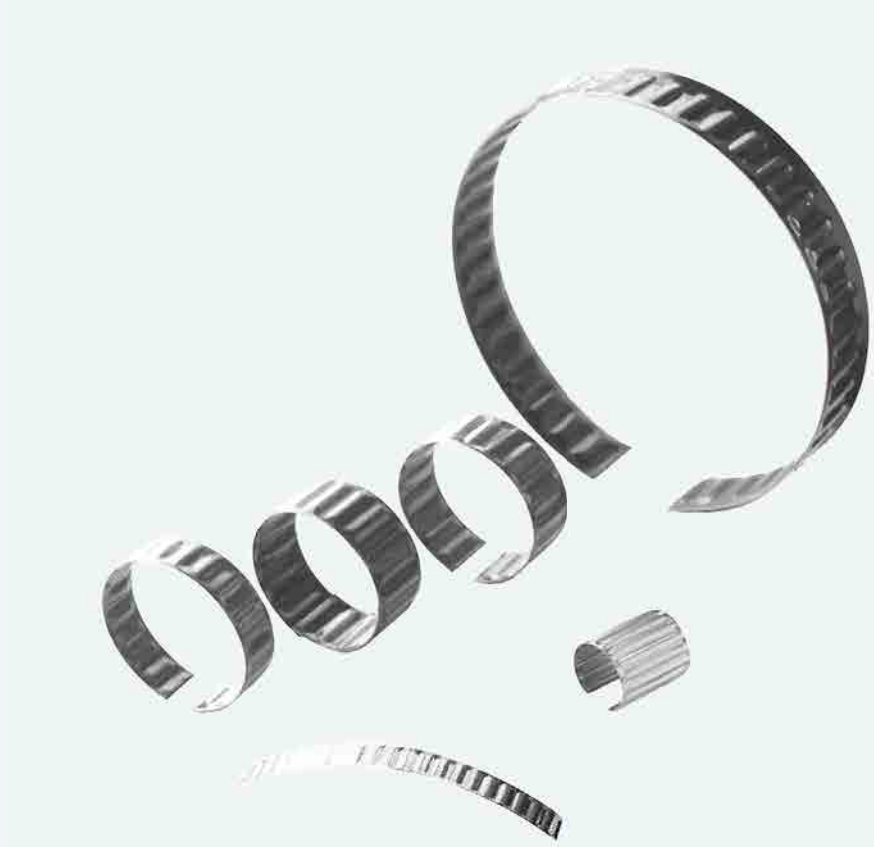
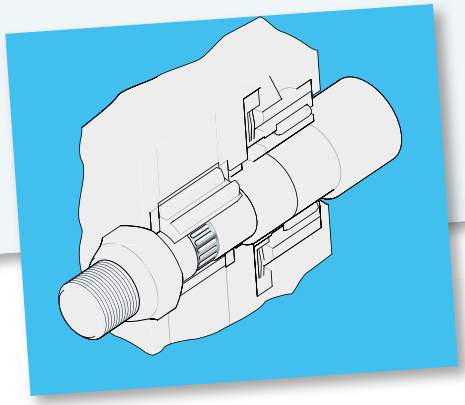
Шаровые опоры и центровочные кольца

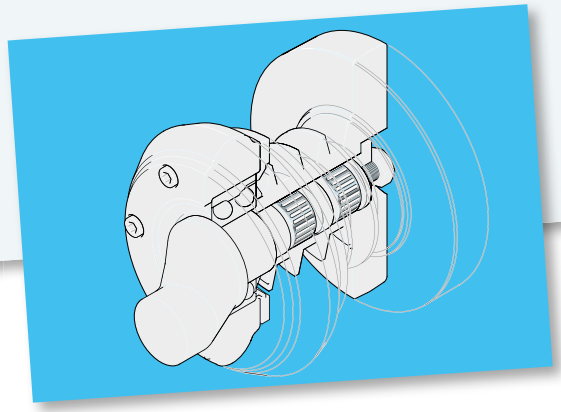
Технические характеристики

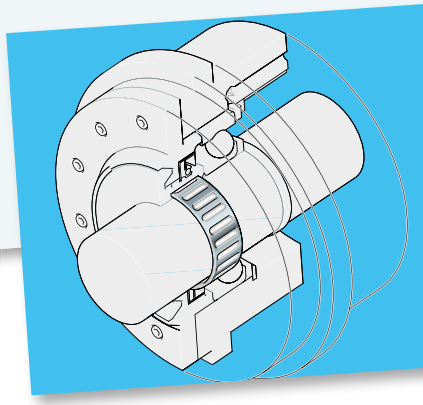
rexroth
A Bosch Company

Tolerance rings









Tolerance Rings

Product Overview

Tolerance rings are made of hard, embossed spring steel strip and belong to the class of frictionally engaging fasteners. Tolerance rings were designed for especially easy, low-cost fastening of machine parts. They replace complex contour-locking keyways or pinned, wedged and threaded connections and eliminate the need for expensive machining.

Weitere Highlights

- Rapid, cost-saving assembly
- Rigid and secure fastening of machine parts
- Elastic seating for small rolling bearings (Series 0801)
- Compensation of different thermal expansion rates between machine parts made of different materials
- Special sizes on request
- Particularly inexpensive machine element
- Simple design of mating parts
- Resistant to a number of chemical substances
- Wide machining tolerances for parts to be joined
- High temperature resistance
- No need for keyways or other contour-locking joints

Please contact us for samples.

Series R0810 (AN)
The flat edges are at the outer diameter of the tolerance ring. For use with a standard nominal shaft.

Series R0820 (BN)
The flat edges are at the inner diameter of the tolerance ring. For use with a standard nominal bore.

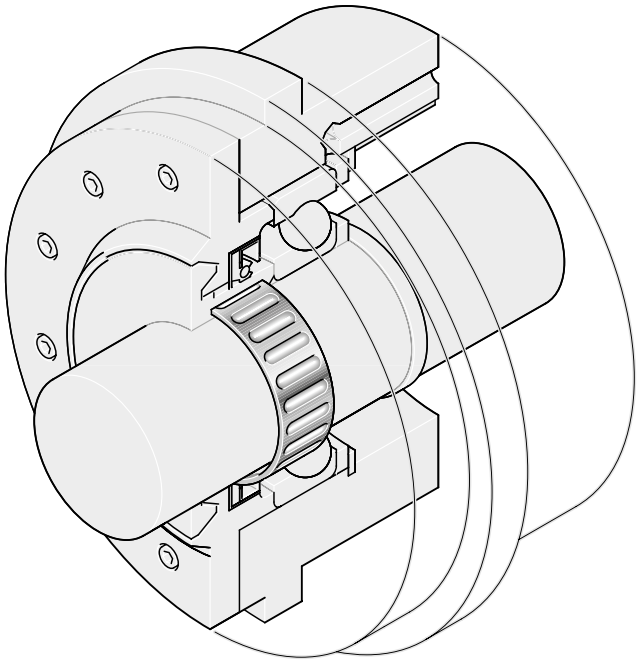
Series R0801 (ANL)
This curved type is specifically designed for mounting small bearings.

Series R0804 (ANS)
This type has a slanting edge and is used for mounting larger rolling bearings, especially in light metal housings.

Application Examples

Tolerance rings for fastening of machine parts without defined force transmission

In many applications there are no defined forces to be transmitted between the parts to be joined. What is generally required in such cases is a fixing device for such simple machine parts as handles, ball knobs, labyrinth rings or bushings.
When Rexroth tolerance rings are used to fasten ball knobs to connecting rods, for example, they eliminate the need for the usual thread on the rod and in the ball knob. Unlike threaded connections, joints made with Rexroth tolerance rings will never loosen.

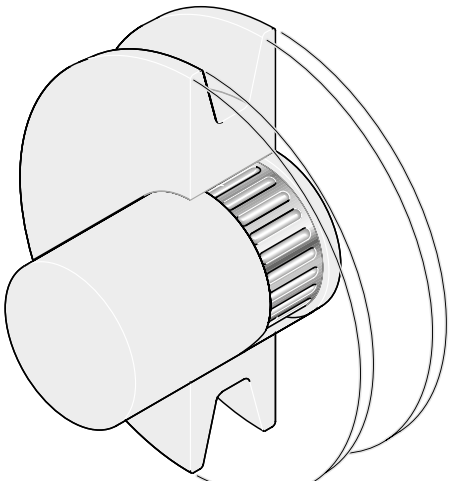


Fastening of a labyrinth ring on a shaft using a Rexroth tolerance ring

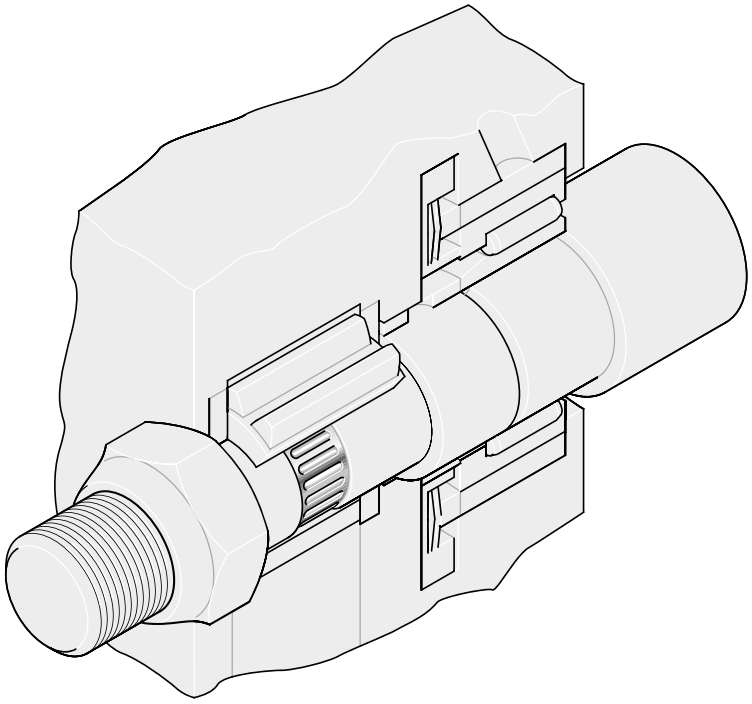
Tolerance rings for fastening of machine parts to transmit torque

The fastening of belt pulleys, flywheels or fan rotors involves transmission of defined axial or circumferential forces.

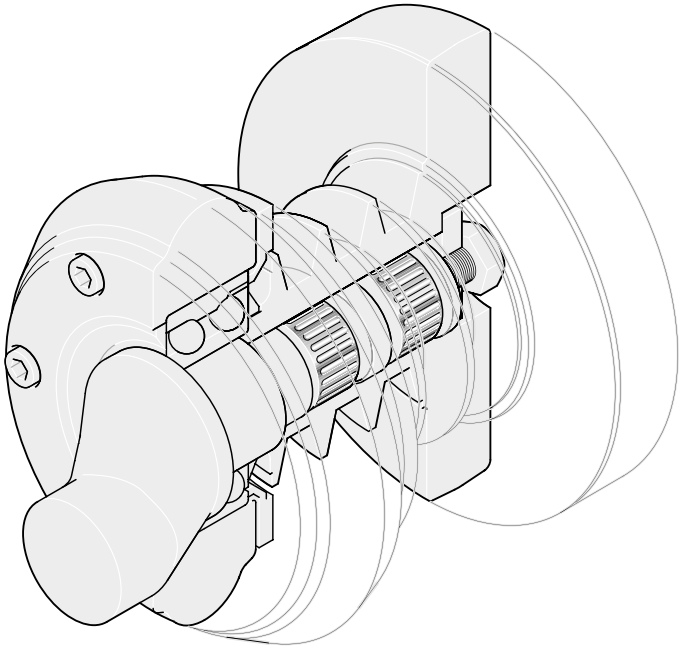
The assembly forces and transmittable torque depend very much on the design and finish of the parts to be joined and can differ greatly in practice from the values given in the tables.



Fastening of a V-belt pulley on a shaft (instead of a contour-locking joint with keyway).



Pinion fastening with Rexroth tolerance ring in turbomolecular pumps.



Tandem mounting of Rexroth tolerance rings in a mowing machine drive.

General

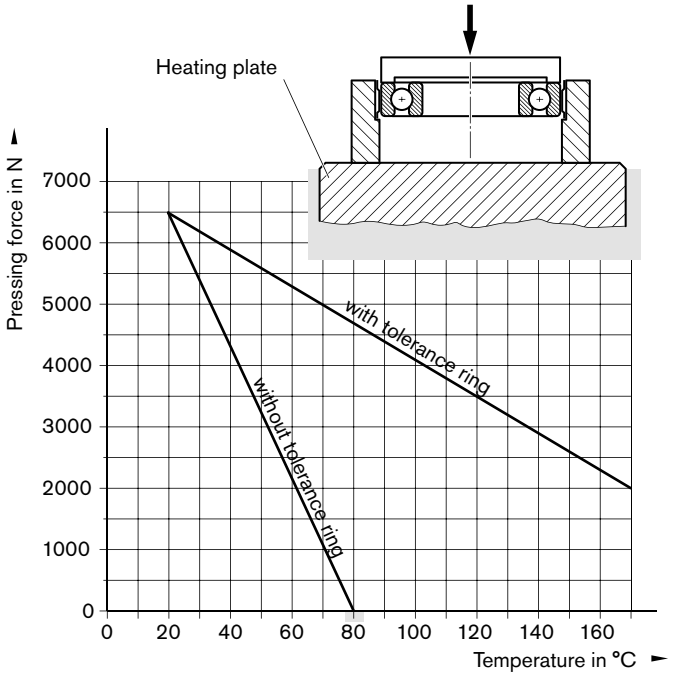
Materials

Top-quality spring steel strip made from
carbon steel or stainless steel (austenitic)

Temperature resistance

Tolerance rings made from carbon steel
up to 200°C continuous; brief peaks up to 250°C
(no deterioration of spring qualities).

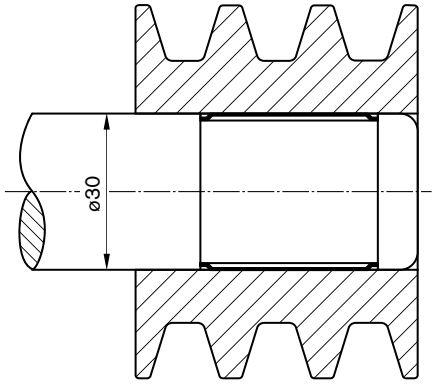
Tolerance rings made from stainless steel
up to 250°C continuous; brief peaks up to 300°C
(no deterioration of spring qualities).



The graph shows the mounting of rolling bearings of 200 mm diameter at a temperature of 20°C with and without a tolerance ring. In both cases the pressing force is initially 6500 N. As the temperature rises, the pressing force falls. For rolling bearings mounted without a tolerance ring, the pressing force falls to zero at a temperature of 80°C, whereas with a tolerance ring there is still a small pressure force of 2000 N at a temperature of 170°C.

Tolerance ring joints for transmission of torque

Very often, an axial or circumferential force of known magnitude is to be transmitted.
Examples include the mounting of pulleys, flywheels or fan rotors, to name but a few.



This figure shows a V-belt pulley fastened to a shaft by means of a tolerance ring 0820-030-08. The connection transfers a torque M of at least 88 Nm.
This corresponds to an
E-motor output of P = 4.3 kW
at a speed n = 1400min-1 and
a safety factor of S = 3 for the starting torque

Transmission of torque

Polar moment of inertia

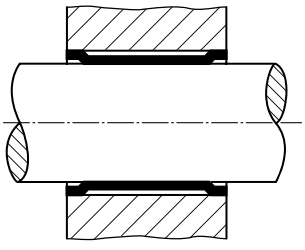
$$W_p = \frac{d^3 \cdot \pi}{16} \ [cm^3]$$

The figures below show tolerance ring joints in **free** and **centered arrangements** as compared with a **conventional contour-locking** connection for the same shaft diameters.

Conventional fastening methods necessitate the machining of keyways into the shafts and bores of the mating parts. These keyways weaken the shaft and thus reduce the polar moment of inertia W_p. This disadvantage does not apply when Rexroth tolerance rings are used.

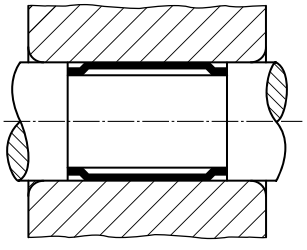
The polar moment of inertia W_p remains constant in the free arrangement and is reduced only very slightly in the centered arrangement.

