SNR ball bearing units

Operating and Maintenance

SNR - Industry

INDUSTRY

Load capacity

SNR housings permit the complete utilization of the bearing insert load rating. The specified radial dynamic load rating of the inserts can be presumed as the maximum radial load capacity of the unit.

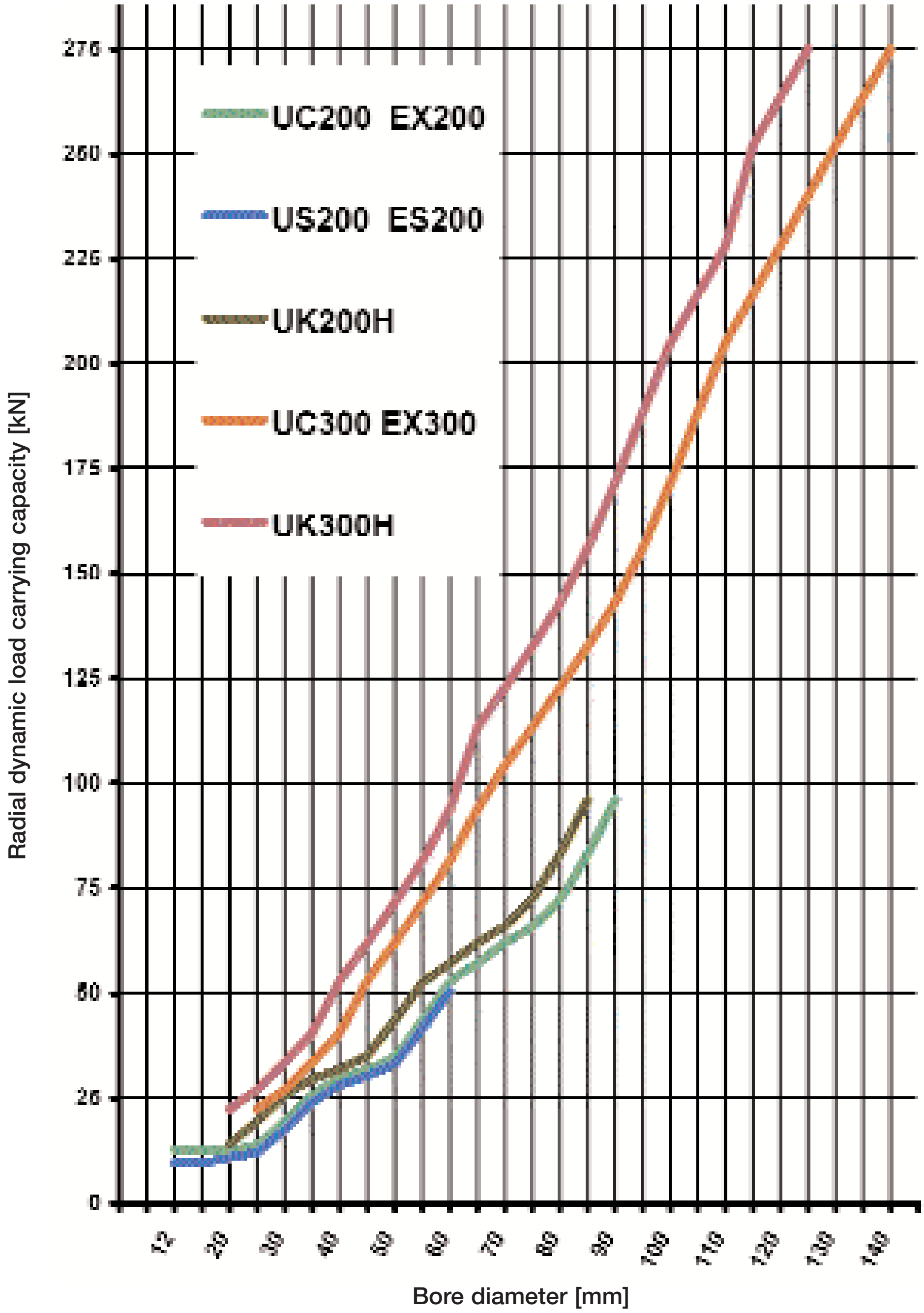
For the housings of the T200 and T300 series the radial dynamic load rating must be multiplied by a factor of 0.3.

The maximum axial load capacity of the inserts is 0.5 x C_{0r} (radial static load rating).

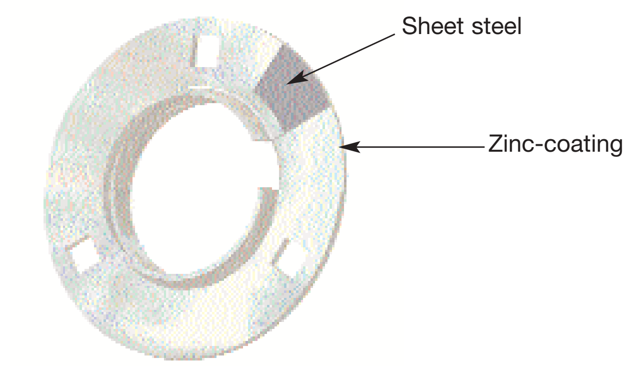
The following safety factors must be taken into consideration for various types of stress:

Type of stress	Safety factor
Constant load	1
Dynamic load	1 – 1.5
Moderate shock load	2
High shock load	> 3

Radial dynamic load ratings (C_r) for inserts of the series UC200 / UC300 / US200 / ES200 EX200 / EX300 / UK200 / UK300



Materials / Surfaces



Material

SNR pressed steel ball bearing units are made of cold rolled sheet steel.

Surfaces

SNR pressed steel ball bearing units are zinc-plated.

Load capacity

Maximum load capacity of the housing in radial direction:

Flanged unit:	C_r x 0.25
Pillow block unit:	C_r x 0.10

Maximum load capacity of the housing in axial direction:

Flanged unit:	C_r x 0.10
Pillow block uni:	C_r x 0.10

C_r = radial dynamic load rating of the bearing insert used.

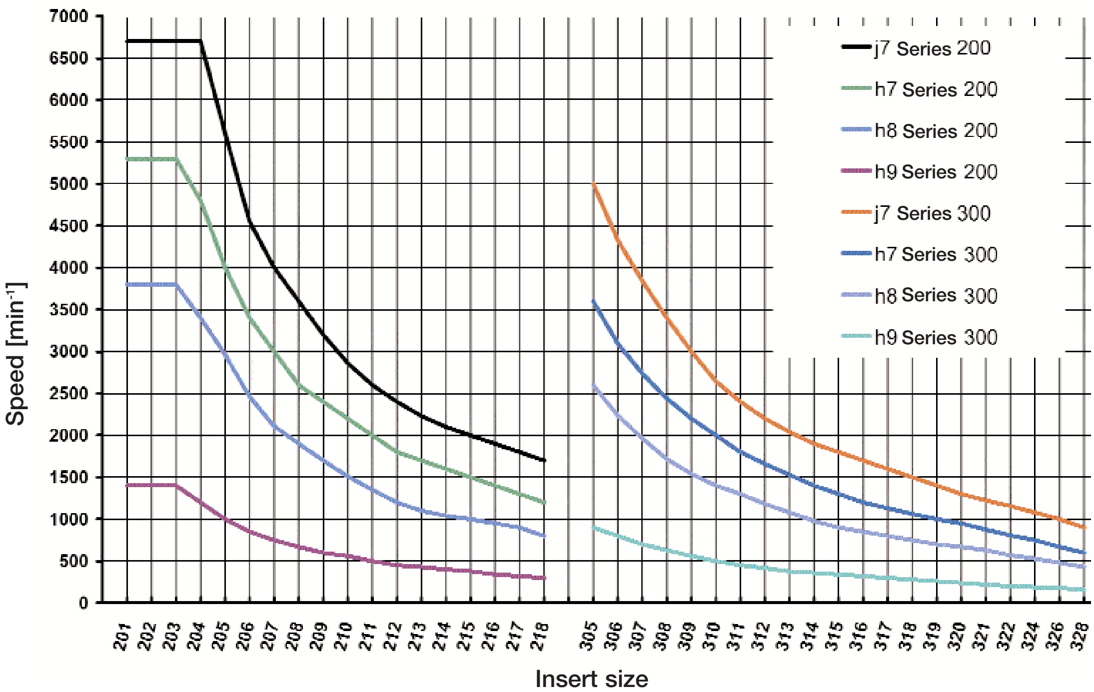
Bearing Inserts

Materials

Inner and outer rings as well as the balls of the SNR ball bearing inserts are made of hardened 100 Cr6 bearing steel.
Inserts are generally supplied with riveted two-piece steel plate cages.
The seals are made of nitrile rubber and zinc-plated sheet metal.

