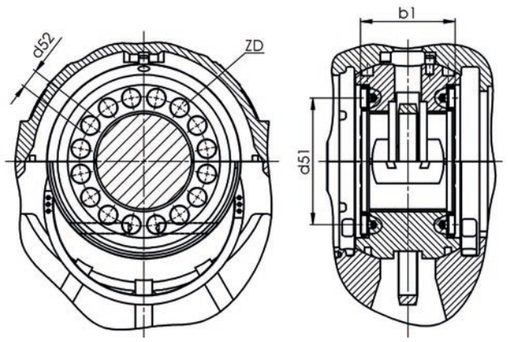
Dimensions in millimeters /
Dimensions not shown for seals see page 12

* in case of thrust face type “A” measure “B” = 225,7
1) bore for dowel pin

d4 = Earthing device or plug M12x1,5
d5 = Oil inlet (oil circulation or recirculating pump)
d6 = Provision for thermometer G 1/2“
d7 = Oil sight glass or oil outlet (oil circulation)
d8 = Plug (connection for heater, oil sump thermometer, water cooler)
d18 = Oil drain plug
for size 9 to 18: G 1/2“
for size 22 and 28: G 3/4“
d19 = Oil filling or breather
for size 9 and 11: G 3/8“
for size 14 and 18: G 1/2“
for size 22 and 28: G 3/4“
t = Depth of thermometer bore







Thrust face type A

Drawings shown here are for reference only. Some fin details, for example, may vary from size to size.

Dimensions of shaft

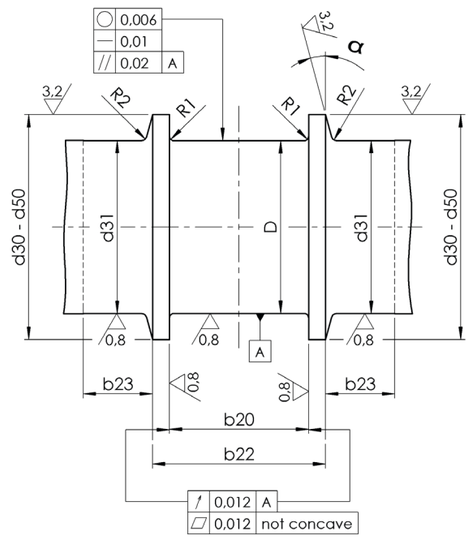
1 // Dimensions of shaft

Size	D [1]	b20 [2] (± 0,1)	b21 [3]	b22	b23 [5]	d30	d31 (e8) d32 [4]	d33	d50	R1 [6]	R2 [6]	R3
9	80	80,4	90	100	50	110	80 / 90 / 100 / 110	90	132	2,5	4	1,6
	90					120		100	142			
	100					130	80 / 80 / 90 / 100	110	143			
11	100	100,4	110	120	50	135	100 / 110 / 125 / 140	110	157	2,5	4	1,6
	110					150		125	162			
	125					160	100 / 100 / 110 / 125	140	168			
14	125	125,4	140	150	60	170	125 / 140 / 160 / 180	140	192	4	6	2,5
	140					190		160	207			
	160					200	125 / 125 / 140 / 160	180	217			
	180					220		200	-			
18	160	160,4	180	190	60	215	160 / 180 / 200 / 225	180	244	4	6	2,5
	180					240		200	264			
	200					250	160 / 160 / 180 / 200	225	273			
	225					275		250	-			
22	200	200,4	220	240	70	265	200 / 225 / 250 / 280 / 300	225	308	6	6	4
	225					290		250	328			
	250					315		280	339			
	280					345	200 / 200 / 225 / 250 / 280	310	348			
	300					345		330	-			
28	250	250,4	280	300	70	325	250 / 280 / 300 / 315 / 335 / 355	280	378	6	10	6
	280					355		310	408			
	300					375		330	408			
	315					390		345	423			
	335					410	250 / 250 / 280 / 300 / 315 / 335	365	414			
	355					430		385	-			

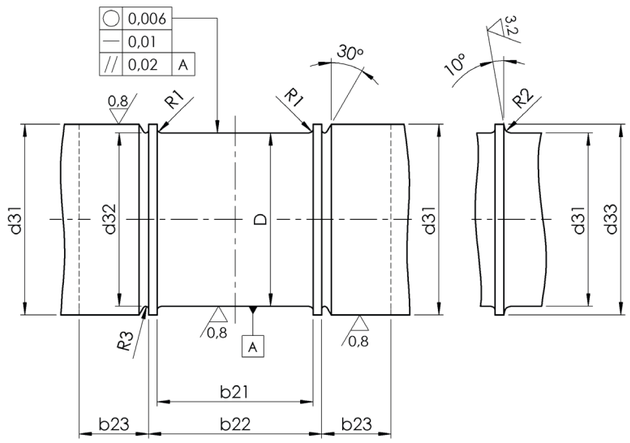
Dimensions in millimeters

[1] Limit dimensions of the shaft acc. DIN 31 698, form and positional tolerance and surfaces roughness acc. to DIN 31 699.
[2] Standard thrust clearance is 0,5 mm. If reversible thrust loads or shock load occur, dimension b20 can be reduced by 0,2 mm. If a locating bearing (shell type B,K) is needed only for test runs, dimension b20 can be enlarged by 4 up to 6 mm.
[3] If the non-locating bearing must allow larger motions (due to heat expansion or to large thrust clearances caused by the unit), dimension b21 can be enlarged.
[4] The plunge cut d32 is dropped, if it is equal or smaller as the shaft diameter D.
[5] Dimension b23 is valid for a bearing with a floating labyrinth seal.
[6] Radii R1 and R2 can be replaced by a plunge cut acc. to DIN 509