Free arrangement, series R0810



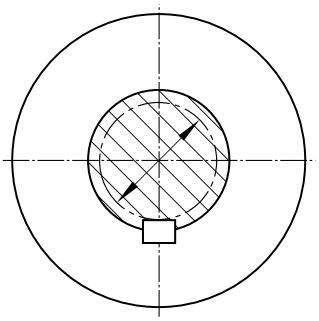
Shaft diameter = 30 mm
Polar moment of inertia W_p = 5.3 cm³

Centered arrangement, series R0820



Shaft diameter = 30 mm
Polar moment of inertia W_p = 4.3 cm³

Conventional connection



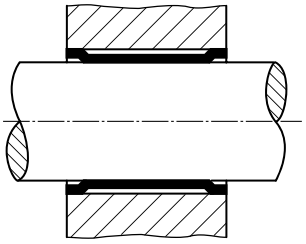
Shaft diameter = 30 mm
Polar moment of inertia W_p = 2.0 cm³

General

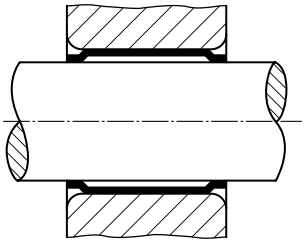
Design hints

Free arrangement
This arrangement is suitable for series R0810 and R0820 rings. It is extremely economical because the ring is simply placed between the straight, cylindrical surfaces of the bore and shaft. However, the assembly may be slightly off-center, and allowance must be made for a reduction of about 20% in the torques M given in the tables.

Free arrangement, series R0810

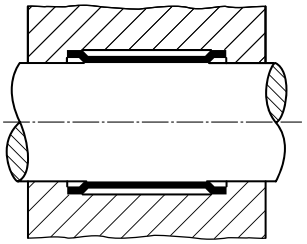


Free arrangement, series R0820

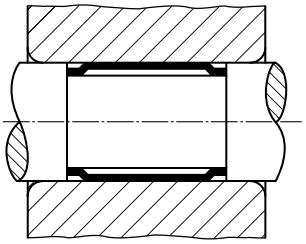


Centered arrangement
This arrangement is used when perfect concentricity is required or when circumferential or major radial impact loads are to be expected. Selection of the appropriate fit between shaft and bore keeps run-out within the required tolerance limits, at the same time providing shock absorption to protect the tolerance rings from damage.

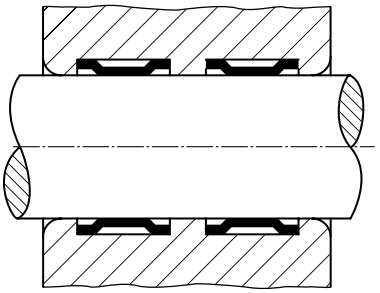
Centered arrangement, series R0810

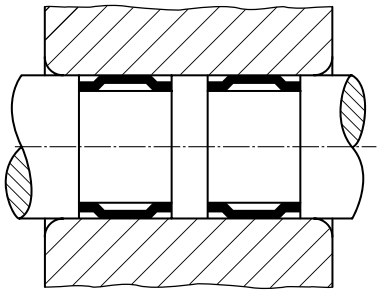


Centered arrangement, series R0820



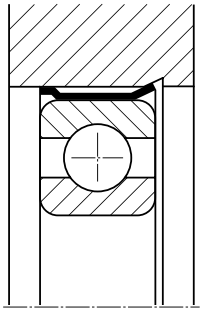
Tandem mounting of tolerance rings
If the load permissible on one tolerance ring is exceeded in a given application, it is possible to fit two or more tolerance rings end to end until the sum of their load ratings exceeds the load to be carried. However, it is important to ensure that the individual tolerance rings of the assembly are separated by webs to prevent adjacent tolerance rings from slipping over each other during mounting.





Note: The shaft tips should not be aligned.

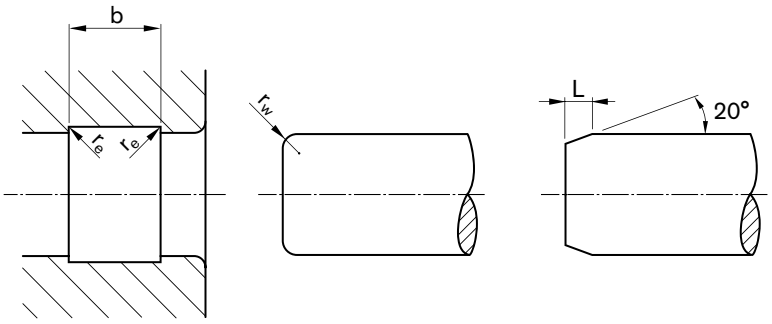
Tolerance rings with slanting edge
The slanting edge keeps the tolerance ring fixed in place. This version is mainly used to mount large rolling bearings in light metal housings.



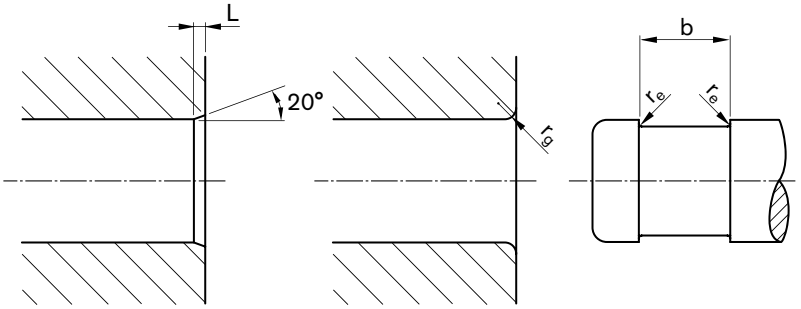
Design of mating parts

In order to ensure maximum effect and long life and to prevent damage to the tolerance rings, the following must be observed in the design of the mating parts:
When series R0810 tolerance rings are to be used, the leading edge of the shaft must be rounded to radius r_w;
series R0820 requires a radius r_g at the leading edge of the bore.
When the centered arrangement is to be used, the transition radii re at the walls of the retaining grooves in the bore and shaft should be as small as possible to ensure that the tolerance rings sit firmly against the walls of the grooves.
Retaining groove b requires a C13 fit.
Details concerning the correct radius and groove width tolerance limits are given in the tables.
If the radii indicated cannot be made, we recommend a chamfer of 20°.

Required radii, series R0810



Required radii, series R0820



Size of radii r_e, r_g and r_w

Dimensions (mm)		
Bore or shaft diameter (mm)	r_g, r_w	Chamfer 20° L
≤ 16	1,0	1,5
> 16 ≤ 48	1,25	2,0
> 48 ≤ 120	1,5 ≤ 2,0	2,5
> 120 ≤ 240	3,0 ≤ 4,0	3,5
> 240	4,0 ≤ 5,0	4,5
r_e ≤ to 0,2 r_g		

C13 tolerance limits for groove width b

Nominal dimension	C13 tolerance limit
mm	µm
≤ 10	+300
	+80
> 10 ≤ 18	+365
	+95
> 18 ≤ 30	+440
	+110
> 30 ≤ 40	+510
	+120
> 40 ≤ 50	+520
	+130
> 50 ≤ 65	+600
	+140
> 65 ≤ 80	+610
	+150

General

Shaft and bore tolerances

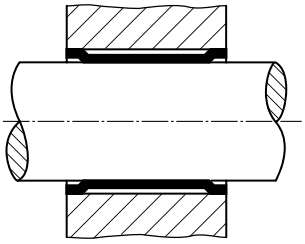
The tolerance limits chosen for shaft and bore diameters determine the fit between the two elements and thus the holding capacity of the tolerance ring assembly. See tolerance ring tables for dimensions.

Please note the following:

1. Shaft tolerances are permissible up to ISO h9, bore tolerances up to ISO H9, in exceptional cases up to ISO h11 resp. H11.
2. The tolerances quoted for the mounting of rolling bearings and for torque transfer refer to the combinations steel on steel or steel on many nonferrous metals. They apply to temperatures up to 100°C. Applications should be tested if they involve materials that differ considerably from steel in their strength properties.
3. The torque capacities given in the tables apply to the centered arrangement. If the free arrangement is used, a reduction of 20% must be allowed for.

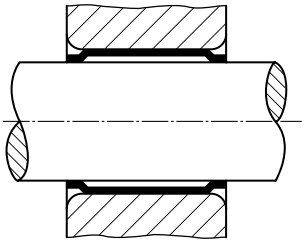
Free arrangement, series R0810

Standard shaft system



Free arrangement, series R0820

Standard bore system



Calculation

Guide values

With the aid of the formulas given below you can approximately calculate the values that determine the size of tolerance ring required for your application.
If you prefer, Rexroth can do this for you.
In this case, please use the form on page 30.

Known:

Output	P [kW] [1 HP = 0.736 kW]
Speed	n [min^{-1}]
Max. radial load	F [N]

Selected:

Safety factor S		
Guide values:	for fastening pulleys	2.5 - 3
	reversible motion	6

Torque calculation

$$M = \frac{9550 \cdot P}{n} \cdot S$$

M = torque [Nm]

Calculation of mounting force:[1)]

$$\frac{7 \cdot M\ (catalog)}{d}\ (N)$$

d = tolerance ring diameter in m

Calculation of axial seating capacity:[1)]

$$\frac{2 \cdot M\ (catalog)}{d}\ (N)$$

1) These values to be taken as guide values only.

Selection criteria

For radial and circumferential radial loads, choose the centered arrangement.

⚠ **The transferable torque capacities and radial loads indicated in the tables are standard values only. These values may be influenced by the strength, surface hardness, surface roughness and lubrication of mounting parts and can thus vary greatly.**

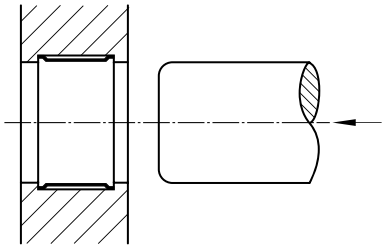
Mounting Instructions

Mounting

Always use a new tolerance ring when assembling parts!

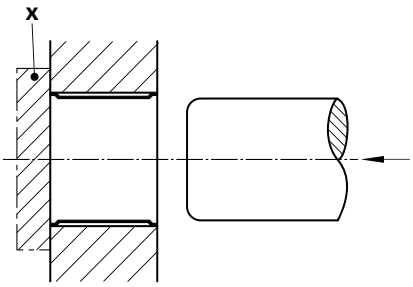
Centered arrangement, series R0810

The tolerance ring is placed in the housing, then the shaft pressed into the ring.



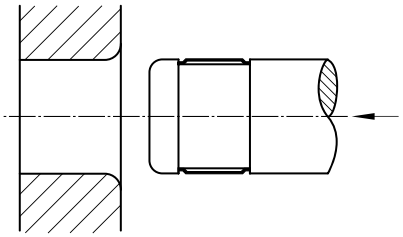
Free arrangement, series R0810

The tolerance ring is placed in the bore and a piece of flat stock (x) used to support it while the shaft is pressed into place.



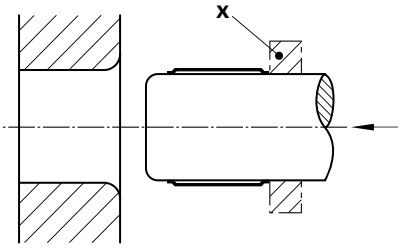
Centered arrangement, series R0820

The tolerance ring is first placed in the shaft groove, then the shaft with the ring in place is pressed into the bore.



Free arrangement, series R0820

The tolerance ring is placed around the straight shaft and a piece of flat stock (x) is used to brace the ring as the shaft is pressed into place.



Part Number / Ordering Example

Part number		R08 . .	. . .	. .
Series	10 = Series R0810 (AN 20 = Series R0820 (BN) 01 = Series R0801 (ANL) only available in stainless steel 04 = Series R0804 (ANS)			
Tolerance ring diameter (d)				
Code for tolerance ring width (b) / material	from 01 to 49 = carbon steel from 51 to 99 = carbon steel			

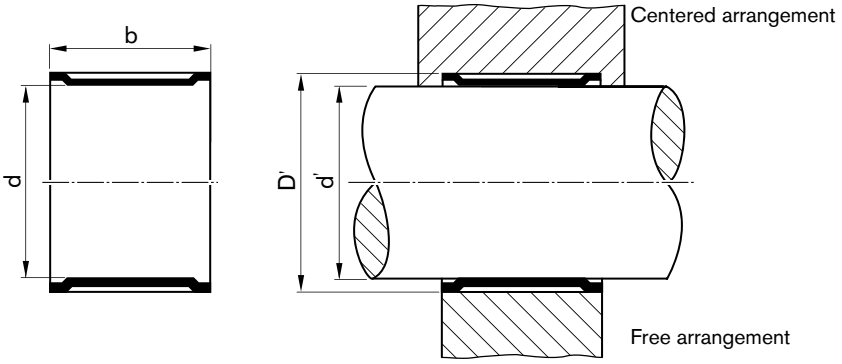
Ordering Example		R08810	010	54
Series	10 = Series R0810 (AN)			
Tolerance ring diameter (d)	d = 10			
Tolerance ring width (b) / material	b = 12 / stainless steel			

Please always use the nine-digit part number when ordering.
We have listed the part numbers in full in the following tables to make your choice easier.

For large quantities, many different special versions are available on request.

Dimensions

Tolerance ring series R0810 (AN)

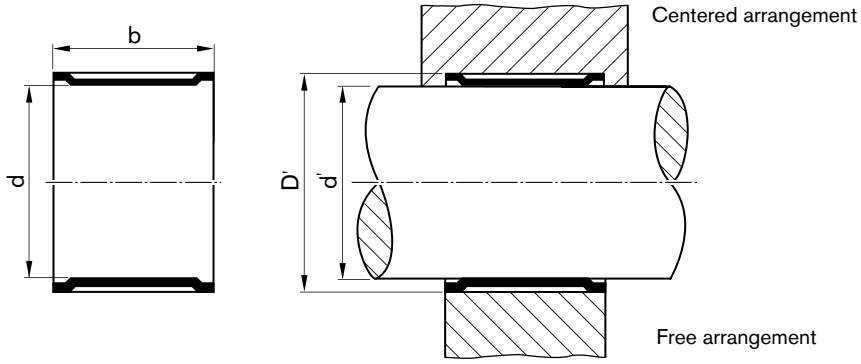


Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0810 006 51	AN 6 x 6		●	6	6	6	6,985 6,93	6,86 6,82	0,5	600	0,16
R0810 010 51	AN 10 x 4		●	10	4	10	11,48	11,30	1,0	1000	0,25
R0810 010 52	AN 10 x 6				6		11,41	11,23	2,0	1500	0,35
R0810 010 53	AN 10 x 10				10				3,0	2100	0,60
R0810 010 54	AN 10 x 12				12				3,5	2600	0,78
R0810 012 52	AN 12 x 6		●	12	6	12	13,48	13,30	2,0	1800	0,40
R0810 012 53	AN 12 x 10				10		13,41	13,23	3,5	2400	0,70
R0810 012 54	AN 12 x 12				12				4,2	2900	0,80
R0810 014 51	AN 14 x 8		●	14	8	14	15,48	15,30	5,5	2000	0,65
R0810 014 52	AN 14 x 12				12		15,41	15,23	7,5	3700	0,95
R0810 014 53	AN 14 x 14				14				8,0	4200	1,10
R0810 015 51	AN 15 x 8		●	15	8	15	16,48	16,30	6,5	2200	0,70
R0810 015 52	AN 15 x 12				12		16,41	16,23	8,5	4000	1,00
R0810 015 53	AN 15 x 14				14				10,0	4700	1,25
R0810 016 52	AN 16 x 8		●	16	8	16	17,48	17,30	7,0	2400	0,70
R0810 016 53	AN 16 x 10				10		17,41	17,23	8,0	2800	0,90
R0810 016 54	AN 16 x 12				12				9,5	3500	1,05
R0810 018 01	AN 18 x 6	●		18	6	18	19,98	19,75	6,0	1900	0,90
R0810 018 02	AN 18 x 10				10		19,89	19,67	11,0	4300	1,50
R0810 018 03	AN 18 x 16				16				17,0	8000	2,40

1) Please refer to the sections „General“ and „Calculation“.

2) Severely reduced in pulsating and alternating load applications. Please inquire.

3) For guide values, see „Calculation“ section, 20% lower in free arrangement.



Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0810 019 01	AN 19 x 6	●		19	6	19	20,98	20,75	7	1900	0,95
R0810 019 02	AN 19 x 10				10		20,89	20,67	13	4500	1,60
R0810 019 03	AN 19 x 16				16				21	8500	2,50
R0810 020 01	AN 20 x 12	●		20	12	20	21,98	21,75	18	6100	2,05
R0810 020 03	AN 20 x 16				16		21,89	21,67	24	8500	2,65
R0810 020 04	AN 20 x 20				20				30	12000	3,30
R0810 022 01	AN 22 x 7	●		22	7	22	23,98	23,75	16	3000	1,30
R0810 022 02	AN 22 x 10				10		23,89	23,67	17	5400	1,80
R0810 022 03	AN 22 x 16				16				28	9000	2,90
R0810 022 04	AN 22 x 20				20				35	11000	3,75
R0810 024 01	AN 24 x 16	●		24	16	24	25,98	25,75	32	11000	3,15
R0810 024 02	AN 24 x 20				20		25,89	25,67	45	15000	3,70
R0810 024 03	AN 24 x 7				7				18	3600	1,45
R0810 025 01	AN 25 x 10	●		25	10	25	26,98	26,75	24	6200	2,05
R0810 025 02	AN 25 x 16				16		26,89	26,67	35	12000	3,20
R0810 025 03	AN 25 x 20				20				47	15000	4,05
R0810 028 01	AN 28 x 10	●		28	10	28	29,98	29,75	30	7200	2,20
R0810 028 02	AN 28 x 12				12		29,89	29,67	36	10000	1,70
R0810 028 03	AN 28 x 20				20				57	17000	4,50
R0810 028 04	AN 28 x 30				30				86	26000	6,80
R0810 030 01	AN 30 x 12	●		30	12	30	31,98	31,75	45	10000	3,00
R0810 030 02	AN 30 x 16				16		31,89	31,67	51	14000	3,90
R0810 030 03	AN 30 x 30				30				97	27000	7,25

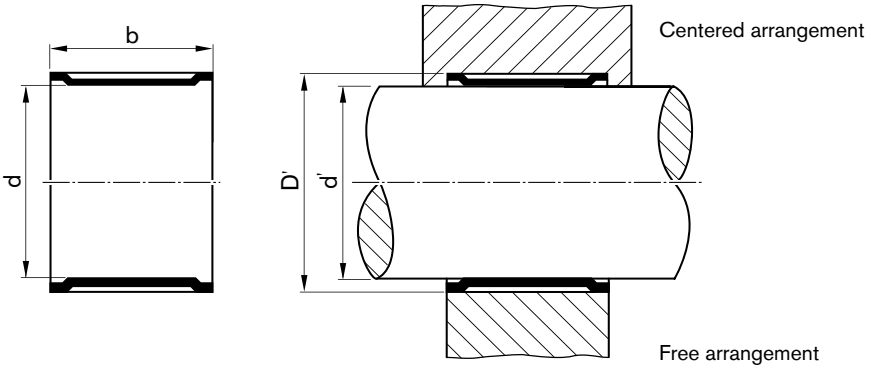
1) Please refer to the sections „General“ and „Calculation“.

2) Severely reduced in pulsating and alternating load applications. Please inquire.

3) For guide values, see „Calculation“ section, 20% lower in free arrangement.

Dimensions

Tolerance ring series R0810 (AN)

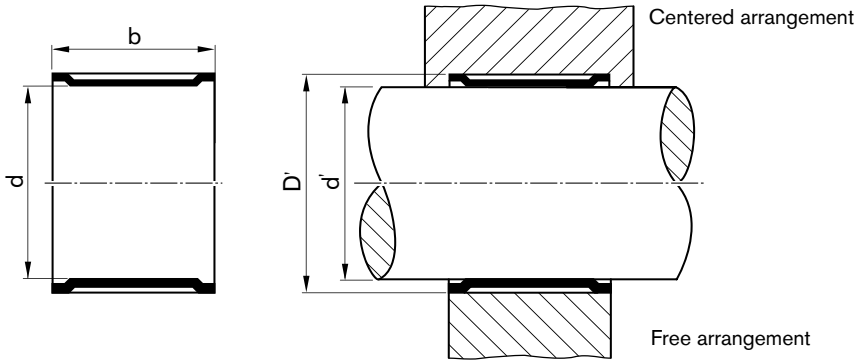


Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0810 032 01	AN 32 x 8	●		32	8	32	33,98	33,75	33	3000	3,00
R0810 032 02	AN 32 x 10				10		33,89	33,67	39	4300	3,45
R0810 032 03	AN 32 x 14				14				55	6800	4,80
R0810 035 01	AN 35 x 10	●		35	10	35	36,98	36,75	44	4800	3,75
R0810 035 02	AN 35 x 14				14		36,89	33,67	64	7500	5,25
R0810 040 01	AN 40 x 10	●		40	10	40	41,98	41,75	60	5400	4,25
R0810 040 02	AN 40 x 12				12		41,89	41,67	74	6900	5,10
R0810 040 03	AN 40 x 16				16				93	11000	6,80
R0810 040 04	AN 40 x 30				30				180	20000	12,85
R0810 045 01	AN 45 x 12	●		45	12	45	46,98	46,75	90	11000	55,75
R0810 045 02	AN 45 x 20				20		46,89	46,67	155	16000	9,55
R0810 047 01	AN 47 x 8	●		47	8	47	48,98	48,75	70	4500	4,00
R0810 047 02	AN 47 x 14				14		48,89	46,67	120	10000	7,00
R0810 047 04	AN 47 x 20				20				200	16000	9,95
R0810 047 05	AN 47 x 22				22				220	18000	10,95
R0810 050 01	AN 50 x 15	●		50	15	50	52,47	52,15	150	11000	10,20
R0810 050 02	AN 50 x 20				20		52,35	52,03	200	17000	13,30

1) Please refer to the sections „General“ and „Calculation“.

2) Severely reduced in pulsating and alternating load applications. Please inquire.

3) For guide values, see „Calculation“ section, 20% lower in free arrangement.

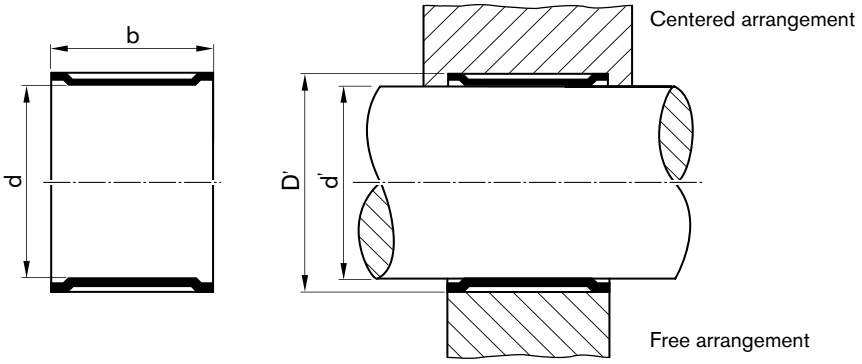


Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0810 052 01	AN 52 x 8	●		52	8	52	54,47	54,15	90	5000	5,50
R0810 052 02	AN 52 x 15				15		54,35	54,03	170	12000	10,40
R0810 052 03	AN 52 x 20				20				230	18000	13,80
R0810 055 01	AN 55 x 15	●		55	15	55	57,47	57,15	210	14000	11,20
R0810 055 02	AN 55 x 20				20		57,35	57,03	260	19000	14,60
R0810 060 01	AN 60 x 15	●		60	15	60	62,47	62,15	270	15000	12,20
R0810 060 02	AN 60 x 25				25		62,35	62,03	440	25000	19,90
R0810 062 01	AN 62 x 9	●		62	9	62	64,47	64,15	190	7100	7,45
R0810 062 02	AN 62 x 10				10		64,35	64,03	200	8200	8,20
R0810 062 03	AN 62 x 15				15				300	14000	12,60
R0810 062 04	AN 62 x 20				20				400	21000	16,40
R0810 065 01	AN 65 x 25	●		65	25	65	67,47	67,15	520	26000	21,50
R0810 065 03	AN 65 x 63				63		67,35	67,03	850	66000	54,20
R0810 070 01	AN 70 x 15	●		70	15	70	72,47	72,15	400	16000	13,85
R0810 070 02	AN 70 x 25				25		72,35	72,03	550	29000	23,10
R0810 070 03	AN 70 x 48				48				800	55000	45,50
R0810 072 01	AN 72 x 10	●		72	10	72	74,47	74,15	230	9500	9,50
R0810 072 02	AN 72 x 20				20		74,35	74,03	490	25000	19,00

1) Please refer to the sections „General“ and „Calculation“.
2) Severely reduced in pulsating and alternating load applications. Please inquire.
3) For guide values, see „Calculation“ section, 20% lower in free arrangement.

Dimensions

Tolerance ring series R0810 (AN)

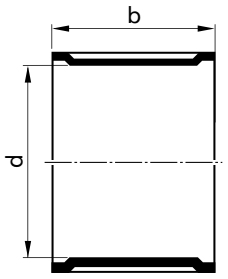


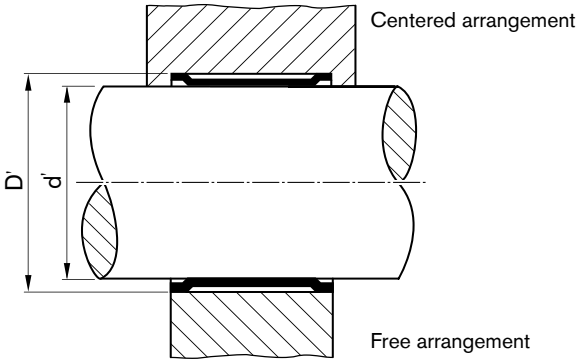
Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0810 075 01	AN 75 x 20	●		75	20	75	77,47	77,15	600	25000	20,10
R0810 075 02	AN 75 x 30				30		77,35	77,03	800	36000	29,70
R0810 080 01	AN 80 x 10	●		80	10	80	82,47	82,15	240	10000	10,60
R0810 080 02	AN 80 x 12				12		82,35	82,03	280	13000	12,65
R0810 080 03	AN 80 x 20				20				630	28000	21,20
R0810 080 04	AN 80 x 25				25				750	35000	26,35
R0810 080 05	AN 80 x 30				30				900	40000	31,60
R0810 090 01	AN 90 x 15	●		90	15	90	92,96	92,56	560	22000	21,40
R0810 090 02	AN 90 x 23				23		92,82	92,42	870	35000	32,80
R0810 090 03	AN 90 x 32				32				1250	50000	45,60
R0810 095 01	AN 95 x 19	●		95	19	95	97,96 97,82	97,56 97,42	960	30000	27,00
R0810 100 01	AN 100 x 15	●		100	15	100	102,96	102,56	950	25000	24,50
R0810 100 02	AN 100 x 19				19		102,82	102,42	1050	30000	30,50
R0810 100 03	AN 100 x 25				25				1300	43000	39,40
R0810 110 01	AN 110 x 15	●		110	15	110	112,96	112,56	1150	28000	26,00
R0810 110 02	AN 110 x 19				19		112,82	112,42	1350	35000	33,00
R0810 110 03	AN 110 x 28				28				1750	52000	48,50
R0810 120 01	AN 120 x 19	●		120	19	120	122,96 122,82	122,56 122,42	1300	36000	35,80

1) Please refer to the sections „General“ and „Calculation“.

2) Severely reduced in pulsating and alternating load applications. Please inquire.

3) For guide values, see „Calculation“ section, 20% lower in free arrangement.





Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0810 125 01	AN 125 x 22	●		125	22	125	128,96 128,80	128,48 128,32	1300	40000	50,80
R0810 140 01	AN 140 x 24	●		140	24	140	143,96 143,80	143,48 143,32	1800	51000	61,80
R0810 145 01	AN 145 x 24	●		145	24	145	148,96 148,80	148,48 148,32	1950	53000	64,00
R0810 150 02	AN 150 x 42	●		150	42	150	153,96 153,80	153,96 153,32	2800 3400	70000 92000	91,00 116,00
R0810 160 01	AN 160 x 24	●		160	24	160	163,96	163,48	2400	60000	70,50
R0810 160 04	AN 160 x 26				26		163,80	163,32	2550	64000	76,50
R0810 200 03	AN 200 x 31	●		200	31	200	204,95 204,77	204,40 204,22	4100	92000	130,00
R0810 210 01	AN 210 x 33	●		210	33	210	214,95 214,77	214,40 214,22	4900	99000	145,00

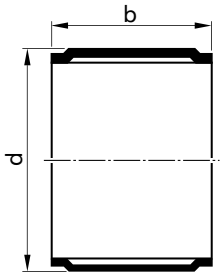
1) Please refer to the sections „General“ and „Calculation“.

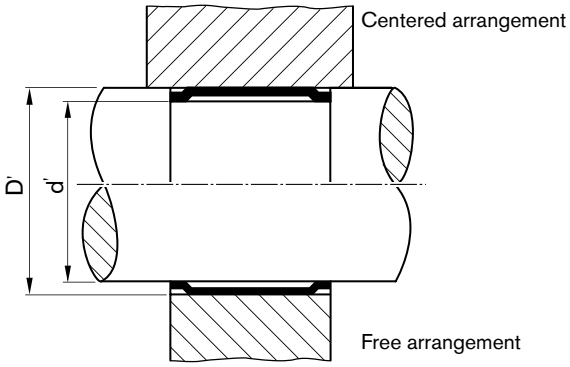
2) Severely reduced in pulsating and alternating load applications. Please inquire.

3) For guide values, see „Calculation“ section, 20% lower in free arrangement.

Dimensions

Tolerance ring series R0820 (BN)



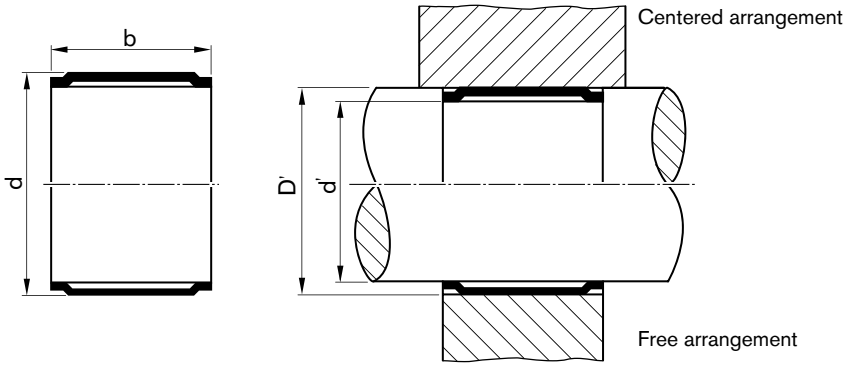


Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0820 005 51	BN 5 x 5		●	5	5	5	4,06	4,18	0,20	250	0,09
R0820 005 52	BN 5 x 6				6		4,01	4,14	0,25	300	0,13
R0820 005 53	BN 5 x 8				8				0,35	400	0,14
R0820 006 51	BN 6 x 6		●	6	6	6	5,06	5,18	0,40	400	0,15
R0820 006 52	BN 6 x 8				8		5,01	5,14	0,55	500	0,16
R0820 006 53	BN 6 x 10				10				0,70	700	0,26
R0820 008 51	BN 8 x 7		●	8	7	8	6,75	6,71	0,75	800	0,28
R0820 008 52	BN 8 x 8				8		6,51	6,65	0,90	1000	0,33
R0820 008 53	BN 8 x 10				10				1,30	1400	0,42
R0820 010 51	BN 10 x 10		●	10	10	10	8,57	8,71	3,0	1800	0,50
R0820 010 52	BN 10 x 12				12		8,51	8,65	3,6	2100	0,60
R0820 010 53	BN 10 x 14				14				4,2	2500	0,70
R0820 011 52	BN 11 x 10		●	11	10	11	9,57	9,71	3,5	2000	0,55
R0820 011 53	BN 11 x 14				14		9,51	9,65	5,0	2800	0,70
R0820 012 51	BN 12 x 6		●	12	6	12	10,59	10,77	2,0	900	0,40
R0820 012 52	BN 12 x 8				8		10,52	10,70	3,0	1600	0,50
R0820 012 53	BN 12 x 10				10				3,5	2300	0,60
R0820 012 54	BN 12 x 12				12				4,5	2900	0,70
R0820 012 55	BN 12 x 14				14				5,0	3600	0,85
R0820 012 56	BN 12 x 18				18				7,0	5000	1,10

1) Please refer to the sections „General“ and „Calculation“.