Fixing to the shaft

One advantage of the SNR ball bearing units are the minimum demands that this type of bearing arrangement makes on the shaft. It must neither be hardened nor ground and the surface quality too has few requirements. We recommend shaft materials having tensile strength of at least 500 N/mm^2. The maximal admissible speed is depending not only on the bearing geometry but also on the tolerance of the shaft diameter, as can be seen in the following diagram.



For most applications, threaded pins provide a sufficiently secure fixing of the inner ring to the shaft. For eccentric locking collars, it is recommended to use shafts manufactured according to **h6-h9** for the bearing seats. If tapered adapter sleeves are used, the shaft tolerance **h9** to **h11** is sufficient. If severe operating conditions are encountered, such as vibrations or shocks, a slight interference fit is preferred.

SNR Ball Bearing Units

Bearing inserts

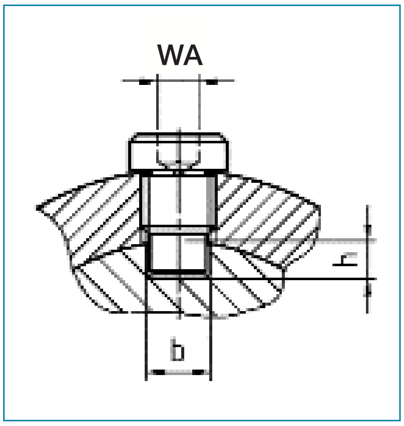
Set screws for bearing inserts

Metric

Set screw	Bearing insert UC CUC		US CUS	ES CES	EX CEX		Max. tightening torque [Nm]	Hexagon socket WA
M5 x 0.8			201-203				3.5	2.5
M6 x 1	201-206	305-306	204-207	201-206	201-206		5.5	3.0
M8 x 1	207-209	307	208-210	207-210	207-210	305-307	11.5	4.0
M10 x 1.25	210-212	308-309	211-212	211-212	211-215	308-312	22.0	5.0
M12 x 1.25	213-218	310-314			216-218	313-314	33.0	6.0
M14 x 1.5		315-316					42.0	7.0
M16 x 1.5		317-319				315-317	64.0	8.0
M18 x 1.5		320-324					75.0	9.0
M20 x 1.5		326-328				318-320	120.0	10.0

Inch

Set screw	Bearing insert UC CUC		US CUS	ES CES	EX CEX		Max. tightening torque [Nm]	Hexagon socket WA
No.10 - 32 UNF			201-08 203-11				3.2	3/32
1/4 - 28 UNF	201-08 206-20	305-14 306-19	204-12 206-20	201-08 205-16	201-08 205-16		3.7	1/8
5/16 -24 UNF	207-22 209-28	307-20 307-23	207-22 211-35	206-18 210-31	206-18 210-31	305-14 307-23	8.0	5/32
3/8 -24 UNF	210-30 213-40	308-24 309-28	212-36 212-39	211-32 212-39	211-32 215-48	308-24 312-39	16.8	3/16
7/16 -20 UNF	214-44 217-52	310-30 314-44			217-52 218-56	313-40 314-44	27.1	7/32
1/2 -20 UNF	218-56	315-47 315-48					33.9	1/4
5/8 -18 UNF		317-52 320-64				315-48 317-52	54.5	5/16
3/4 -16 UNF						318-56 320-64	65.2	3/8



Dimensions of the shaft slot.

Dimensions, floating bearing screws

Designation floating bearing screw	Thread	WA
SH 06 x 075	M6x1	3
SH 06 x 090	M6x1	3
SH 06 x 100	M6x1	3
SH 06 x 110	M6x1	3
SH 08 x 105	M8x1	4
SH 08 x 115	M8x1	4
SH 10 x 110	M10x1.25	5
SH 10 x 125	M10x1.25	5
SH 10 x 135	M10x1.25	5
SH 12 x 145	M12x1.25	6
SH 12 x 155	M12x1.25	6
SH 12 x 175	M12x1.25	6
SH 14 x 200	M14x1.5	6
SH 16 x 215	M16x1.5	8
SH 16 x 235	M16x1.5	8
SH 18 x 250	M18x1.5	8
SH 18 x 300	M18x1.5	8
SH 20 x 330	M20x1.5	10

Fitting dimensions for floating bearing screws, 200 series

Designation		Fitting dimensions [mm]	
Bearing insert	Screw	h	w
UC 201	SH 06 x 110	3.0	4
UC 202	SH 06 x 110	4.5	4
UC 203	SH 06 x 090	3.5	4
UC 204	SH 06 x 075	3.5	4
UC 205	SH 06 x 075	3.5	4
UC 206	SH 06 x 090	4.5	4
UC 207	SH 08 x 105	4.5	6
UC 208	SH 08 x 105	4.5	6
UC 209	SH 08 x 105	5.0	6
UC 210	SH 10 x 110	5.5	7
UC 211	SH 10 x 125	6.0	7
UC 212	SH 10 x 135	6.5	7
UC 213	SH 10 x 135	6.5	7
UC 214	SH 12 x 145	6.5	9
UC 215	SH 12 x 145	6.5	9
UC 216	SH 12 x 155	7.5	9
UC 217	SH 12 x 175	8.5	9
UC 218	SH 12 x 175	7.5	9

Fitting dimensions for floating bearing screws, 300 series

Designation		Fitting dimensions [mm]	
Bearing insert	Screw	h	w
UC 305	SH 06 x 090	4.5	4
UC 306	SH 06 x 110	4.5	4
UC 307	SH 08 x 115	5.0	6
UC 308	SH 10 x 125	5.0	7
UC 309	SH 10 x 135	5.5	7
UC 310	SH 12 x 145	5.5	9
UC 311	SH 12 x 155	6.0	9
UC 312	SH 12 x 155	5.5	9
UC 313	SH 12 x 175	6.5	9
UC 314	SH 12 x 175	6.0	9
UC 315	SH 14 x 200	7.5	10
UC 316	SH 14 x 200	6.5	10
UC 317	SH 16 x 215	7.5	12
UC 318	SH 16 x 235	9.0	12
UC 319	SH 16 x 235	8.0	12
UC 320	SH 18 x 250	8.0	13
UC 321	SH 18 x 250	7.5	13
UC 322	SH 18 x 300	11.5	13
UC 324	SH 18 x 300	9.0	13
UC 326	SH 20 x 330	10.0	15
UC 328	SH 20 x 330	8.5	15

SNR Ball Bearing Units

Tightening torques for groove nuts with adapter sleeve fixing

Bearing insert		Tightening torque [Nm]	Hook spanner DIN 1810 A size
UK 205	UK 305	20	38-45
UK 206	UK 306	30	45-50
UK 207	UK 307	40	52-55
UK 208	UK 308	50	58-62
UK 209	UK 309	60	65-70
UK 210	UK 310	70	65-70
UK 211	UK 311	95	68-75
UK 212	UK 312	125	80-90
UK 213	UK 313	150	85-92
UK 215	UK 315	350	98-105
UK 216	UK 316	400	98-105
UK 217	UK 317	450	110-115
UK 218	UK 318	550	120-130
	UK 319	650	120-130
	UK 320	800	120-130
	UK 322	1050	135-145
	UK 324	1350	155-165
	UK 326	1650	155-165
	UK 328	1900	180-195

The designation of the corresponding adapter sleeve is listed in the dimension tables.