For locating bearing shell
Z…B (d30; α=10°)
Z…K (d30; α=10°)
Z…D (d30; α=10°)
Z…A (d50; α=15°)



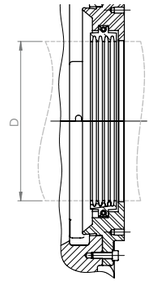
For non-locating bearing shell
Z...Q



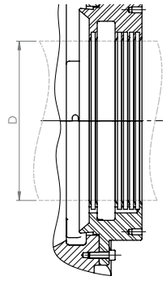
Types and dimensions of seals

1 // Types and dimensions of seals

Size	D	b27	b28	b29	b30	b31	b32	d3	d14	d36	d37	d38	d39	d40
9	80 90 100 110	29	39	27	14	8	21,5	160	200	160	160	158	160	160
11	100 110 125 140	31	41	27	16	8	21,5	190	230	190	190	188	160 190	160 190
14	125 140 160 180	33	43	27	18	8	21,5 —— 26,5	240	280	240	240	238	190 —— 240	190 —— 240
18	160 180 200 225	36	46	27	21	10	26,5	285	350	295	295	282	240 295	240 295
22	200 225 250 280 300	39	49	27	24	10	26,5 —— 31,5	350	420	365	365	347	295 —— 365	295 —— 365
28	250 280 300 315 335 355	42	52	27	27	10	31,5	450	540	480	365 —— 480	447	365 —— 480	365 —— 460

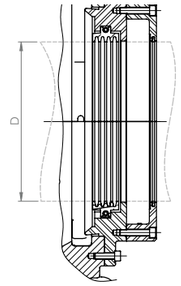


Floating labyrinth seal
(Protection IP 44)

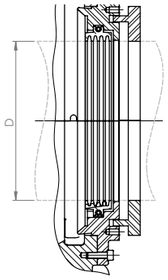


Rigid seal*
(Protection IP 44)

*Can be combined either
with a bolt-on baffle (IP 55)
or with a dust flinger (IP 54).

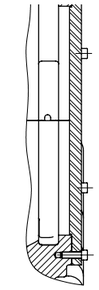


Floating labyrinth seal
with bolt-on baffle
(Protection IP 55)



Floating labyrinth seal
with dust flinger
(Protection IP 54)

Max. axial movement of
the dust flinger ± 6,5mm
(Meets NEMA spec.)



End cover

Special seal designs for specific applications upon request.

Bearing types and designations

Z	R				–		–	
1	2	3	4	5		6		7

1 // Type

Z	Plain bearing

2 // Housing

R	Pedestal bearing, finned

3 // Heat dissipation

N	Naturally cooled by convection
Z	Lubrication by oil circulation with external oil cooling
X	Lubrication by oil circulation withexternal oil cooling for high oil throughput
W	Finned water cooler in the oil sump
U	Recirculating oil pump and natural cooling
T	Recirculating oil pump and water cooler in the oil sump

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 oil disk
Y	Two-lobe bore without oil ring
V	Four-lobe bore without oil ring
K	Journal tilting pads without oil ring

5 // Geometry of thrust bearing

Q	Without thrust capability
B	Plain white metal lined shoulders with oil grooves
K	Tapered land thrust faces for both sense of rotation
D	Tapered land thrust faces for one sense of rotation
A	Round tilting thrust pads, cup spring supported

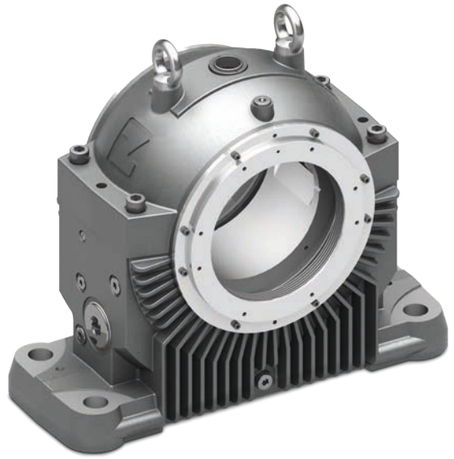
6 // Size

7 // Shaft diameter (mm)

Example of a bearing designation:

Z R N L B - 11 - 125

Pedestal bearing, finned, naturally cooled by convection, plain cylindrical bore with loose oil ring, plain white metal lined shoulders with oil grooves (locating or non-locating bearing), size 11, for shaft diameter 125 mm.



ZF - End flange mounted bearing
The type ZF horizontal bearing is designed acc. to DIN 31693 norm specifications for a wide range of heavy duty applications (electrical machines, turbines and test rigs)

ZM - Center flange bearing
The type ZM horizontal bearing is designed acc. to DIN 31694 norm specifications for a wide range of heavy duty applications (electrical machines, turbines and test rigs)

Checklist

- ☐ Operating conditions for calculation complete?
- ☐ Certification necessary (Lloyd`s, RINA…)?
- ☐ Atex class?
- ☐ Watercooler required?
- ☐ Hydrostatic oil supply required?
- ☐ Oil inlet or outlet flanges required (flange DIN)?
- ☐ Connecting diagram filled out?
- ☐ Electrical insulation required?
- ☐ Earthing device required?
- ☐ Protection class specified?
- ☐ Sealing type and diameter (outside)?
- ☐ Sealing type and diameter (inside)?
- ☐ Sealing diameter of machine seal?
- ☐ Shaft drawing available?
- ☐ Shaft vibration sensors required (thread…)?
- ☐ Speed sensor required (thread…)?
- ☐ Absolute vibration sensor required (position, thread…)?

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