2) Severely reduced in pulsating and alternating load applications. Please inquire.

3) For guide values, see „Calculation“ section, 20% lower in free arrangement.



Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0820 014 52	BN 14 x 10		●	14	10	14	12,59	12,77	5	2500	0,75
R0820 014 53	BN 14 x 14				14		12,52	12,70	7	4100	1,00
R0820 014 54	BN 14 x 15				15				7,5	4500	1,20
R0820 014 55	BN 14 x 20				20				10	5000	1,65
R0820 015 51	BN 15 x 6		●	15	6	15	13,59	13,77	3,5	1100	0,50
R0820 015 52	BN 15 x 8				8		13,52	13,70	5	2000	0,60
R0820 015 53	BN 15 x 10				10				6	2800	0,75
R0820 015 54	BN 15 x 12				12				7	3500	0,90
R0820 015 55	BN 15 x 14				14				8	4300	1,05
R0820 016 51	BN 16 x 10		●	16	10	16	14,59	14,77	6,5	3100	0,80
R0820 016 53	BN 16 x 16				16		14,52	14,70	11	6000	1,30
R0820 017 51	BN 17 x 6		●	17	6	17	15,59	15,77	4,5	1300	0,60
R0820 017 52	BN 17 x 8				8		15,52	15,70	6	2300	0,70
R0820 017 53	BN 17 x 10				10				8	3200	0,85
R0820 017 54	BN 17 x 2				12				9	4100	1,05
R0820 017 55	BN 17 x 14				14				11	5100	1,20
R0820 018 51	BN 18 x 10		●	18	10	18	16,95	16,77	9	3400	0,90
R0820 018 53	BN 18 x 22				22		16,52	16,70	20	9500	2,00

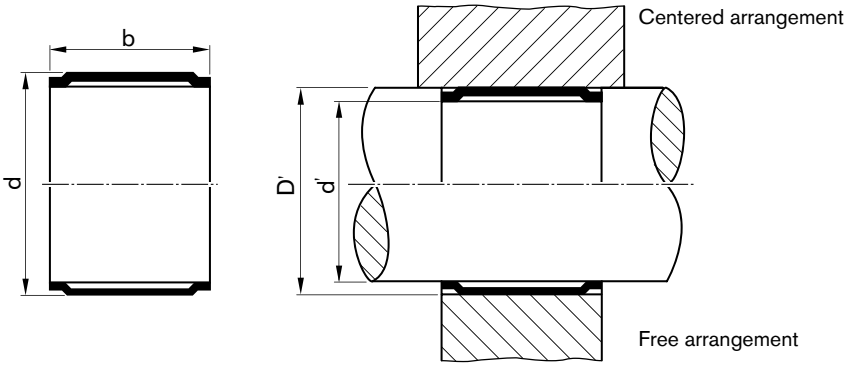
1) Please refer to the sections „General“ and „Calculation“.

2) Severely reduced in pulsating and alternating load applications. Please inquire.

3) For guide values, see „Calculation“ section, 20% lower in free arrangement.

Dimensions

Tolerance ring series R0820 (BN)

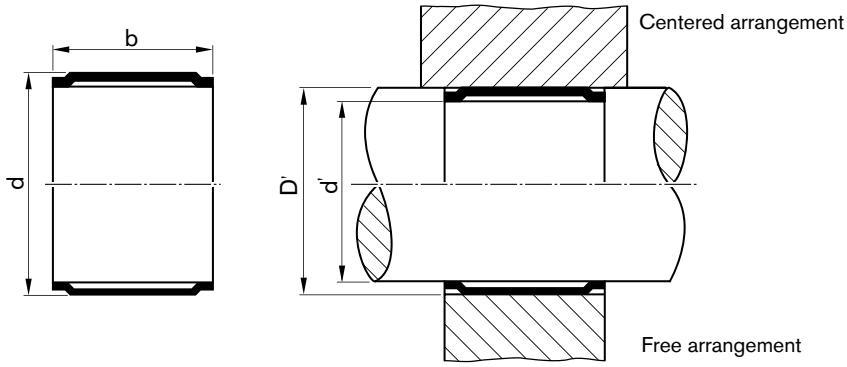


Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0820 019 51	BN 19 x 10		●	19	10	19	17,59	17,77	9,5	3000	0,95
R0820 019 52	BN 19 x 19				19		17,52	17,70	20	8500	1,80
R0820 019 53	BN 19 x 22				22				23	9900	2,10
R0820 020 01	BN 20 x 6	●		20	6	20	18,11	18,33	6,5	1900	0,90
R0820 020 02	BN 20 x 8				8		18,02	18,25	9	3200	1,20
R0820 020 03	BN 20 x 10				10				11	4500	1,50
R0820 020 04	BN 20 x 12				12				13	5800	1,70
R0820 020 06	BN 20 x 15				15				17	7900	2,25
R0820 020 08	BN 20 x 20				20				23	11000	3,00
R0820 020 09	BN 20 x 22				22				25	12500	3,25
R0820 022 01	BN 22 x 12	●		22	12	22	20,11	20,33	18	6000	2,00
R0820 022 02	BN 22 x 15				15		20,02	20,25	25	8000	2,40
R0820 022 03	BN 22 x 22				22				33	13000	3,60
R0820 024 01	BN 24 x 15	●		24	15	24	22,11 22,02	22,33 22,25	27	8400	2,35
R0820 025 01	BN 25 x 8	●		25	8	25	23,11	23,33	14	4000	1,50
R0820 025 02	BN 25 x 10				10		23,02	23,25	20	5700	2,00
R0820 025 03	BN 25 x 12				12				24	7200	2,25
R0820 025 04	BN 25 x 14				14				28	8900	2,62
R0820 025 05	BN 25 x 15				15				30	10000	2,80
R0820 025 06	BN 25 x 18				18				35	12000	3,40
R0820 025 07	BN 25 x 20				20				39	14000	3,75
R0820 025 08	BN 25 x 21				21				41	15000	3,95
R0820 025 09	BN 25 x 25				25				50	18000	4,70

1) Please refer to the sections „General“ and „Calculation“.

2) Severely reduced in pulsating and alternating load applications. Please inquire.

3) For guide values, see „Calculation“ section, 20% lower in free arrangement.



Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0820 028 01	BN 28 x 12	●		28	12	28	26,11	26,33	28	8000	2,25
R0820 028 02	BN 28 x 20				20		26,02	26,25	50	16000	4,20
R0820 028 04	BN 28 x 25				25				64	20000	5,10
R0820 030 01	BN 30 x 8	●		30	8	30	28,11	28,33	27	4900	1,85
R0820 030 02	BN 30 x 10				10		28,02	28,25	30	7000	2,30
R0820 030 03	BN 30 x 12				12				37	9000	2,80
R0820 030 04	BN 30 x 15				15				47	14000	2,85
R0820 030 06	BN 30 x 20				20				58	17000	4,35
R0820 030 08	BN 30 x 30				30				88	26000	6,80
R0820 032 01	BN 32 x 12	●		32	12	32	30,11	30,33	40	9200	2,90
R0820 032 02	BN 32 x 16				16		30,02	30,25	52	14000	3,90
R0820 032 03	BN 32 x 23				23				75	21000	5,50
R0820 032 04	BN 32 x 30				30				100	27000	7,17
R0820 035 01	BN 35 x 8	●		35	8	35	33,13	33,40	35	3200	2,85
R0820 035 02	BN 35 x 10				10		33,03	33,30	41	4500	3,20
R0820 035 03	BN 35 x 12				12				48	5800	3,35
R0820 035 04	BN 35 x 15				15				60	7900	3,92
R0820 035 05	BN 35 x 17				17				68	9200	6,00
R0820 035 06	BN 35 x 23				23				95	13000	8,10
R0820 035 07	BN 35 x 25				25				100	14000	8,80
R0820 035 08	BN 35 x 30				30				120	15500	10,60

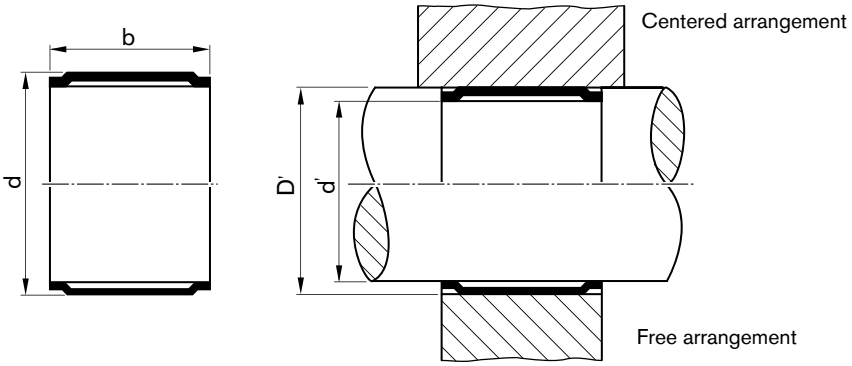
1) Please refer to the sections „General“ and „Calculation“.

2) Severely reduced in pulsating and alternating load applications. Please inquire.

3) For guide values, see „Calculation“ section, 20% lower in free arrangement.

Dimensions

Tolerance ring series R0820 (BN)

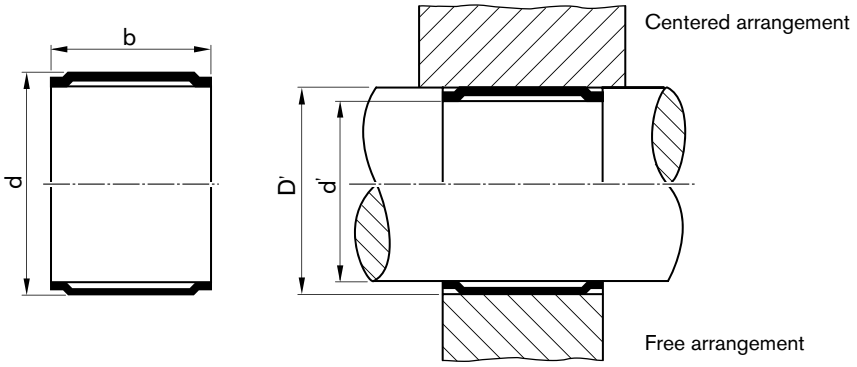


Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0820 040 01	BN 40 x 10	●		40	10	40	38,13	38,40	57	5200	4,25
R0820 040 02	BN 40 x 15				15		38,03	38,30	80	9000	5,50
R0820 040 03	BN 40 x 23				23				130	15000	9,30
R0820 040 04	BN 40 x 30				30				176	20000	12,15
R0820 040 06	BN 40 x 40				40				200	24000	16,20
R0820 045 01	BN 45 x 10	●		45	10	45	43,13	43,40	75	6500	5,00
R0820 045 02	BN 45 x 15				15		43,03	43,30	110	10000	6,85
R0820 045 03	BN 45 x 23				23				170	17000	10,50
R0820 045 04	BN 45 x 25				25				180	18000	11,40
R0820 045 05	BN 45 x 30				30				210	23000	13,70
R0820 050 02	BN 50 x 16	●		50	16	50	48,13	48,40	150	13000	8,15
R0820 050 03	BN 50 x 23				23		48,03	48,30	220	19000	11,70
R0820 050 06	BN 50 x 40				40				380	32000	20,35
R0820 055 01	BN 55 x 14	●		55	14	55	52,65	52,97	160	11000	10,00
R0820 055 02	BN 55 x 29				29		52,53	52,85	340	25000	20,20
R0820 060 01	BN 60 x 22	●		60	22	60	57,65	57,97	320	21000	16,80
R0820 060 02	BN 60 x 28				28		57,53	57,85	420	27000	21,35
R0820 075 01	BN 75 x 31	●		75	31	75	72,65	72,97	780	37000	29,65
R0820 075 02	BN 75 x 37				37		72,53	72,85	950	37000	35,40

1) Please refer to the sections „General“ and „Calculation“.

2) Severely reduced in pulsating and alternating load applications. Please inquire.

3) For guide values, see „Calculation“ section, 20% lower in free arrangement.



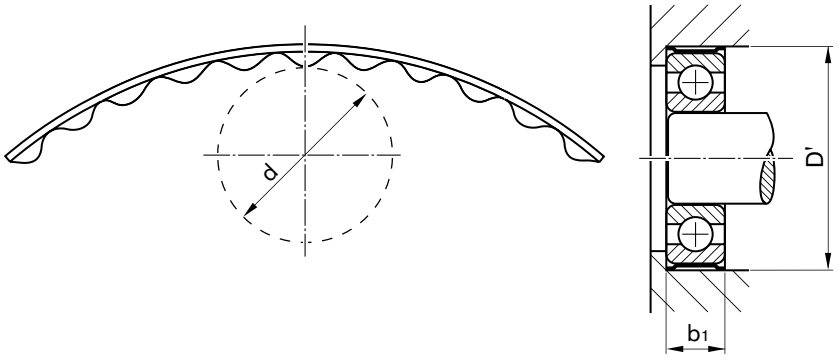
Part number		Carbon steel	Stainless steel	Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]		
						Shaft	Bore for mounting rolling bearings	Bore for torque transfer	Torque capacity[3]	Permissible radial load[2]	Weight kg/1000 pieces approx.
	old			d	b	d' h9	D'	D'	M Nm	F N	
R0820 080 01	BN 80 x 39	●		80	39	80	77,65 77,53	77,97 77,85	1120	51000	39,80
R0820 085 01	BN 85 x 22	●		85	22	85	82,18 82,04	82,58 82,44	800	31000	28,55
R0820 090 01	BN 90 x 24	●		90	24	90	87,18	87,58	850	37000	33,00
R0820 090 02	BN 90 x 30				30		87,04	87,44	1100	46000	41,20
R0820 120 01	BN 120 x 28	●		120	28	120	117,18 117,04	117,58 117,44	2300	56000	51,60
R0820 140 01	BN 140 x 22	●		140	22	140	136,20 136,04	136,68 136,52	1250	44000	58,50

1) Please refer to the sections „General“ and „Calculation“.
2) Severely reduced in pulsating and alternating load applications. Please inquire.
3) For guide values, see „Calculation“ section, 20% lower in free arrangement.

Dimensions

Tolerance ring series R0801 (ANL)

Available in stainless steel only

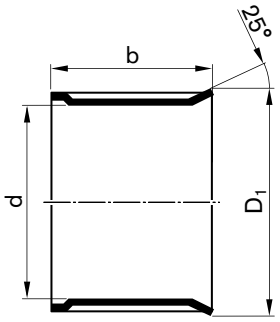


Part number		Tolerance ring dimensions (mm)		Shaft or bore diameter[1] (mm)			Load[1]	Weight kg/1000 pieces approx.
				Rolling bearing diameter	Bore	Working width	Permissible radial load[2]	
	old	d	b		D'	b_1^{C13}	F (N)	
R0801 013 51	ANL 13 x 5	13	5	13 ≙ 624 (EL 4)	13,65 13,60	5	125	0,20
R0801 016 51	ANL 16 x 5	16	5	13 ≙ 625 (EL 5)	16,65 16,60	5	150	0,21
R0801 019 51	ANL 19 x 6	19	6	19 ≙ 626 (EL 6) 604 (EL 7) 635 (R 5)	19,65 19,60	6	220	0,35
R0801 022 52	ANL 22 x 7	22	7	22 ≙ 608 (EL 8) 627 (R 7)	22,65 22,60	7	300	0,37
R0801 024 51	ANL 24 x 7	24	7	24 ≙ 609 (EL 9)	24,65 24,60	7	330	0,50
R0801 026 51	ANL 26 x 8	26	8	26 ≙ 629 (R 9) 6000	26,65 26,60	8	400	0,55
R0801 028 51	ANL 28 x 8	28	8	28 ≙ 6001	28,65 28,60	8	440	0,62
R0801 030 51	ANL 30 x 9	30	9	30 ≙ 6200	30,65 30,60	9	520	0,70
R0801 032 52	ANL 32 x 9	32	9	32 ≙ 6002	32,65 32,60	9	560	0,84
R0801 032 53	ANL 32 x 10	32	10	32 ≙ 6201	32,65 32,60	10	620	0,88
R0801 040 52	ANL 40 x 12	40	12	40 ≙ 6203	40,65 40,60	12	810	1,31

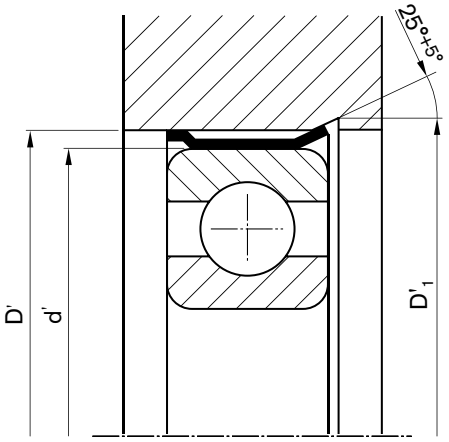
1) Please refer to the sections „General“ and „Calculation“.