SNR Ball Bearing Units

Operating temperature

Standard ball bearing inserts are suitable for all applications in the temperature range of –20 °C to +100 °C.

SNR high temperature inserts were specially designed for applications with operating temperatures above the range mentioned previously. They have a steel plate cage like standard inserts. However, they are equipped with a high temperature grease and can be used up to + 200 °C. The suffix for these inserts is “T20” and is added to the bearing designation on orders , e.g., “UCP206T20”.

For applications below the normal temperature range (down to –40 °C), we supply bearing inserts with the designation “T04”. They also have a steel plate cage but are filled with a low temperature grease. On orders, the designation is also added to the end, e.g., “UCP206T04”.

For further specifications about the lubricants used, refer to the section “Lubrication and maintenance” starting on page 34.

Bearing clearance

Standard ball bearing inserts are manufactured with an increased bearing clearance of group C3.

Inserts with conical bore for adapter sleeve fixing as well as inserts for high or low temperature applications have C4 bearing clearance.

The bearing clearance values can be found in the following tables:

Inserts with cylindrical bore

Bore nominal size [mm]		Radial bearing clearance [µm]					
		normal		C3		C4	
above	up to	min.	max.	min.	max.	min.	max.
10	18	3	18	11	25	18	33
18	24	5	20	13	28	20	36
24	30	5	20	13	28	23	41
30	40	6	20	15	33	28	46
40	50	6	23	18	36	30	51
50	65	8	28	23	43	38	61
65	80	10	30	25	51	46	71
80	100	12	36	30	58	53	84
100	120	15	41	36	66	61	97
120	140	18	48	41	81	71	114

Inserts with tapered bore

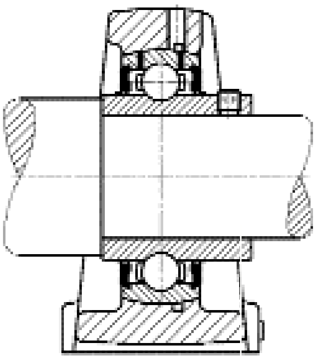
Bore nominal size [mm]		Radial bearing clearance [µm]					
		normal		C3		C4	
above	up to	min.	max.	min.	max.	min.	max.
24	30	13	28	23	41	32	50
30	40	15	33	28	46	39	60
40	50	18	36	30	51	43	68
50	65	23	43	38	61	54	84
65	80	25	51	46	71	64	99
80	100	30	58	53	84	74	114
100	120	36	66	61	97	89	134
120	140	41	81	71	114	109	159

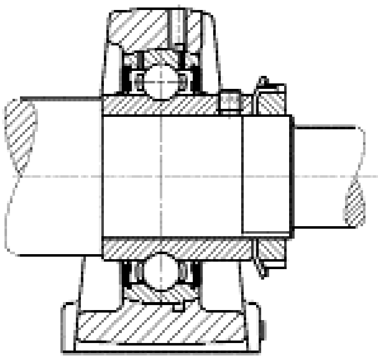
Axial load capacity of bearing inserts

The axial load capacity of the inserts depends largely on the type of fixing on the shaft. The inner design of the raceways and balls is of little importance in most cases. A further factor is the shaft tolerance used.

In order to attain the largest possible axial load capacity for the respective type of fixing, it is necessary that the fixing element (e.g., threaded pin, adapter sleeve) is secured at the specified tightening torque.

For running conditions with strong vibrations or shock loads it is recommended to set the inner ring against a shaft shoulder and to secure with a groove nut and lock washer as necessary. In this case, the axial load carrying capacity of the inserts can be fully utilised like with standard deep groove ball bearings. This can amount to up to 0.5-times the radial static load rating C_{0r}. Such an application should be examined closely taking into consideration the respective load conditions.





Load carrying capacity and speed limits

Load carrying capacity and speed limits of the bearing inserts are specified in the dimension tables starting on page 160. The effect of shaft tolerances on speed limits is shown in the diagram on page 18.

SNR Ball Bearing Units

Life calculation

Bearing life calculation

The inner design of bearing inserts for SNR ball bearing units are identical to deep groove ball bearings. They are manufactured out of the same material, have the same degree of precision, and are subject to the same strict production controls.

The calculation of bearing life and load ratings are performed using the calculation methods in accordance with ISO 281 and ISO 76.

Determining bearing sizes

Before calculating the life of bearing units, the loads occurring must be determined. The required bearing size essentially depends on the load and the speed. If the load occurs mostly while the bearing rotates, this is referred to as dynamic load. However, if the load acts mainly during stand still, at very low speeds, or with slight rotating movements, this is referred to as static load.

It is unimportant how the externally applied forces have their effect on the insert. The specification dynamic or static only refer to the operating condition of the bearing.

Dynamic equivalent load

If both radial and axial forces are applied to a bearing insert, these must be converted to an equivalent load (P) necessary for the calculation, as follows:

$$P = X \cdot F_r + Y \cdot F_a \quad [kN]$$

P = dynamic equivalent load [kN]
F_r = actual radial load [kN]
F_a = actual axial load [kN]
X = radial factor
Y = axial factor

$\frac{F_a}{C_{0r}}$	e	$\frac{Fa}{Fr} \le e$		$\frac{Fa}{Fr} > e$	
		X	Y	X	Y
0.014	0.19				2.30
0.028	0.22				1.99
0.056	0.26				1.71
0.084	0.28				1.55
0.110	0.30	1	0	0.56	1.45
0.170	0.34				1.31
0.280	0.38				1.15
0.420	0.42				1.04
0.560	0.44				1.00

e = limiting value
C_{0r} = radial static load rating (see dimension tables for ball bearing units)

Static equivalent load

For a simultaneously occurring radial and axial static load, an equivalent load (P_0) must be determined:

$$P_0 = X_0 \cdot F_r + Y_0 \cdot F_a \quad [kN]$$

but: $P_0 = Fr,\quad$ *if* $\quad \frac{F_a}{F_r} \leq 0.8$

P_0 = static equivalent load [kN]
X_0 = static radial factor
Y_0 = static axial factor

For all bearing inserts, the following applies:
X_0 = 0.6
Y_0 = 0.5

Using the ratio ***fs*** it can be checked if sufficient static dimensioning for the insert has been ensured:

$$fs = \frac{C_{0r}}{P_0}$$

Some standard values are:
fs = 0.7 minimal demands for running smoothness and rotating movement
fs = 1.0 occasional rotating bearing, normal demands for running smoothness
fs = 2.0 high demands for running smoothness

It should be noted that this ratio does not provide any assurance against a break or similar, but instead, it is assurance against excessive local deformation in the rolling contact (ball/raceway).

Calculating bearing life

When calculating bearing life for bearing units, the following applies:

$$L_{10} = \left(\frac{Cr}{P}\right)^3 \quad [10^6 \text{ revolutions}]$$

If the bearing life should be specified in hours, the following applies:

$$L10h = \left(\frac{Cr}{P}\right)^3 \cdot \frac{10^6}{60n} \quad [h]$$

n = speed [min^{-1}]

Life calculation

Example calculation

The bearing life of a UCP210 ball bearing unit under the following conditions:

Radial load:	F_r	=	2 kN
Axial load:	F_a	=	1.7 kN
Normal operating condition speed:	n	=	1800 min^{-1}
UCP210 ball bearing unit data:	C_r	=	35.1 kN
	C_{0r}	=	23.2 kN

Dynamic equivalent bearing load:

$$P = X \cdot F_r + Y \cdot F_a \qquad [kN]$$

with $\frac{F_a}{C_{0r}} = \frac{1.7\ \text{kN}}{23.2\ \text{kN}} = 0.073$ and $\frac{F_a}{F_r} = \frac{1.7\ \text{kN}}{2\ \text{kN}} = 0.85$

From Table 1:

with $Fa/C_{0r} = 0.073$, e is determined to be ≈ 0.28

with Fa/Fr = 0.85 > e = 0.28

$\rightarrow$ X=0.56 Y=1.55

$$P = 0.56 \cdot 2\ kN + 1.55 \cdot 1.7\ kN = 3.76\ kN$$

$$L_{10h} = \left(\frac{C_r}{P}\right)^3 \cdot \left(\frac{10^6}{60n}\right) \qquad [h]$$

it follows

$$L_{10h} = \left(\frac{35.1}{3.76}\right)^3 \cdot \left(\frac{10^6}{60x1800}\right) = 7532\ h$$

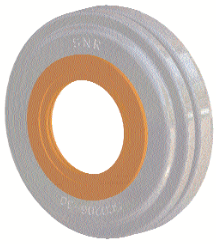
The theoretical bearing life of the bearing unit, under normal operating conditions, is 7532 hours.

Protective caps

Designs

In order to obtain protection from rotating shafts, increased sealing action, or additional mechanical protection of the bearing units in harsh ambient conditions, it is possible to equip many of the SNR ball bearing units with protective caps made of stainless steel. These are available closed or open with a double lip seal for diameter lines 201 to 213.

SCC – closed protective cap for shaft ends



SCO – open protective cap with double lip seal for through shafts

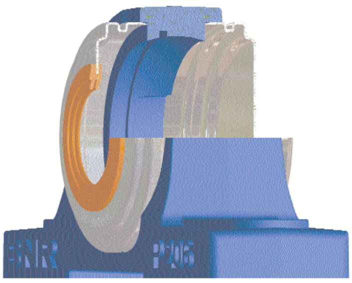
Materials

The protective caps are manufactured from stainless steel. The double lip seal is made of silicon rubber.

Fixing on the housing

There is no need for special tools to assemble the protective caps on the housing. The cap is inserted in a groove in the housing, and is sufficiently secured by the resulting press fit.

Caution: Housings with a corresponding groove must be ordered with the specific Suffix “N”, e.g.: “UCP.206.N”



Protective caps

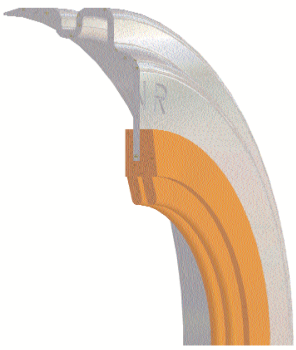
Protective cap assembly

Protective cap assembly

Protective cap disassembly

Seals

The double lip seal of the SNR protective cap is manufactured from silicon rubber, and is suitable for operating temperatures up to a maximum of +200 °C.



Units

Designs

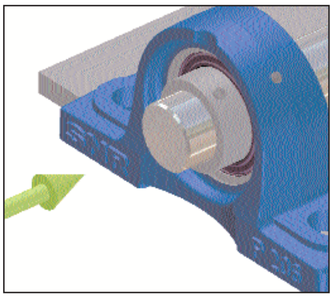
SNR ball bearing units are supplied as a ready-to-fit assembly. If relubrication is necessary, the included lubricating nipple must be mounted.

The spherical bearing seatings of the housings are manufactured in two different ISO tolerances. Bore diameters of up to 180 mm are manufactured in the tolerance class **J7**, which performes a firm seat for the bearing inserts.

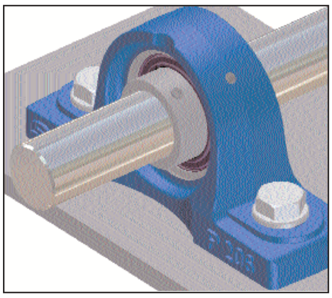
Larger bore diameters are manufactured in the tolerance class **H7**. In this cases the insert is secured by a locking pin in the outer ring.

Assembly

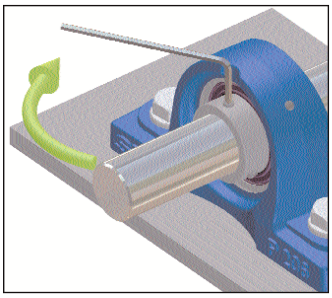
SNR pillow blocks and inserts with set screw fixing



1. Release set screws and slide bearing unit onto the shaft.

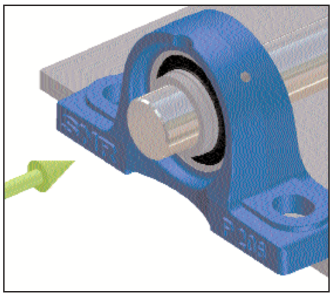


2. Screw down the housing on a flat surface. Mount the housing on the other end of the shaft in the same manner.

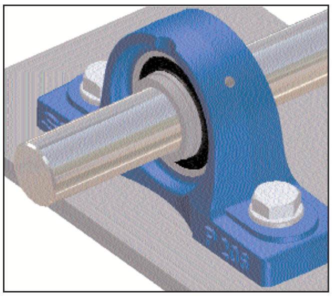


3. Screw down the set screws at the recommended tightening torque.

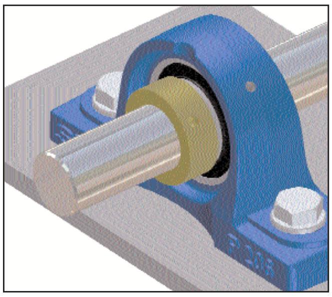
SNR pillow blocks and inserts with eccentric locking collar



1. Slide the unit onto the shaft. Do not tighten the eccentric locking collar.

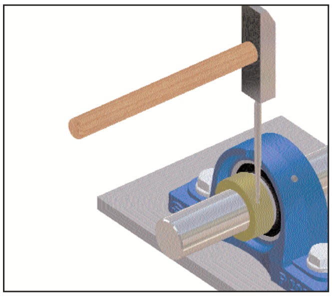


2. Tighten the screws slightly. Mount the unit on the other end of the shaft in the same manner. Securely tighten the screws.

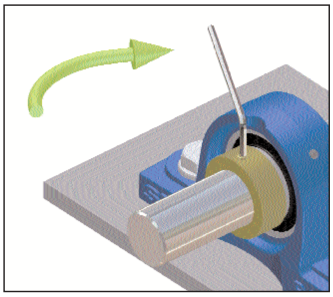


3. Preferably tighten the eccentric locking collar by hand in the direction of the shaft rotation.

Assembly

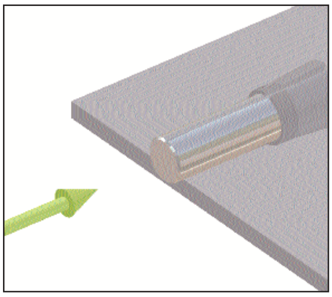


4. Tighten the eccentric locking collar with mandrel and hammer.

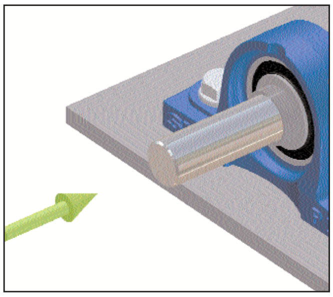


5. Tighten the set screws.

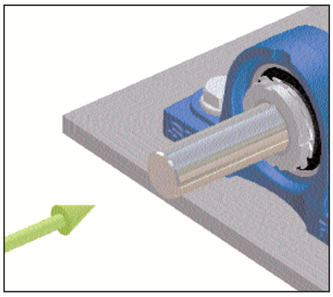
SNR pillow blocks and inserts with adapter sleeve fixing



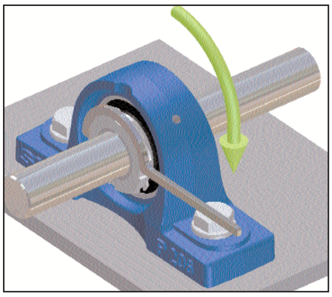
1. Slide the adapter sleeve onto the shaft.