2) Severely reduced in pulsating and alternating load applications. Please inquire.

Tolerance ring series R0804 (ANS)



$D'_{1\ min} = D_1 + 1$ (mm)



Part number		Carbon steel	Stainless steel	Tolerance ring dimension (mm)			Shaft or bore diameter[1] (mm)		Load	Weight
							Rolling bearing diameter	Bore	Permissible radial load[2]	kg/1000 pieces approx.
	old			d	b	D_1	d'	D´	F (N)	
R0804 090 01	ANS 90 x 18	●		90	18	94,1	90	92,96 92,82	2600	25,60
R0804 110 01	ANS 110 x 19	●		110	19	114,1	110	112,96 112,82	3500	34,70
R0804 140 01	ANS 140 x 24	●		140	24	145,3	140	143,96 143,80	5100	61,80
R0804 160 02	ANS 160 x 26	●		160	26	165,3	160	163,96 163,80	6500	87,50
R0804 180 01	ANS 180 x 28	●		180	28	185,3	180	183,96 183,80	7000	92,40
R0804 200 01	ANS 200 x 31	●		200	31	206,4	200	204,95 204,77	9000	132,00
R0804 225 01	ANS 225 x 31	●		225	31	231,6	225	229,95 229,77	10000	148,00

1) Please refer to the sections „General“ and „Calculation“.
2) Severely reduced in pulsating and alternating load applications. Please inquire.

Inquiry/Specification

Tolerance rings

Operating conditions:			
Corrosion due to moisture or other media		☐ yes	☐ no
		which	
Operating temperatures			
Continuous temperature	°C		
Peak temperature	°C	how long	hrs.
Drive output power	kW		
Drive speed	min^{-1}		
Reversing motion		☐ no	☐ yes
Torque level to be transmitted?	Nm		
Radial load	N		
Axial load	N	☐ no	☐ yes
Additional data for rolling bearing mounting			
Type of bearing			
What is to be fixed?		☐ inner race	☐ outer race
What moves?		☐ inner race	☐ outer race
Only low circumferential load possible with centered arrangement.			
Arrangement		☐ free	☐ centered

Mating parts:

				Dimensions (mm)		
	Material / strength	Surface	Heat treatment	Diameter / tolerance	Wall thickness	Possible TR width
Housing						
Shaft						

Additional information:

If you have a drawing (sketch) of your application, please attach it with this inquiry.

Quantities **Samples** _____ **pcs.** _____ **Serial production** _____ **Quantity** _____

Delivery date _____ **Delivery date** _____

From

Company: _____ **Name:** _____

Address: _____ **Department:** _____

_____ **Phone:** _____

_____ **Fax:** _____

The Drive & Control Company

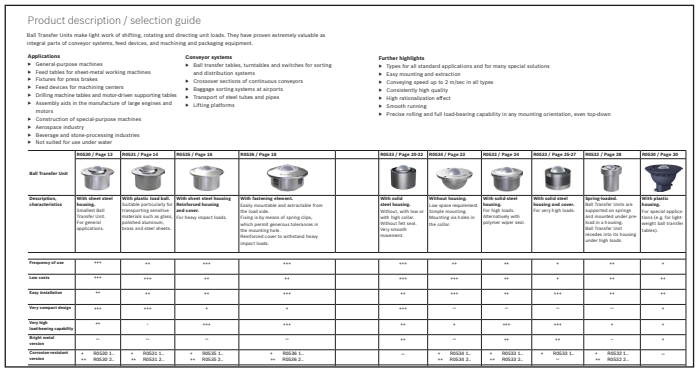
Rexroth
Bosch Group

Ball Transfer Units

Changes/amendments at a glance

- Notes on: Intended use, general safety instructions, directives and standards; page 4
- Revised product description with selection guide; page 6/7
- Revision of the technical data
- Installation suggestions, notes for mounting, installation examples added;
- New Ball Transfer Unit versions with the following types:
  R0530 131 10 and R0530 231 10 with bottom hole Ø 30
  R0530: Size 15 to 45 with bottom hole
  R0532 125 10: Helical spring with amended spring characteristic curve
  R0533 .61 10: with bottom hole and lube port;
  R0533: Size 76 and 90 galvanized; with bottom hole and lube port
  R0533 111 10: galvanized
  R0534 223 10: with bottom hole
  R0535 737 00: with 7 bottom holes, felt seal up to 150 °C
- New short product names; page 34

Product description with selection guide



Product description / selection guide

Ball Transfer Units make light work of shifting, rotating and directing unit loads. They have proven extremely valuable as integral parts of conveyor systems, feed devices, and machining and packaging equipment.

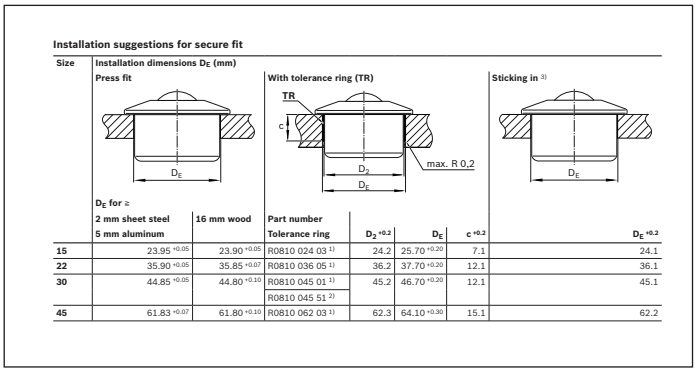
Applications
- General-purpose machines
- Feed tables for sheet-metal working machines
- Fixtures for press brakes
- Feed devices for machining centers
- Drilling machine tables and motor-driven supporting tables
- Assembly aids in the manufacture of large engines and motors
- Construction of special-purpose machines
- Aerospace industry
- Beverage and store-processing industries
- Not suited for use under water

Conveyor systems
- Ball transfer tables, turntables and switches for sorting and distribution systems
- Crossover sections of continuous conveyors
- Baggage sorting systems at airports
- Transport of steel tubes and pipes
- Lifting platforms

Further highlights
- Types for all standard applications and for many special solutions
- Easy mounting and extraction
- Conveying speed up to 2 m/sec in all types
- Consistently high quality
- High rationalization effect
- Smooth running
- Precise rolling and full load-bearing capability in any mounting orientation, even top-down

	R0530 / Page 12	R0531 / Page 14	R0535 / Page 16	R0536 / Page 18		R0532 / Page 20-22	R0534 / Page 22	R0533 / Page 24	R0533 / Page 26-27	R0532 / Page 28	R0535 / Page 30
Ball Transfer Unit											
Description, characteristics	**With sheet steel housing.** Smallest Ball Transfer Unit. For general applications.	**With plastic load ball.** Suitable particularly for transporting sensitive materials such as glass, polished aluminum, brass and steel sheets.	**With sheet steel housing Reinforced housing and cover.** For heavy impact loads.	**With fastening element.** Easily mountable and extractable from the load side. Fixing is by means of spring clips, which permit generous tolerances in the mounting hole. Reinforced cover to withstand heavy impact loads.		**With solid steel housing.** Without, with low or with high collar. Without felt seal. Very smooth movement.	**Without housing.** Low space requirement. Simple mounting. Mounting via holes in the collar.	**With solid steel housing.** For high loads. Alternatively with polymer wiper seal.	**With solid steel housing and cover.** For very high loads.	**Spring-loaded.** Ball Transfer Units are supported on springs and mounted under pre-load in a housing. Ball Transfer Unit recedes into its housing under high loads.	**With plastic housing.** For special applications (e.g. for light-weight ball transfer tables).
Frequency of use	***	**	***	***		***	**	**	*	**	*
Low costs	***	***	**	**		***	***	**	*	**	**
Easy installation	**	**	**	***		**	***	**	***	**	**
Very compact design	***	***	*	*		***	–	–	–	–	*
Very high load-bearing capability	**	-	***	***		**	*	***	***	*	*
Bright metal version	–	–	–	–		**	–	**	**	–	*
Corrosion-resistant version	* R0530 1.. ** R0530 2..	* R0531 1.. ** R0531 2..	* R0535 1.. ** R0535 2..	* R0536 1.. ** R0536 2..		–	* R0534 1.. ** R0534 2..	* R0533 1.. ** R0533 2..	* R0533 1.. –	* R0532 1.. ** R0532 2..	–

Installation suggestions



Installation suggestions for secure fit

Size	Installation dimensions D_E (mm) Press fit		With tolerance ring (TR)				Sticking in [3]
	D_E for ≥ 2 mm sheet steel 5 mm aluminum	16 mm wood	Part number Tolerance ring	D_2 +0.2	D_E	c +0.2	D_E +0.2
15	23.95 +0.05	23.90 +0.05	R0810 024 03 [1]	24.2	25.70 +0.20	7.1	24.1
22	35.90 +0.05	35.85 +0.07	R0810 036 05 [1]	36.2	37.70 +0.30	12.1	36.1
30	44.85 +0.05	44.80 +0.10	R0810 045 01 [1]	45.2	46.70 +0.20	12.1	45.1
			R0810 045 51 [2]				
45	61.83 +0.07	61.80 +0.10	R0810 062 03 [1]	62.3	64.10 +0.30	15.1	62.2

Notes for mounting

Assembling the Ball Transfer Units with tolerance rings

Installation examples

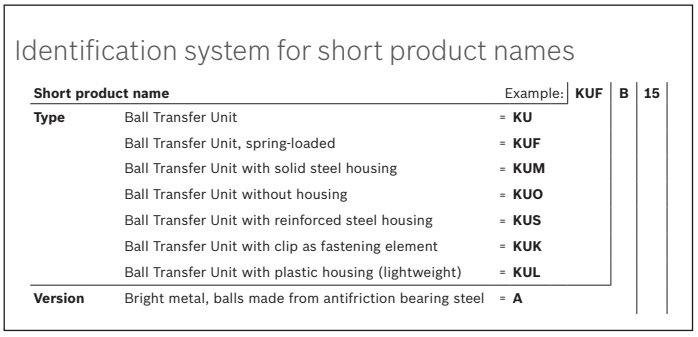
Ball Transfer Unit installation exa

with arrangement and determination of the Ball Transfer U

Scenario A
Arrangement as an equilateral triangle.

The square item to be transported (375 x 375 mm) has a central center of gravity and is supported by 5 Ball Transfer Units.
The distance of the Ball Transfer Units should not be larger than 150 mm (375 / 2.5 = 150 mm).
The mass[1] (3500 N) is distributed over three Ball Transfer Units and is 1166.7 N per Ball Transfer Unit (3500 N / 3 = 1166.7 N).
Selected Ball Transfer Unit, e.g.: R0530 122 10.

Short product names



Identification system for short product names

Short product name		Example:	**KUF**	**B**	**15**
Type	Ball Transfer Unit	=	**KU**		
	Ball Transfer Unit, spring-loaded	=	**KUF**		
	Ball Transfer Unit with solid steel housing	=	**KUM**		
	Ball Transfer Unit without housing	=	**KUO**		
	Ball Transfer Unit with reinforced steel housing	=	**KUS**		
	Ball Transfer Unit with clip as fastening element	=	**KUK**		
	Ball Transfer Unit with plastic housing (lightweight)	=	**KUL**		
Version	Bright metal, balls made from antifriction bearing steel	=	**A**		

Contents

Notes

Intended use

The product may be used in accordance with the technical documentation (product catalog) for the following purposes:

- For moving loads, in bottom installation (load ball to the top) or top installation (load ball to the bottom) or side installation.
- The type-specific load data from the relevant catalogs and the supplementary technical calculations provided by our company must be considered in all cases.
- The product is intended exclusively for professional use and not for private use.
- Use for the intended purpose also includes the requirement that you must have read and understood the product documentation completely, in particular these “Safety instructions”.

Misuse

Use of the product in any other way than as described under “Intended Use” is considered to be misuse and is therefore not permitted. If unsuitable products are installed or used in safety-relevant applications, this may lead to uncontrolled operating statuses in the application which can cause personal injury and/or damage to property.

The product may only be used in safety-relevant applications if this use has been expressly specified and permitted in the product documentation.

Bosch Rexroth AG will not accept any liability for injury or damage caused by misuse of the product. The risks associated with any misuse of the product shall be borne by the user alone.

Misuse of the product includes:

– the transport of persons

General safety instructions

- The safety rules and regulations of the country in which the product is used must be complied with.
- All current and applicable accident prevention and environmental regulations must be adhered to.
- The product may only be used when it is in technically perfect condition.
- The technical data and environmental conditions stated in the product documentation must be complied with.
- The product must not be put into service until it has been verified that the final product (for example a machine or system) into which the product has been installed complies with the country-specific requirements, safety regulations and standards for the application.
- Rexroth Ball Transfer Units may not be used in zones with potentially explosive atmospheres as defined in the ATEX directive 94/9/EC.
- Rexroth Ball Transfer Units must never be altered or modified.
- The product must never be disassembled.
- Special safety requirements for specific sectors (e.g. cranes, theaters, foodstuffs) as provided for in laws, directives and standards must be complied with.

Directives and standards:
Rexroth Ball Transfer Units are suitable for dynamic and static applications. All users must comply with a series of standards and guidelines. The standards can vary significantly worldwide. It is therefore essential to understand the legislation and standards that apply in each particular region.

EN ISO 12100

This standard is entitled Safety of machinery – General principles for design – Risk assessment and risk reduction. It gives a general overview and contains a guide to the major developments governing machines and their intended use.

Directive 2006/42/EC

The European Machinery Directive describes the basic safety and health requirements for the design and manufacture of machinery. The manufacturer of a machine or his authorized representative has a duty to ensure that a risk assessment has been performed in order to determine the health and safety requirements which have to be fulfilled for that machine. The machine must be designed and built with the results of the risk assessment in mind.

Directive 2001/95/EC

This directive covers general safety requirements for any product placed on the market and intended for consumers, or likely to be used by consumers under reasonably foreseeable conditions, including products that are made available to consumers in the context of service provision for use by them.

Directive 1999/34/EC

This directive concerns liability for defective products and applies to industrially manufactured movables, irrespective of whether they have been incorporated into another movable or into an immovable or not.

ORDINANCE (EC) no. 1907/2006 (REACH)

This regulation relates to restrictions on the marketing and use of certain dangerous substances and preparations. “Substances” means chemical elements and their compounds as they occur in the natural state or as produced by industry. “Preparations” are mixtures, compounds or solutions consisting of two or more substances.