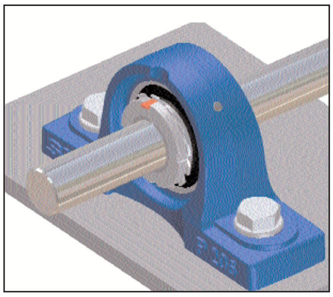
2. Slide the unit onto the shaft.



3. Align the unit on the shaft, then screw on the housing securely.



4. Mount the lock washer and groove nut and then tighten at the recommended tightening torque.



5. Secure the adapter sleeve (bend the tab of the lock washer into a slot in the groove nut).

Additional information about assembly

In order to prevent possible damage to the bearing insert due to improper assembly, the housing must first be screwed down onto its respective base or onto the frame before the inner rings of the inserts are tightened into their final position on the shaft. Otherwise, undesirable axial distortion could result and thus premature failure of the bearing.

The ends of the shaft should be provided with a chamfer for easier assembly.

It must be ensured that the set screws of the bearing inserts are screwed out far enough so that they do not project in the inner ring bore. Otherwise, assembly can be difficult or the shaft could even be damaged. Normally the bearing inner rings are slid onto the shaft with a tight loose fit. If for individual cases an interference fit proves to be essential, the inner rings should be fit using a suitable piece of pipe, preferably made of brass or plastic.

We also supply the respective assembly tools for all bearing inserts, as well as for standard bearings.

Direct hammer impacts on the inserts or the housing must be avoided because they can damage the bearing.

When assembly is finished, the shaft is initially turned by hand in order to ensure rotation without problems.

In operation, cast iron housings should be stressed by pressure force and not by tension, if possible. Take-up units must be positioned in that way, that the straining screw presses against the housing during adjustment.

Grey cast iron housings are not suitable for highly alternating or axial dynamic loads. In such cases, housings made of cast steel or nodular graphite iron should be used.

Mountings with large bearing spread and bearings which are exposed to additional axial loads because of highly variable temperatures, require special measures, such as mounting a floating bearing screw.

Securing the housing

If exact positioning of the bearing unit is required, some of the housing types can be secured using available centring, or straight or tapered pins.

Housing types with possible positions of the pin bores can be found in the tables starting on page 190.

Lubrication and maintenance

SNR ball bearing units are filled with the required amount of grease at the factory. Thus additional lubrication during assembly is not necessary.

Relubrication is not necessary for normal operating conditions.

Under severe conditions, such as continuous operation at high speeds, high temperatures (above +70 °C operating temperature), heavy loads, or very humid or dirty surroundings, regular relubrication is necessary.

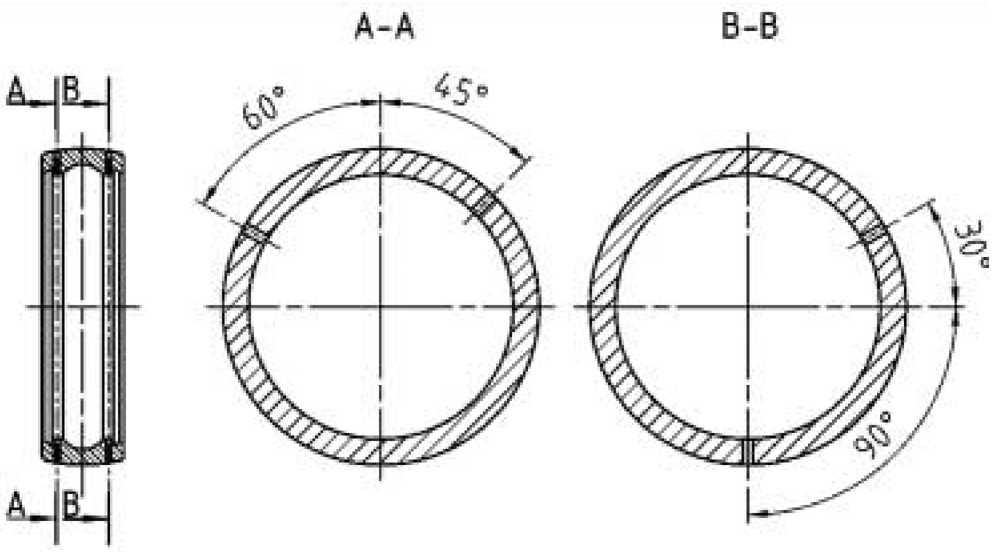
Relubrication is dependent on the insert size. Relubrication should be performed during operation (rotating insert under operating temperature). Press the suitable grease into the unit until a fresh collar of grease is formed on the seals.

Caution: The old grease must be allowed to emerge without hindrance.

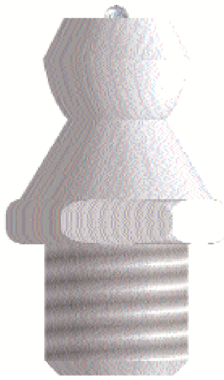
Relubrication system

Grey cast iron housings are equipped with a lubrication groove within the spherical bore. The inserts have 4 lubrication holes in the outer ring which are arranged offset.

Because of the arrangement of the lubrication holes, SNR inserts can be mounted in nearly all housings with lubrication groove and then be relubricated.



Lubricating nipple



The lubricating nipple used is made of steel and is zinc plated.

The following sizes of the lubricating nipple are used:

M6x1, M8x1, M10x1 and R1/8“

Specifications about suitable lubricating nipples for individual housings can be found in the dimension tables.

Delivery condition: Lubricating nipples are supplied together with the bearing units. They are not mounted. The lubrication hole in the housings is closed with a plastic plug.

Grease

SNR ball bearing inserts are lubricated for life at the factory. If relubrication is necessary because of severe operating conditions, grease having the same base and consistency should be used.

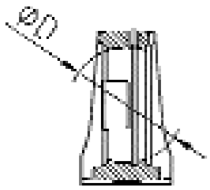
The greases for SNR ball bearing units have the following technical characteristics:

Range of application for grease	Grease base	Temperature range [°C]	Consistency DIN 51 818 NLGI class	Speed characteristic (n • dm) [min^{-1} • mm]	Viscosity at 40°C [mm^2/s]
Standard	Lithium soap	–20 to +120	II	500 000	100
High temperatures (e.g., “T20”)	Perfluorpolyether oil and PTFE	–40 to +260	II	300 000	400
Low temperatures (e.g., “T04”)	Lithium soap	–60 to +120	III	–	25

Tolerances of cast iron housings

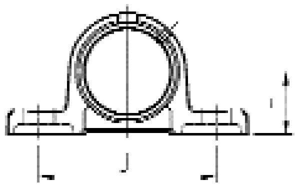
Tolerance of spherical bearing seat

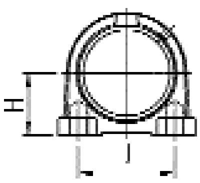
Nominal size bearing seat D1 [mm]		Fit
over	incl.	
	180	J7
180	300	H7