Product description / selection guide

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Applications

- General-purpose machines
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	R0530 / Page 12	R0531 / Page 14	R0535 / Page 16	R0536 / Page 18	
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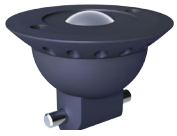
Frequency of use	+++	++	+++	+++	
Low costs	+++	+++	++	++	
Easy installation	++	++	++	+++	
Very compact design	+++	+++	+	+	
Very high load-bearing capability	++	-	+++	+++	
Bright metal version	--	--	--	--	
Corrosion-resistant version	+ R0530 1.. ++ R0530 2..	+ R0531 1.. ++ R0531 2..	+ R0535 1.. ++ R0535 2..	+ R0536 1.. ++ R0536 2..	
Stainless version	+++ R0530 6..	+++ R0531 6..	--	--	
Suitable for coarse dirt	+	-	+	+	
Designed for vacuum[1)2)]	+	+	+	+	

[1)] In "dry version" only (all part oil- and grease-free), without felt seal (R053x xxx 60)
[2)] In "dry version" only (all part oil- and grease-free), with felt seal (R053x xxx 90)

+++ Very good
++ Good
+ Fair
- Adequate, not recommended
-- Version not available

Further highlights

- Types for all standard applications and for many special solutions
- Easy mounting and extraction
- Conveying speed up to 2 m/sec in all types
- Consistently high quality
- High rationalization effect
- Smooth running
- Precise rolling and full load-bearing capability in any mounting orientation, even top-down

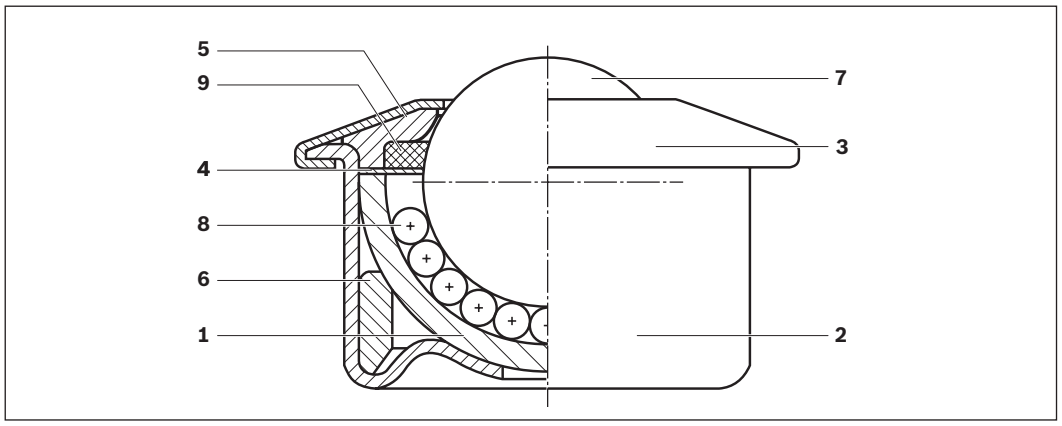
	R0533 / Page 20-22	**R0534 / Page 23**	**R0533 / Page 24**	**R0533 / Page 25-27**	**R0532 / Page 28**	**R0530 / Page 30**
						
	With solid steel housing. Without, with low or with high collar. Without felt seal. Very smooth movement.	**Without housing.** Low space requirement. Simple mounting. Mounting via holes in the collar.	**With solid steel housing.** For high loads. Alternatively with polymer wiper seal.	**With solid steel housing and cover.** For very high loads.	**Spring-loaded.** Ball Transfer Units are supported on springs and mounted under pre-load in a housing. Ball Transfer Unit recedes into its housing under high loads.	**With plastic housing.** For special applications (e.g. for light-weight ball transfer tables).
	+++	++	++	+	++	+
	+++	+++	++	+	++	++
	++	+++	++	+++	++	++
	+++	--	--	--	--	+
	++	+	+++	+++	+	+
	++	--	++	++	--	+
	--	+ R0534 1.. ++ R0534 2..	+ R0533 1.. ++ R0533 2..	+ R0533 1.. --	+ R0532 1.. ++ R0532 2..	--
	--	--	--	--	--	--
	+	+	+ R0533 .6. +++ R0533 .05	+++	+	+
	+++	+	-	-	-	-

Technical data

Structural design of the Ball Transfer Units

A hardened ball cup serves as a raceway for a multitude of small supporting balls.
The supporting balls roll against the ball cup when the load ball turns.
Rexroth Ball Transfer Units are designed so that precise rolling and full load-bearing capability are ensured in any mounting orientation. Ball Transfer Units require little maintenance, and almost every type is protected against dirt by an oil-soaked felt seal.

1 Ball cup
2 Housing
3 Cover
4 Ball retaining ring
5 Supporting ring
6 Reinforcing ring
7 Load ball
8 Supporting balls
9 Felt seal



Corrosion protection

Corrosion, caused by moisture or chemical attack, can lead to impaired functioning or even failure of the Ball Transfer Units. Coated (galvanized + chromated) surfaces similar to DIN 50979 specifications and/or higher-grade materials offer enhanced corrosion protection.

Cover and housing galvanized, R053. 1..

Offer simple protection against corrosion. In this type, the supporting balls and load balls are made from standard antifriction bearing steel and are protected from corrosive attack by the lubricant.

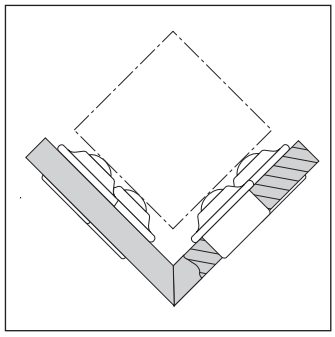
All parts galvanized, balls made from corrosion-resistant steel, R053. 2..

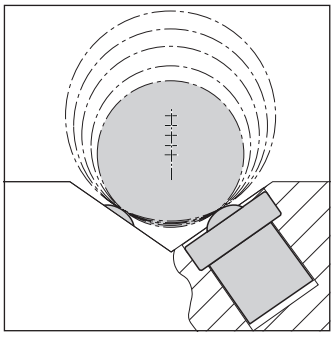
Consistent coating of all internals and the use of corrosion-resistant steels for the antifriction bearing elements, similar to ISO 683-17 specifications, ensures comprehensive corrosion protection such as specified in ASTM B117-03.

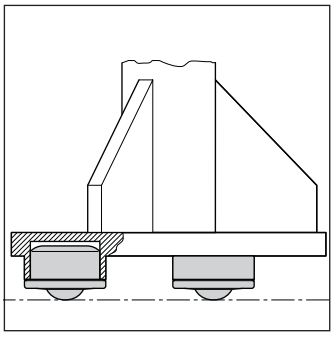
Complete version made from corrosion-resistant steel (in accordance with EN 10 088), R053. 6..

This version should be used for abrasive conveyed articles and/or where there is exposure to aggressive ambient conditions, especially to chemicals.

Mounting possibilities

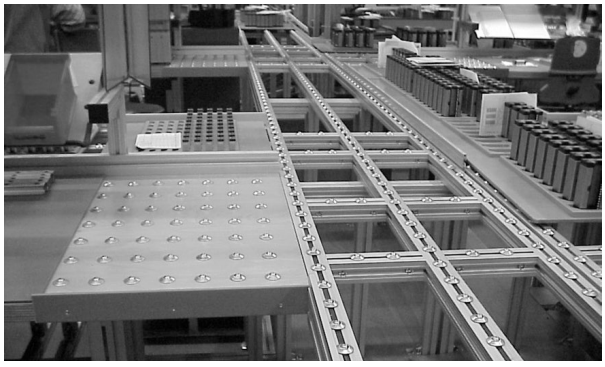


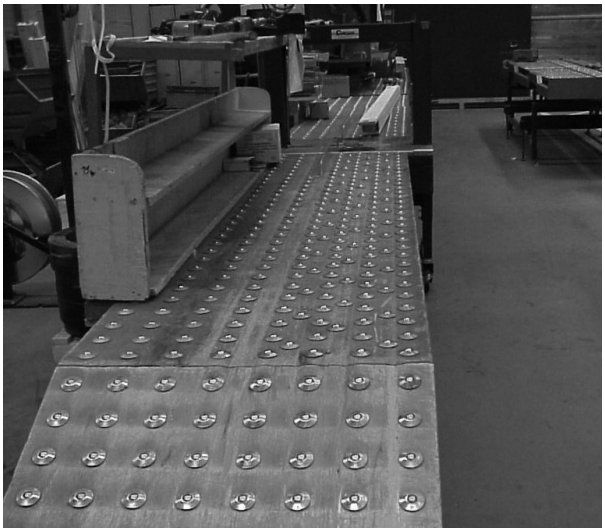




Application examples

- **E.g. Ball Transfer Units used for assembling ball runner blocks, assembly lines, packaging workstations.**





Technical data

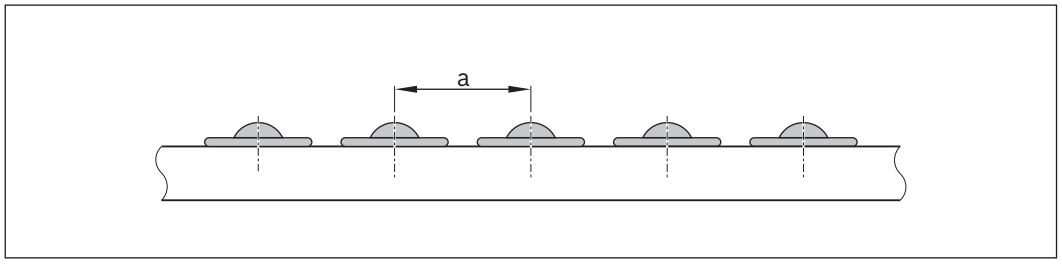
Arrangement of the Ball Transfer Units

How the Ball Transfer Units should be arranged depends on the undersurface of the conveyed article. For articles with a uniform, smooth undersurface, such as boxes and cases, the distance between the Ball Transfer Units is calculated simply by dividing the smallest edge length by 2.5.

Example:

Undersurface of the conveyed article = 500 x 1000 mm

Distance between Ball Transfer Units $a = \frac{500\ mm}{2.5} = 200\ mm$



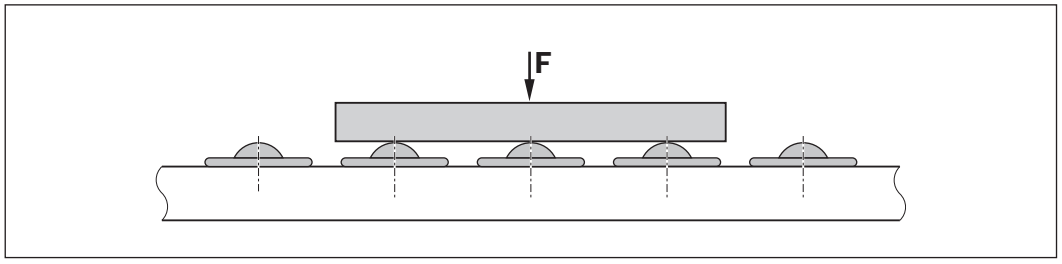
Determining the load for Ball Transfer Units

To determine the load for a Ball Transfer Unit, the weight of the conveyed article is divided by 3. If the load ball height tolerances are well-correlated, it is possible, depending on the nature of the conveyed article, to also perform the calculation based on the number of load-bearing Ball Transfer Units.

Example:

Mass = 3000 N

Ball Transfer Unit load $F = \frac{3000\ N}{3} = 1000\ N$



Please refer to page 32 for installation examples

Spring-loaded Ball Transfer Units

The figures in the column headed "Preload" are most important when choosing the size for these types. The weight of the conveyed article is divided in this case by the number of load-bearing Ball Transfer Units.

Conveying speed

V_{max} = 2m/s

Load capacity

The stated load capacities apply to all mounting orientations and relate to 10^6 rotations of the load ball.
In case of prolonged periods of use at speeds above 1 m/sec, an increase in temperature and reduction in service life must be expected as a function of the load, especially for sizes 60 to 120.

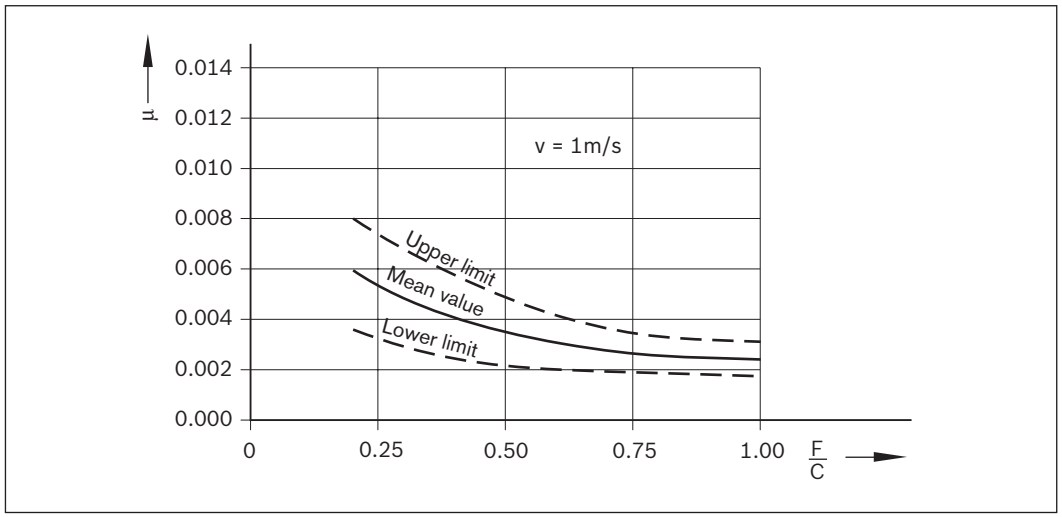
Calculation of the service life

$$L = \left(\frac{C}{F} \cdot f_t\right)^3 \cdot 10^6$$

L	= service life	(rotations)
C	= dynamic load capacity	(N)
C_0	= static load capacity	(N)
F	= load	(N)
f_t	= temperature factor	(–)

Friction coefficients

The diagram shows the friction coefficients of Ball Transfer Units as a function of load and speed. These guideline values apply to any mounting orientation for rolling contact on a hardened steel plate.



Operating temperature

Ball Transfer Unit with steel load ball

–30 °C to 100 °C.
At temperatures above 100 °C, only bright metal load balls without a felt seal should be used. Make allowance for reduction in load capacity. Use high-temperature lubricant! Follow the manufacturer's instructions! The existing lubricant oil may have to be washed out.

Ball Transfer Unit with plastic load ball

Up to 30 °C.
At temperatures above 30 °C, make allowance for reduction in load capacity.

Temperature factor

Steel load ball	
Temperature (°C)	**Temperature factor f_t**
125	0.9
150	0.8
175	0.7
200	0.5

Plastic load ball	
Temperature (°C)	**Temperature factor f_t**
40	0.9
50	0.8
60	0.7
80	0.5

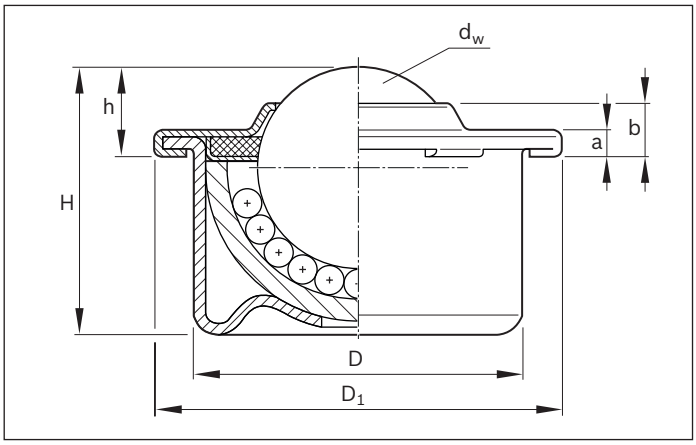
The load capacity must be multiplied by the temperature factor.

Lubrication

The lubrication must be adapted to the conveyed articles and to the ambient conditions. The lubricant (oil) can be introduced via the load ball.
For example:

- Morlina S2 B 100 from Shell
- Renolin DTA 100 from Fuchs
- Acer 100 from Agip

Ball Transfer Units with sheet steel housing R0530 1.., R0530 2.., R0530 6..