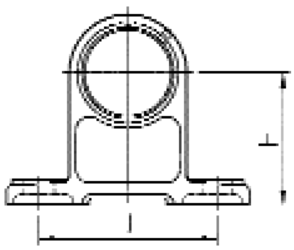


Tolerances of pillow block housings

Housing							Tolerances [µm]	
P		PLE	PE	PH / PG	PA / PAE	PP	H	J
203		203	203	203	203	203	±150	±700
204		204	204	204	204	204		
205	305	205	205	205	205	205		
206	306	206	206	206	206	206		
207	307	207	207	207	207	207		
208	308	208	208	208	208			
209	309	209	209	209	209			
210	310	210	210	210	210			
211	311	211	211		211		±200	±1000
212	312	212	212		212			
213	313							
214	314		214					
215	315		215					
216	316		216					
217	317		217					
218	318		218				±300	
	319							
	320							
	321							
	322							
	324							
	326							
	328							

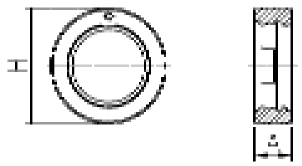




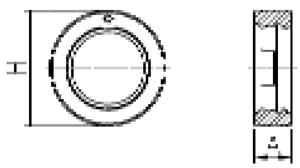


Tolerances of cartridge housings

<table>
<tr><th>Housing</th><th colspan="4">Tolerances [µm]</th></tr>
<tr><th rowspan="2">C200</th><th colspan="2">H</th><th rowspan="2">A</th><th rowspan="2">Radial Runout max.</th></tr>
<tr><th>max.</th><th>min.</th></tr>
<tr><td>203</td><td rowspan="3">0</td><td rowspan="3">-30</td><td rowspan="8">±200</td><td rowspan="8">200</td></tr>
<tr><td>204</td></tr>
<tr><td>205</td></tr>
<tr><td>206</td><td rowspan="5">0</td><td rowspan="5">-35</td></tr>
<tr><td>207</td></tr>
<tr><td>208</td></tr>
<tr><td>209</td></tr>
<tr><td>210</td></tr>
<tr><td>211</td><td rowspan="4">0</td><td rowspan="4">-40</td><td rowspan="6">±300</td><td rowspan="6">300</td></tr>
<tr><td>212</td></tr>
<tr><td>213</td></tr>
<tr><td>214</td></tr>
<tr><td>215</td><td rowspan="2">0</td><td rowspan="2">-46</td></tr>
<tr><td>216</td></tr>
</table>



<table>
<tr><th>Housing</th><th colspan="4">Tolerances [µm]</th></tr>
<tr><th rowspan="2">C300</th><th colspan="2">H</th><th rowspan="2">A</th><th rowspan="2">Radial Runout max.</th></tr>
<tr><th>max.</th><th>min.</th></tr>
<tr><td>305</td><td rowspan="4">0</td><td rowspan="4">-35</td><td rowspan="6">±200</td><td rowspan="6">200</td></tr>
<tr><td>306</td></tr>
<tr><td>307</td></tr>
<tr><td>308</td></tr>
<tr><td>309</td><td rowspan="6">0</td><td rowspan="6">-40</td></tr>
<tr><td>310</td></tr>
<tr><td>311</td><td rowspan="8">±300</td><td rowspan="15">300</td></tr>
<tr><td>312</td></tr>
<tr><td>313</td></tr>
<tr><td>314</td></tr>
<tr><td>315</td><td rowspan="5">0</td><td rowspan="5">-46</td></tr>
<tr><td>316</td></tr>
<tr><td>317</td></tr>
<tr><td>318</td></tr>
<tr><td>319</td><td rowspan="7">±400</td></tr>
<tr><td>320</td><td rowspan="3">0</td><td rowspan="3">-52</td></tr>
<tr><td>321</td></tr>
<tr><td>322</td></tr>
<tr><td>324</td><td rowspan="3">0</td><td rowspan="3">-57</td></tr>
<tr><td>326</td></tr>
<tr><td>328</td></tr>
</table>

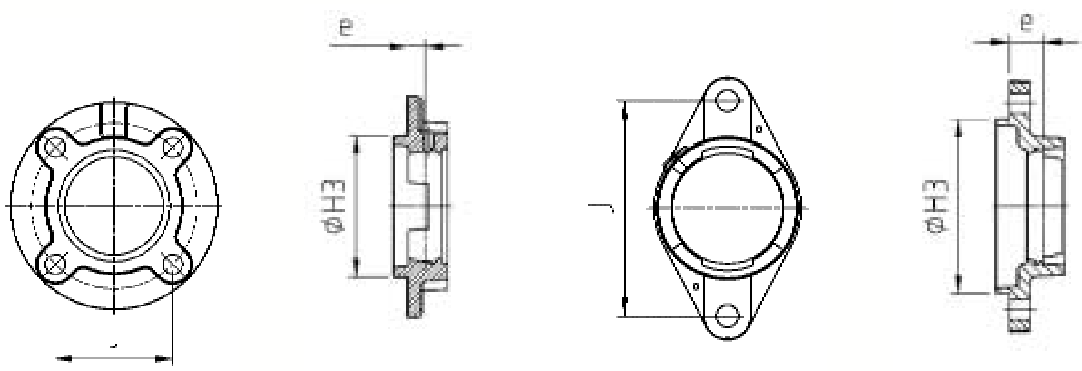


SNR INDUSTRY

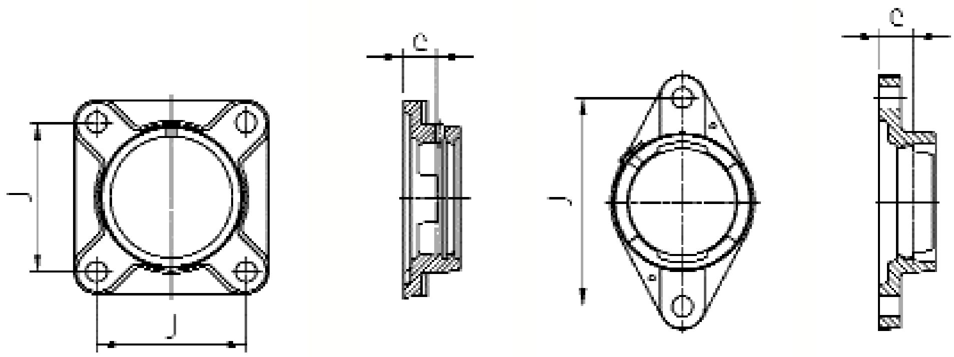
Tolerances and Fixing of housings

Tolerances of flanged housings

Housing											
F		FE	FCE	FC	FEE	FS	FTE	FLE	FL		FLZ
203		203		203			203	203	203		
204		204	204	204			204	204	204		204
205	305	205	205	205	205	305	205	205	205	305	205
206	306	206	206	206	206	306	206	206	206	306	206
207	307	207	207	207	207	307	207	207	207	307	207
208	308	208	208	208	208	308	208	208	208	308	208
209	309	209	209	209	209	309	209	209	209	309	209
210	310	210	210	210	210	310	210	210	210	310	210
211	311	211	211	211		311		211	211	311	
212	312	212	212	212	212	312		212	212	312	212
213	313	213	213	213		313			213	313	
214	314	214	214	214		314		214	214	314	
215	315	215	215	215		315		215	215	315	
216	316	216	216	216		316			216	316	
217	317	217	217	217		317			217	317	
218	318	218	218	218		318			218	318	
	319					319				319	
	320					320				320	
	321					321				321	
	322					322				322	
	324					324				324	
	326					326				326	
	328					328				328	

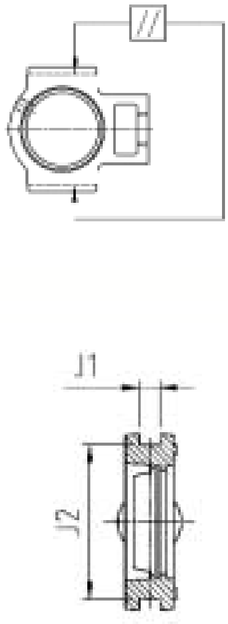


FD	FA	FAE	Tolerances [µm] J	e	H3	Radial Runout max.
203	203		±700	±500	h8	200
204	204	204				
205	205	205				
206	206	206				
207	207	207				
208	208					
	209					
	210					
	211		±1000	±800		300
	212					
						400