Version With sheet steel housing. Smallest Ball Transfer Unit. For general applications.	Size	Part number	Load capacities (N)		Dimensions (mm)							Weight (kg)
			dyn. C	stat. C_0	d_w	D	D_1	h	H	a	b	m
R0530 1.. **KU-B.. - MFG** **Cover and housing galvanized.** **Balls made from antifriction bearing steel 1.3505.** **With felt seal**	**8**	R0530 108 10 [1]	130	250	7.938	12.6 ±0.055	17.0	4.8 ±0.15	11.2	1.9	3.2	0.007
	12	R0530 112 10 [1]	250	500	12.000	18.0 ±0.055	23.3	7.4 ±0.15	15.4	2.1	4.4	0.018
	15	R0530 115 10 [1]	500	1 000	15.875	24.0 ±0.065	31.0	9.5 ±0.20	21.5	2.5	6.1	0.038
		R0530 116 10 [1] [2]										
	22	R0530 122 10	1 300	2 500	22.225	36.0 ±0.080	45.0	9.8 ±0.20	29.5	2.9	5.7	0.132
		R0530 123 10 [2]										
	30	R0530 130 10	2 500	5 000	30.162	45.0 ±0.080	55.0	13.8 ±0.30	37.5	3.7	7.9	0.265
		R0530 131 10 [2]										
	45	R0530 145 10	6 000	12 000	44.450	62.0 ±0.095	75.0	19.0 ±0.40	53.7	4.2	10.5	0.720
		R0530 146 10 [2]										
R0530 2.. **KU-C.. - MFG** **All parts galvanized.** **Balls made from corrosion-resistant steel 1.3541 / 1.4034** **With felt seal**	**8**	R0530 208 10 [1]	100	200	7.938	12.6 ±0.055	17.0	4.8 ±0.15	11.2	1.9	3.2	0.007
	12	R0530 212 10 [1]	180	350	12.000	18.0 ±0.055	23.3	7.4 ±0.15	15.4	2.1	4.4	0.018
	15	R0530 215 10 [1]	370	700	15.875	24.0 ±0.065	31.0	9.5 ±0.20	21.5	2.5	6.1	0.038
		R0530 216 10 [1] [2]										
	22	R0530 222 10	970	1 800	22.225	36.0 ±0.080	45.0	9.8 ±0.20	29.5	2.9	5.7	0.132
		R0530 223 10 [2]										
	30	R0530 230 10	1 900	3 000	30.162	45.0 ±0.080	55.0	13.8 ±0.30	37.5	3.7	7.9	0.265
		R0530 231 10 [2]										
	45	R0530 245 10	4 500	7 000	44.450	62.0 ±0.095	75.0	19.0 ±0.40	53.7	4.2	10.5	0.720
		R0530 246 10 [2]										
R0530 6.. **KU-N.. - MFG** **All parts made from corrosion-resistant steel.** **Balls made from 1.3541 / 1.4034.** **With felt seal**	**8**	R0530 608 00 [1]	100	200	7.938	12.6 ±0.055	17.0	4.8 ±0.15	11.2	1.9	3.2	0.007
	12	R0530 612 00 [1]	180	350	12.000	18.0 ±0.055	23.3	7.4 ±0.15	15.4	2.1	4.4	0.018
	15	R0530 615 00 [1] [3]	370	700	15.875	24.0 ±0.065	31.0	9.5 ±0.20	21.5	2.5	6.1	0.038
	22	R0530 622 00 [3]	970	1 800	22.225	36.0 ±0.080	45.0	9.8 ±0.20	29.5	2.9	5.7	0.132
	30	R0530 630 00 [3]	1 900	3 000	30.162	45. ±0.80	55.0	13.8 ±0.30	37.5	3.7	7.9	0.265

[1] Without felt seal

[2] Ball Transfer Units with bottom hole

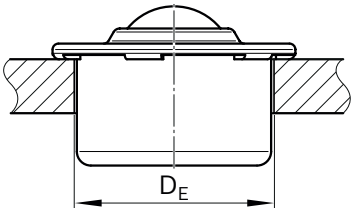
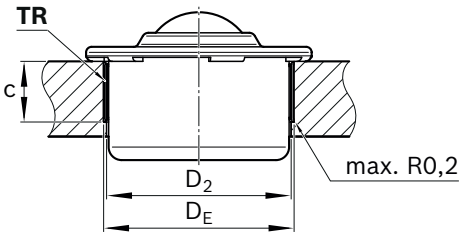
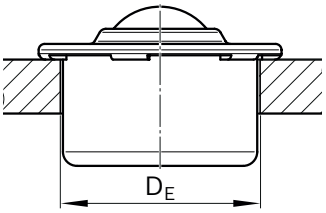
[3] Ball Transfer Unit with bottom hole on request

Explanation of short product name

(Example: R0530 130 10 KU-B30-MFG)

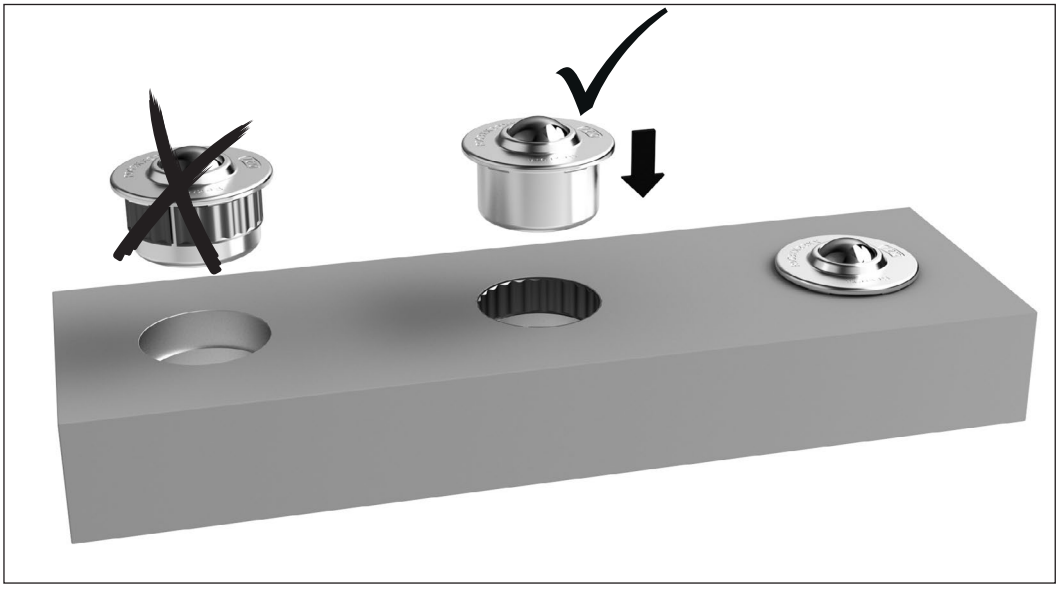
KU	B	30	MFG
Ball Transfer Unit	Cover and housing galvanized, balls made from antifriction bearing steel	Size	With felt seal, oiled

Installation suggestions for secure fit

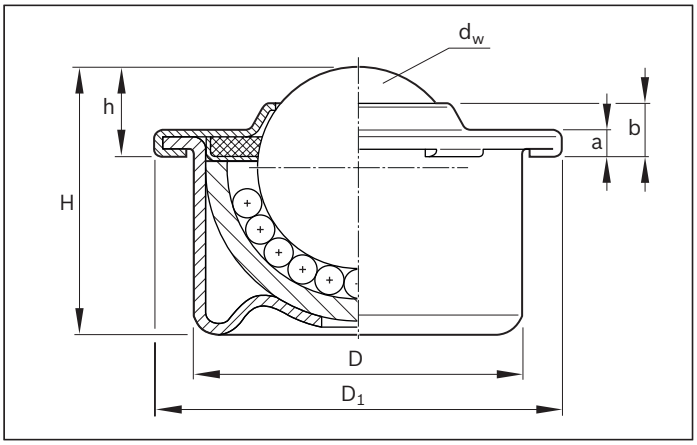
Size	Installation dimensions D_E (mm)						
	Press fit		with tolerance ring (TR)				Sticking in [3]
							
	D_E		Part numbers				
	2 mm sheet steel 5 mm aluminum	16 mm wood	Tolerance ring	D_2 +0.2	D_E	c +0.2	D_E +0.2
8	12.57 +0.03	12.50 +0.05	R0810 012 52 [2]	12.8	13.87 +0.15	6.1	12.7
12	17.97 +0.03	17.90 +0.05	R0810 018 01 [1]	18.2	19.70 +0.20	6.1	18.1
15	23.95 +0.05	23.90 +0.05	R0810 024 03 [1]	24.2	25.70 +0.20	7.1	24.1
22	35.90 +0.05	35.85 +0.07	R0810 036 05 [1]	36.2	37.70 +0.20	12.1	36.1
30	44.85 +0.05	44.80 +0.10	R0810 045 01 [1]	45.2	46.70 +0.20	12.1	45.1
			R0810 045 51 [2]				
45	61.83 +0.07	61.80 +0.10	R0810 062 03 [1]	62.3	64.10 +0.30	15.1	62.2

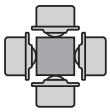
[1] Made from spring hinge 1.1248 alternative 1.8159
[2] Made from corrosion-resistant steel 1.4310
[3] For small gap dimensions in metal, we recommend single-component acrylate adhesive. Two-component acrylate adhesives are also possible. The technical data sheets of the manufacturer must be observed.

Assembling the Ball Transfer Units with tolerance ring



Ball Transfer Units with plastic load balls R0531 1.., R0531 2.., R0531 6..



Version With plastic load ball. Suitable particularly for transporting sensitive materials such as glass, polished aluminum, brass and steel sheets.	Size	Part number	Load capacities [3] (N) 		Dimensions (mm)							Weight (kg)
			dyn. C	stat. C_0	d_w	D	D_1	h	H	a	b	m
R531 1.. **KU-B.. - P- MFK** **Load balls made from PA66.** **Cover and housing galvanized.** **Balls made from antifriction bearing steel 1.3505.** **With dry felt seal.**	**8**	R0531 108 10 [1]	10	10	7.938	12.6 $^{\pm 0.055}$	17.0	4.8 $^{\pm 0.15}$	11.2	1.9	3.2	0.005
	12	R0531 112 10 [1]	35	35	12.000	18.0 $^{\pm 0.055}$	23.3	7.4 $^{\pm 0.15}$	15.4	2.1	4.4	0.012
	15	R0531 115 10 [1] [2]	70	70	15.875	24.0 $^{\pm 0.065}$	31.0	9.5 $^{\pm 0.20}$	21.5	2.5	6.1	0.024
	22	R0531 122 10 [2]	100	100	22.000	36.0 $^{\pm 0.080}$	45.0	9.6 $^{\pm 0.20}$	29.3	2.9	5.7	0.093
	30	R0531 130 10 [2]	150	150	29.900	45.0 $^{\pm 0.080}$	55.0	13.6 $^{\pm 0.30}$	37.3	3.7	7.9	0.168
R531 2.. **KU-C.. - P- MFK** **Load balls made from PA66.** **All parts galvanized.** **Balls made from corrosion-resistant steel 1.3541 / 1.4034.** **With dry felt seal.**	**8**	R0531 208 10 [1]	10	10	7.938	12.6 $^{\pm 0.055}$	17.0	4.8 $^{\pm 0.15}$	11.2	1.9	3.2	0.005
	12	R0531 212 10 [1]	35	35	12.000	18.0 $^{\pm 0.055}$	23.3	7.4 $^{\pm 0.15}$	15.4	2.1	4.4	0.012
	15	R0531 215 10 [1] [2]	70	70	15.875	24.0 $^{\pm 0.065}$	31.0	9.5 $^{\pm 0.20}$	21.5	2.5	6.1	0.024
	22	R0531 222 10 [2]	100	100	22.000	36.0 $^{\pm 0.080}$	45.0	9.6 $^{\pm 0.20}$	29.3	2.9	5.7	0.093
	30	R0531 230 10 [2]	150	150	29.900	45.0 $^{\pm 0.080}$	55.0	13.6 $^{\pm 0.30}$	37.3	3.7	7.9	0.168
R531 6.. **KU-C.. - P- MFK** **Load balls made from PA66.** **All parts made from corrosion-resistant steel.** **Balls made from corrosion-resistant steel 1.3541 / 1.4034.** **With dry felt seal.**	**8**	R0531 608 00 [1]	10	10	7.938	12.6 $^{\pm 0.055}$	17.0	4.8 $^{\pm 0.15}$	11.2	1.9	3.2	0.005
	12	R0531 612 00 [1]	35	35	12.000	18.0 $^{\pm 0.055}$	23.3	7.4 $^{\pm 0.15}$	15.4	2.1	4.4	0.012
	15	R0531 615 00 [1] [2]	70	70	15.875	24.0 $^{\pm 0.065}$	31.0	9.5 $^{\pm 0.20}$	21.5	2.5	6.1	0.024
	22	R0531 622 00 [2]	100	100	22.000	36.0 $^{\pm 0.080}$	45.0	9.6 $^{\pm 0.20}$	29.3	2.9	5.7	0.093
	30	R0531 630 00 [2]	150	150	29.900	45.0 $^{\pm 0.080}$	55.0	13.6 $^{\pm 0.30}$	37.3	3.7	7.9	0.168

[1] Without felt seal

[2] Ball Transfer Unit with bottom hole on request

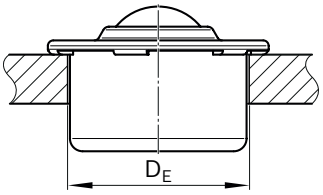
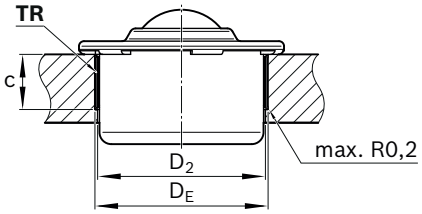
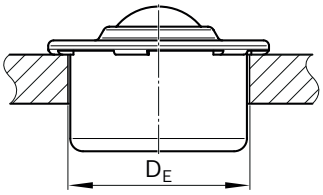
[3] At 20 °C

Explanation of short product name

(Example: R0531 215 10 KU-C15-P-OFK)

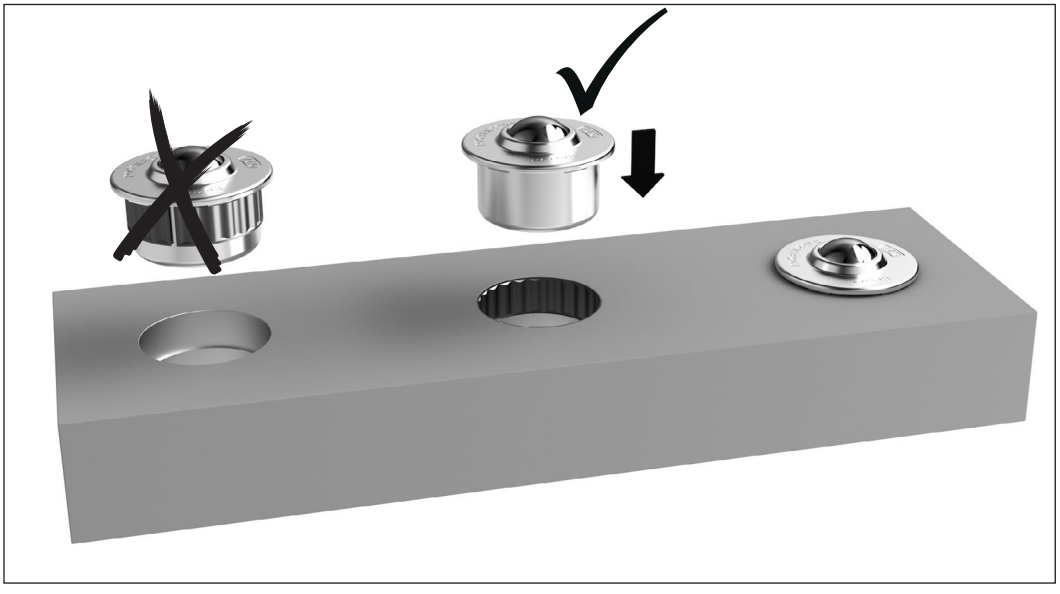
KU	C	15	P	OFK
Ball Transfer Unit	All parts galvanized, balls made from corrosion-resistant steel	Size	Load balls made from plastic	Without felt seal, preserved

Installation suggestions for secure fit

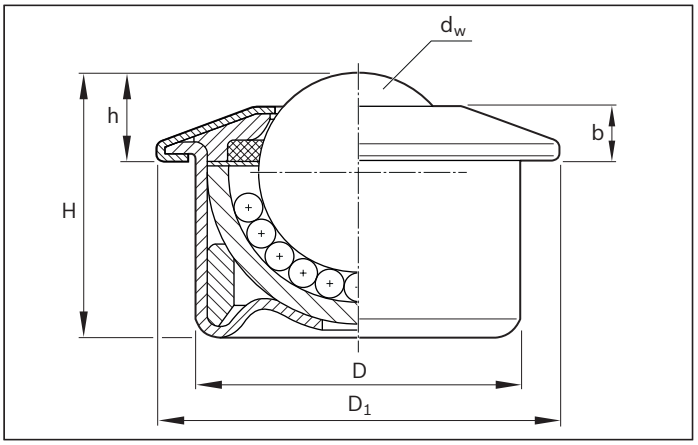
Size	Installation dimensions D_E (mm)						
	Press fit		**With tolerance ring (TR)**				**Sticking in** [3]
							
	D_E for ≧		**Part number**				
	2 mm sheet steel	**16 mm wood**	**Tolerance ring**				
	5 mm aluminum			**D_2 +0.2**	**D_E**	**c +0.2**	**D_2 +0.2**
8	12.57 +0.03	12.50 +0.05	R0810 012 52 [2]	12.8	13.87 +0.15	6.1	12.7
12	17.97 +0.03	17.90 +0.05	R0810 018 01 [1]	18.2	19.70 +0.20	6.1	18.1
15	23.95 +0.05	23.90 +0.05	R0810 024 03 [1]	24.2	25.70 +0.20	7.1	24.1
22	35.90 +0.05	35.85 +0.07	R0810 036 05 [1]	36.2	37.70 +0.20	12.1	36.1
30	44.85 +0.05	44.80 +0.10	R0810 045 01 [1]	45.2	46.70 +0.20	12.1	45.1
			R0810 045 51 [2]				

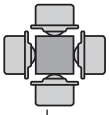
[1] Made from spring hinge 1.1248 alternative 1.8159
[2] Made from corrosion-resistant steel 1.4310
[3] For small gap dimensions in metal, we recommend single-component acrylate adhesive. Two-component acrylate adhesives are also possible. The technical data sheets of the manufacturer must be observed.