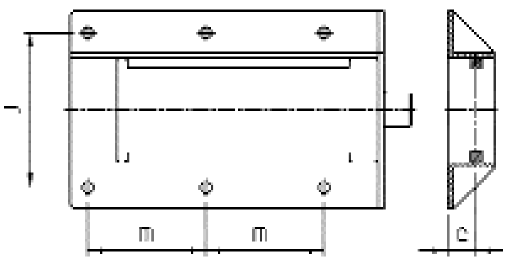
Tolerances of take-up housings

Housing		Tolerances [µm]				
		J1		J2		Parallelism of guiding groove
T		max.	min.	max.	min.	max.
204						
205	305					
206	306					
207	307	+200	0	0	-500	500
208	308					
209	309					
210	310					
211	311					
212	312					
213	313					
214	314					600
215	315					
216	316					
217	317					
218	318	+300	0	0	-800	
	319					
	320					700
	321					
	322					
	324					
	326					800
	328					



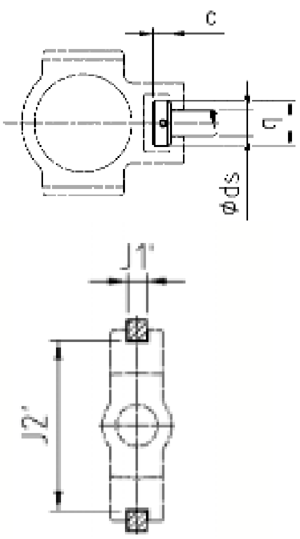
Tolerances of stretcher frames

Housing	Tolerances [µm]		
WB	m	J	e
204 - 213	±700	±700	±500



Tolerances stretcher frame accessories

Housing	Dimensions [mm]				
	Guiding rail		nut of threaded spindle		
T200	J2' ±0,5	J1'	ds	q	o
204	77		16	28	
205		11			12
206	90		18	32	
207					
208					
209	103	15	26	42	14
210					
211	131	20	30	56	20
212					
213					
214	152	24	36	60	26
215					
216	167				
217	175	28	42	65	30



Housing	Dimensions [mm]				
	Guiding rail		nut of threaded spindle		
T300	J2' ±0,5	J1'	ds	q	o
305	81	11	22	32	12
306	91	15	24	38	14
307	101		26	40	16
308	113	16	28	46	18
309	126		30	50	20
310	141	18	32	55	22
311	151	20	34	60	24
312	161		36	64	
313	172		38		26
314	182	24	42	75	28
315	194				
316	206	28	46	90	34
317	216	30			
318	230		50	95	
319	242				38
320	262	32	52	100	
321					
322	287	36	55	110	42
326	322	42	60	120	48
326	352	46	65	130	52
328	382		70	140	56

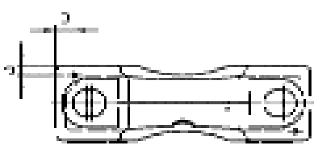
Tolerances and Fixing of housings

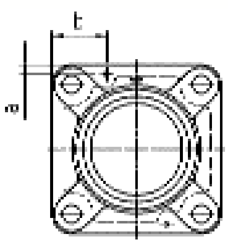
Fixing of housings

Pin placing
To meet an exact positioning of bearing units when mounted, the following cast iron housings are equipped with additional supporting surface for the positioning of pins.

Housing		Dimensions [mm]			
P	PH	a	b	Thickness of housing	recom-mended Pin Ø
203	203	5,0	8,0	15	3
204	204	5,0	8,0	15	3
205	205	6,0	9,0	16	3
206	206	6,0	13,0	18	3
207	207	6,0	11,0	19	4
208	208	9,0	12,0	19	4
209	209	9,0	12,0	20	5
210	210	10,0	13,0	22	5
211		10,0	13,0	22	6
212		10,0	17,0	25	6
213		9,0	18,5	27	6
214		9,0	15,0	27	6
215		9,5	16,0	28	6
216		11,0	17,0	30	8
217		11,0	17,0	32	8
218		11,0	18,0	34	10
305		5,5	12,5	16	4
306		6,5	11,5	19	4
307		8,0	13,0	21	5
308		9,0	13,0	23	5
309		10,0	14,0	25	6
310		10,0	15,0	28	6
311		12,0	19,0	31	8
312		13,0	22,5	33	8
313		12,5	22,0	36	10
314		13,0	21,0	40	10
315		13,0	26,0	40	10
316		15,0	30,0	45	10
317		15,0	30,0	45	10
318		15,0	30,0	50	10
319		20,0	32,0	50	10
320		20,0	32,0	55	13
321		20,0	32,0	55	13
322		22,5	35,0	60	13
324		25,0	35,0	70	13
326		29,0	35,0	80	13
328		29,0	35,0	80	16

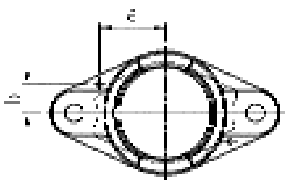
Housing	Dimensions [mm]			
F	a	b	Thickness of housing	recom-mended Pin Ø
203	6	30	9	3
204	6	30	9	3
205	6	34	9	3
206	6	35	10	3
207	7	38	12	4
208	8	40	12	4
209	8	43	14	5
210	8	47	14	5
211	8	47	15	6
212	8	50	15	6
213	9	52	15	6
214	9	54	20	6
215	9	54	20	6
216	10	55	20	8
217	10	58	20	8
218	11	62	20	10
305	6	37	9	4
306	7	40	11	4
307	8	46	12	5
308	8	48	13	5
309	8	48	14	6
310	9	52	15	6
311	10	55	16	8
312	10	56	17	8
313	11	56	17	10
314	11	62	20	10
315	11	65	20	10
316	11	70	22	10
317	11	70	22	11
318	12	78	24	10
319	12	80	24	10
320	14	85	26	13
321	14	85	26	13
322	14	90	29	13
324	14	95	34	13
326	15	105	39	13
328	17	120	42	16



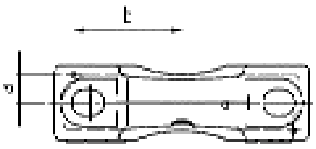


Fixing of housings

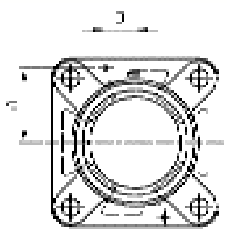
Housing FLE	Dimensions [mm] a	b	Thickness of housing	recommended Pin Ø
204	31,0	14,5	8,5	3
205	35,0	16,0	9,0	3
206	42,5	17,0	10,0	3
207	50,0	17,0	11,0	4
208	55,0	19,0	11,0	4
209	58,0	21,0	11,0	5
210	60,0	22,5	11,0	5
211	70,0	26,0	13,0	6
212	75,0	26,0	14,0	6
214	85,0	28,0	15,0	6
215	85,0	30,0	15,0	6



Housing PE	Dimensions [mm] a	b	Thickness of housing	recommended Pin Ø
204	10,0	59,0	14,5	3
205	12,0	59,0	14,5	3
206	13,0	72,0	17,0	3
207	14,5	73,5	19,0	4
208	16,0	81,5	19,0	4
209	16,0	88,0	21,5	5
210	18,0	91,0	21,5	5
211	20,0	101,0	22,5	6
212	20,0	110,0	25,0	6
214	21,5	119,0	27,5	6
215	22,0	121,5	27,5	6
216	26,0	132,0	30,0	8
218	28,5	151,0	35,0	10



Housing FE	Dimensions [mm] a	b	Thickness of housing	recommended Pin Ø
204	36,0	13,0	10,0	3
205	40,5	15,0	11,0	3
206	46,0	17,0	12,0	3
207	51,0	18,0	12,5	4
208	57,0	20,0	13,0	4
209	60,5	21,0	13,0	5
210	63,5	22,0	13,0	5
211	71,0	25,0	15,0	6
212	77,5	27,0	16,0	6
214	85,0	29,0	18,0	6
215	88,5	30,0	20,0	6

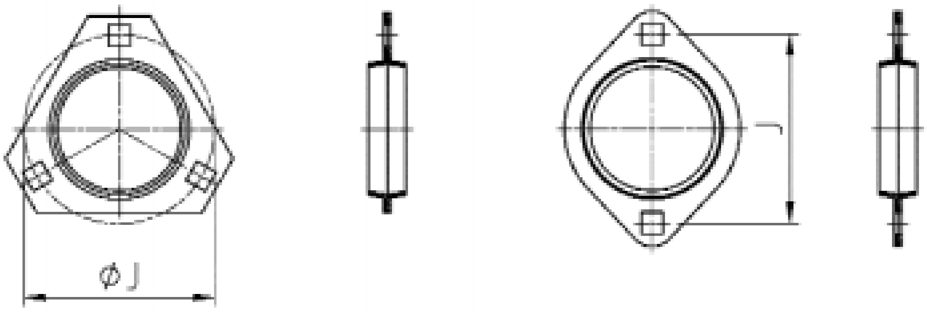


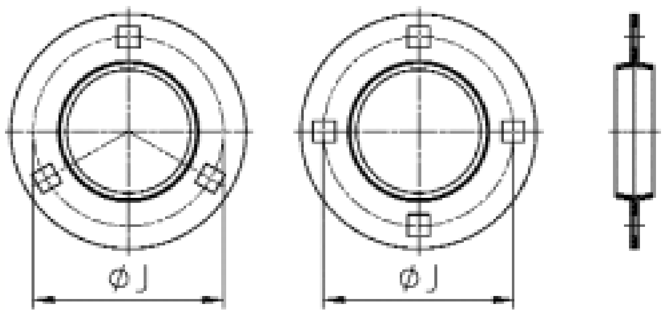
Tolerances and Fixing of housings

Tolerances of pressed steel housings

Tolerances of flanged housings

Housing			Tolerance [µm]
PF / PFT	PFL	PFE	J
203	203		
204	204		
205	205	205	±500
206	206	206	
207	207		
	208		
209			
210			±1000
211			
212			



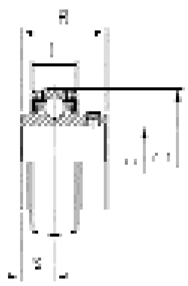


4 mounting holes from shaft diameter 40 on

Tolerances of bearing inserts

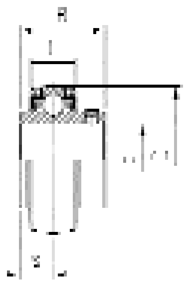
Tolerances of outer ring

Nominal diameter D [mm] over	incl.	Dmp [µm] min.	max.	K_{ea} [µm] max.
	50	-11	0	20
50	80	-13	0	25
80	120	-15	0	35
120	150	-18	0	40
150	180	-25	0	45
180	250	-30	0	50
250	315	-35	0	60



Tolerances of inner ring

Nominal diameter d [mm] over	incl.	Tolerance of S [µm]
	50	±200
50	80	±250
80	120	±300
120	140	±350



CUC/CUS/CES/CEX

Nominal diameter d [mm] over	incl.	Δdmp [µm] min.	max.	K_{ia} [µm] max.	ΔBs [µm] min.	max.
	18	-8	0	10	-120	0
18	30	-8	0	10	-120	0
30	50	-10	0	13	-120	0

Tolerances and Fixing of housings

Tolerances of inner ring

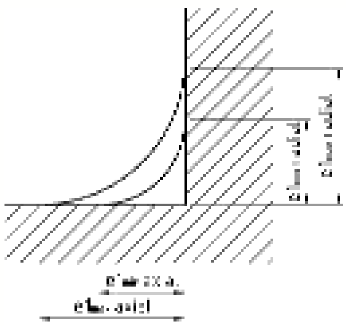
UC/ES/US/EX

Nominal diameter d [mm]		Δdmp [µm]		K_{ia} [µm]	ΔBs [µm]	
over	incl.	min.	max.	max.	min.	max.
	18	0	+18	12	-120	0
18	30	0	+21	15	-120	0
30	50	0	+25	18	-120	0
50	80	0	+30	22	-150	0
80	120	0	+35	28	-200	0
120	140	0	+40	35	-250	0

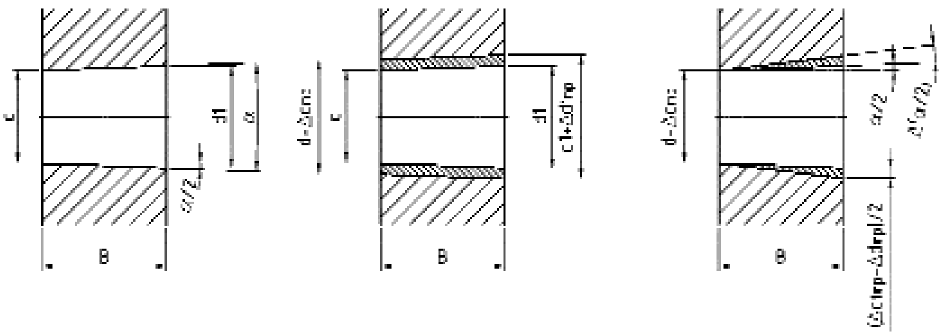
Δdmp = Allowance of the average bore diameter in a single plane
ΔDmp = Allowance of the average outer diameter in a single plane
K_{ia} = Radial runout of the inner race in an assembled bearing bearing insert
K_{ea} = Radial runout of the outer race in an assembled bearing bearing insert
ΔBs = Allowance of a single inner race width

Tolerances of edge clearances

Nominal size of edge clearance e1 [mm]	Bore diameter [mm]		e1 min [mm]		e1 max [mm]	
	over	incl.	radial	axial	radial	axial
0,6		40,0	0,6	0,6	1,0	2,0
1,0		50,0	1,0	1,0	1,5	3,0
1,1		120,0	1,1	1,1	2,0	3,5
1,5		120,0	1,5	1,5	2,3	4,0
2,0		80,0	2,0	2,0	3,0	4,5
	80,0				3,5	5,0
2,5		100,0	2,5	2,5	3,8	6,0
3,0		280,0	3,0	3,0	5,0	8,0
4,0			4,0	4,0	6,5	9,0



Tolerance of tapered bore



Nominal size

Allowance for nominal size

Allowance for angle of taper

Nominal diameter d [mm]		Deviation Δdmp [µm]		Δd1mp-Δdmp [µm]	
over	incl.	min.	max.	min.	max.
18	30	0	+33	0	+21
30	50	0	+39	0	+25
50	80	0	+46	0	+30
80	120	0	+54	0	+35
120	180	0	+63	0	+40

α = Nominal angle of taper = 4°46'18,8''

$\alpha/2$ = Angle of inclination at end of cone = 2°23'9,4''

$\Delta\alpha/2$ = Deviation of angle of inclination $=1{,}716 \bullet \frac{\Delta d1mp - \Delta dmp}{B}$ [minutes]

B = Width of inner ring

d = Nominal bore diameter

d1 = Bore diameter at large cone end = d+0,083333 • B

Δdmp = Deviation of average bore diameter in a single plane

Δd1mp = Deviation of bore diameter d1