Assembling the Ball Transfer Units with tolerance ring



Ball Transfer Units with reinforced sheet steel housing R0535 ...



Version With sheet steel housing Reinforced housing and cover. For heavy impact loads.	Size	Part number	Load capacities (N)  dyn. C	stat. C_0	Dimensions (mm) d_w	D	D_1	h	H	b	Weight (kg) m
R0535 1.. **KUS - B.. - MFG** **Cover and housing galvanized.** **Balls made from antifriction bearing steel 1.3505** **With felt seal**	**15**	R0535 115 10 [1]	500	1 300	15.875	24.0 $^{\pm 0.065}$	31.0	9.5 $^{\pm 0.20}$	21.5	5.5	0.045
	22	R0535 122 10 [1]	1 300	3 000	22.225	36.0 $^{\pm 0.080}$	45.0	9.8 $^{\pm 0.20}$	29.5	6.2	0.150
	30	R0535 130 10 [1]	2 500	6 000	30.162	45.0 $^{\pm 0.080}$	55.0	13.8 $^{\pm 0.30}$	37.5	8.2	0.300
	45	R0535 145 10 [1]	6 000	15 000	44.450	62.0 $^{\pm 0.095}$	75.0	19.0 $^{\pm 0.40}$	53.7	10.5	0.820
		R0535 147 10	8 000	15 000							
R0535 2.. **KUS - C.. - MFG** **All parts galvanized.** **Balls made from corrosion-resistant steel 1.3541 / 1.4034** **With felt seal**	**15**	R0535 215 10 [1]	370	700	15.875	24.0 $^{\pm 0.065}$	31.0	9.5 $^{\pm 0.20}$	21.5	5.5	0.045
	22	R0535 222 10 [1]	970	1 800	22.225	36.0 $^{\pm 0.080}$	45.0	9.8 $^{\pm 0.20}$	29.5	6.2	0.150
	30	R0535 230 10 [1]	1 900	4 000	30.162	45.0 $^{\pm 0.080}$	55.0	13.8 $^{\pm 0.30}$	37.5	8.2	0.300
	45	R0535 245 10 [1]	4 500	9 000	44.450	62.0 $^{\pm 0.095}$	75.0	19.0 $^{\pm 0.40}$	53.7	10.5	0.820
		R0535 247 10	6 000	12 000							
R0535 3.. **KUS - 330 - BL - MFG** **Ball cup and ball retaining ring made from corrosion-resistant steel, other parts galvanized.** **Balls made from 1.3541 / 1.4034.** **With bottom hole and felt seal**	**30**	R0535 331 10	1 900	4 000	30.162	45.0 $^{\pm 0.080}$	55.0	13.8 $^{\pm 0.30}$	37.5	8.2	0.300
R0535 7.. **KUS - 737 - BL - MFG** **Reinforcing ring and supporting ring galvanized, other parts made from corrosion-resistant steel.** **Balls made from 1.3541 / 1.4034** **With 7 bottom holes.** **With felt seal to 150 °C**	**30**	R0535 737 00	1 900	4 000	30.162	45.0 $^{\pm 0.080}$	55.0	13.8 $^{\pm 0.30}$	37.5	8.2	0.300

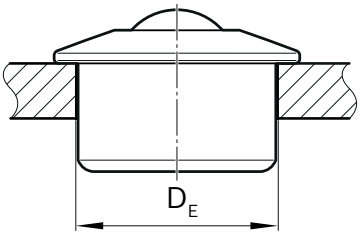
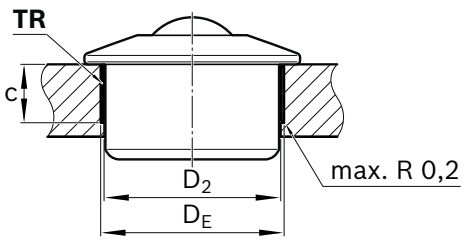
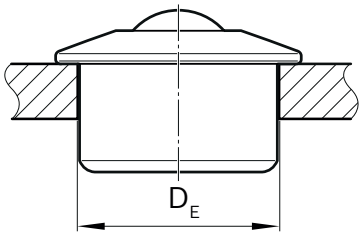
[1] Ball Transfer Unit with bottom hole on request

Explanation of short product name

(Example: R0535 222 10 KUS-C22-MFG)

KUS	C	22	MFG
Ball Transfer Unit with reinforced steel housing	All parts galvanized, balls made from corrosion-resistant steel	Size	With felt seal, oiled

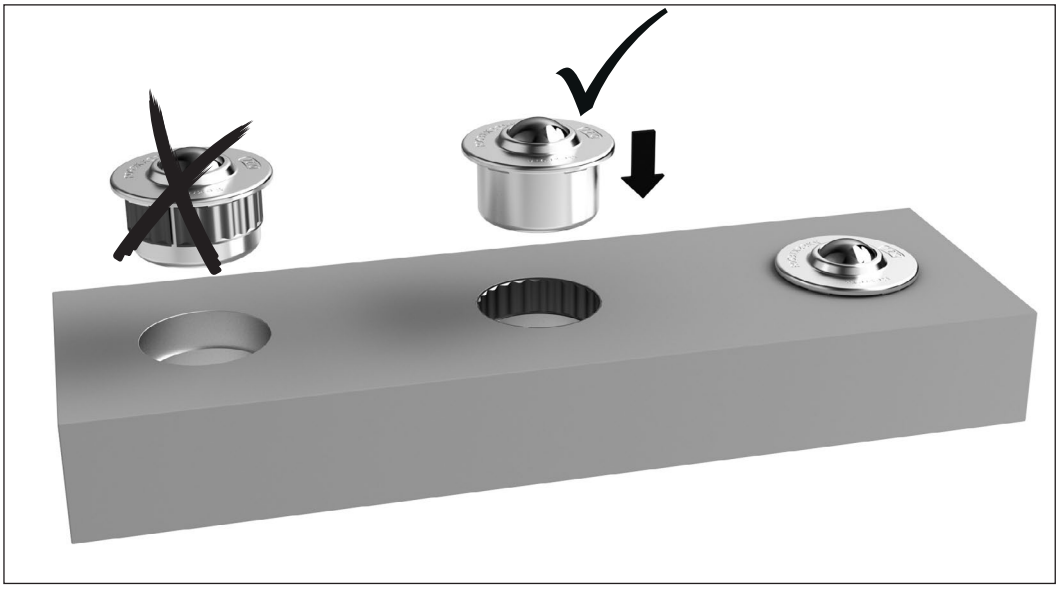
Installation suggestions for secure fit

Size	Installation dimensions D_E (mm)						
	Press fit		**With tolerance ring (TR)**				**Sticking in** [3]
							
	D_E for ≧						
	2 mm sheet steel	**16 mm wood**	**Part number**				
	5 mm aluminum		**Tolerance ring**	**D_2 +0.2**	**D_E**	**c +0.2**	**D_E +0.2**
15	23.95 +0.05	23.90 +0.05	R0810 024 03 [1]	24.2	25.70 +0.20	7.1	24.1
22	35.90 +0.05	35.85 +0.07	R0810 036 05 [1]	36.2	37.70 +0.20	12.1	36.1
30	44.85 +0.05	44.80 +0.10	R0810 045 01 [1]	45.2	46.70 +0.20	12.1	45.1
			R0810 045 51 [2]				
45	61.83 +0.07	61.80 +0.10	R0810 062 03 [1]	62.3	64.10 +0.30	15.1	62.2

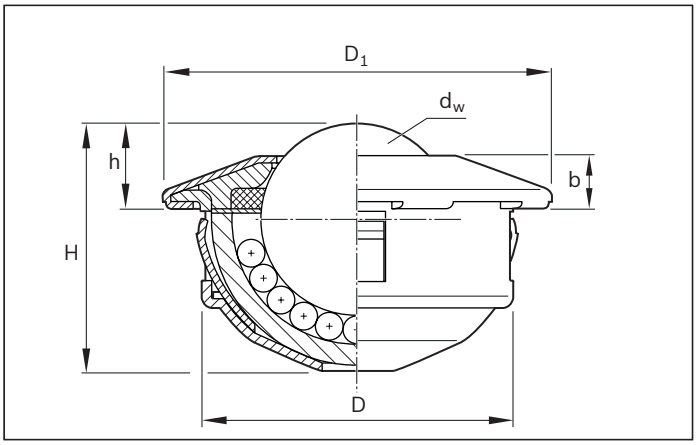
[1] Made from spring hinge 1.1248 alternative 1.8159
[2] Made from corrosion-resistant steel 1.4310
[3] For small gap dimensions in metal, we recommend single-component acrylate adhesive. Two-component acrylate adhesives are also possible. The technical data sheets of the manufacturer must be observed.

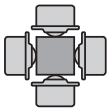
Assembling the Ball Transfer Units with tolerance ring

Use a mounting tool
(see page 19)



Ball Transfer Units with clip as fastening element R0536 ...



Version With fastening element. Easily mountable and extractable from the load side. Fixing is by means of spring clips, which permit generous tolerances in the mounting hole. Reinforced cover to withstand heavy impact loads.	Size	Part number	Load capacities (N) 		Dimensions (mm)						Weight (kg)
			dyn. C	stat. C_0	d_w	D	D_1	h	H	b	m
R0536 1.. **KUK - B.. - MFG** **Cover and housing galvanized.** **Balls made from antifriction bearing steel 1.3505.** **With felt seal**	**15**	R0536 115 10 [1]	500	1 000	15.875	24.0 $^{-0.13}$	31	9.5 $^{\pm 0.20}$	20.0	5.5	0.044
	22	R0536 122 10 [1]	1 300	2 600	22.225	36.0 $^{-0.16}$	45	9.8 $^{\pm 0.20}$	28.6	6.2	0.146
	30	R0536 130 10 [1]	2 500	5 000	30.162	45.0 $^{-0.25}$	55	13.8 $^{\pm 0.30}$	37.2	8.2	0.290
R0536 2.. **KUK - C.. - MFG** **All parts galvanized.** **Balls made from corrosion-resistant steel 1.3541 / 1.4034.** **With felt seal**	**15**	R0536 215 10 [1]	370	700	15.875	24.0 $^{-0.13}$	31	9.5 $^{\pm 0.20}$	20.0	5.5	0.044
	22	R0536 222 10 [1]	970	1 800	22.225	36.0 $^{-0.16}$	45	9.8 $^{\pm 0.20}$	28.6	6.2	0.146
	30	R0536 230 10 [1]	1 900	3 500	30.162	45.0 $^{-0.25}$	55	13.8 $^{\pm 0.30}$	37.2	8.2	0.290
R0536 3.. **KUK - 330 - BL - MFG** **Ball cup and ball retaining ring made from corrosion-resistant steel, other parts galvanized.** **Balls made from 1.3541 / 1.4034.** **With bottom hole and felt seal**	**30**	R0536 331 10	1 900	3 500	30.162	45.0 $^{-0.25}$	55	13.8 $^{\pm 0.30}$	37.2	8.2	0.290
R0536 4.. **KUK - B.. - P - MFK** **Load balls made from PA66.** **Cover and housing galvanized.** **Balls made from antifriction bearing steel 1.3505.** **With dry felt seal.**	**15**	R0536 415 10 [1]	70 [2]	70 [2]	15.875	24.0 $^{-0.13}$	31	9.5 $^{\pm 0.20}$	20.0	5.5	0.030
	22	R0536 422 10 [1]	100 [2]	100 [2]	22.000	36.0 $^{-0.16}$	45	9.6 $^{\pm 0.20}$	28.4	6.2	0.105
	30	R0536 430 10 [1]	150 [2]	150 [2]	29.900	45.0 $^{-0.25}$	55	13.6 $^{\pm 0.30}$	37.0	8.2	0.196

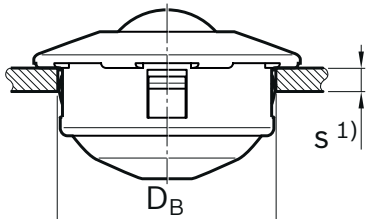
[1] Ball Transfer Unit with bottom hole on request
[2] At 20 °C

Explanation of short product name

(Example: R0536 230 10 KUK-C30-MFG)

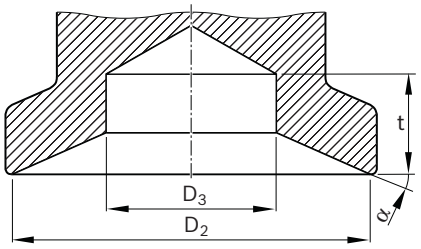
KUK	C	30	MFG
Ball Transfer Unit with clip as fastening element	All parts galvanized, balls made from corrosion resistant steel	Size	With felt seal, oiled

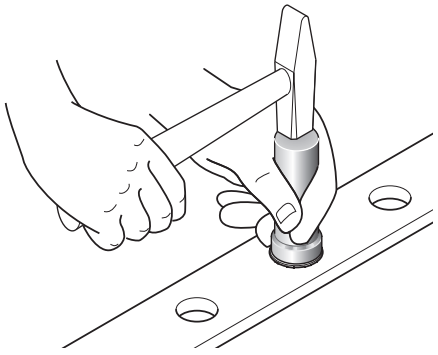
Installation suggestion

Size	Installation dimensions (mm)	
		
	D_B	s
15	24 $^{+0.5}$	1.5
22	36 $^{+0.8}$	2.0
30	45 $^{+1.0}$	2.5

1) Minimum thickness of the mounting plate

Mounting tool for Ball Transfer Units R0535 and R0536





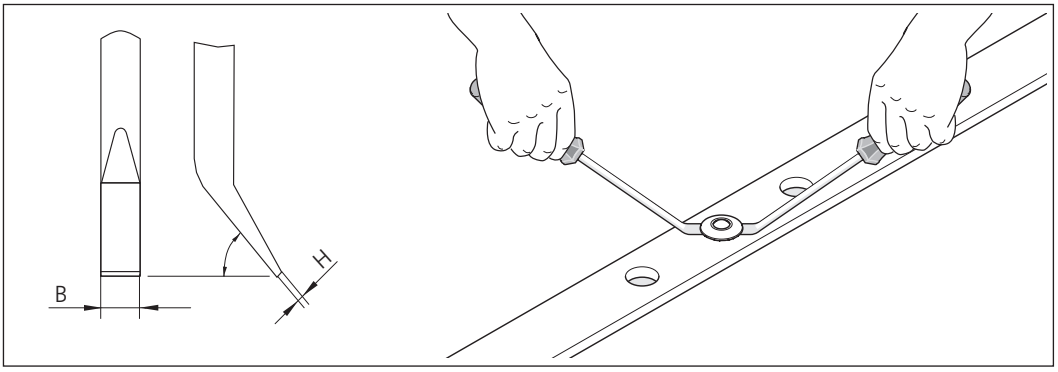
Size	Part number	Dimensions (mm)			α
		D_2	D_3	t_{min}	(°)
15	R0536 015 30	29	17	10	30
22	R0536 022 30	43	24	10	20
30	R0536 030 30	53	30	10	24
45	R0536 045 30	73	45	15	26

Extraction tool

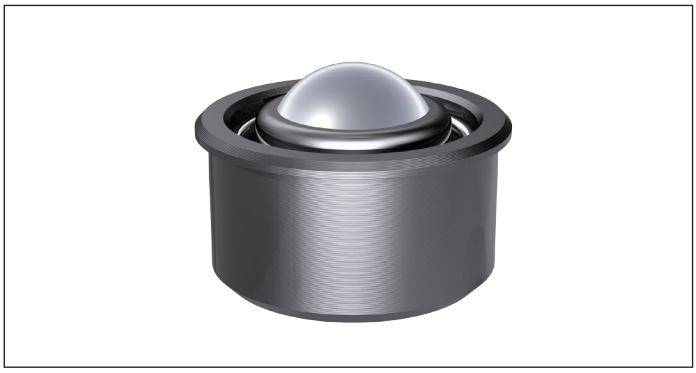
Recommendation for Ball Transfer Units R0536

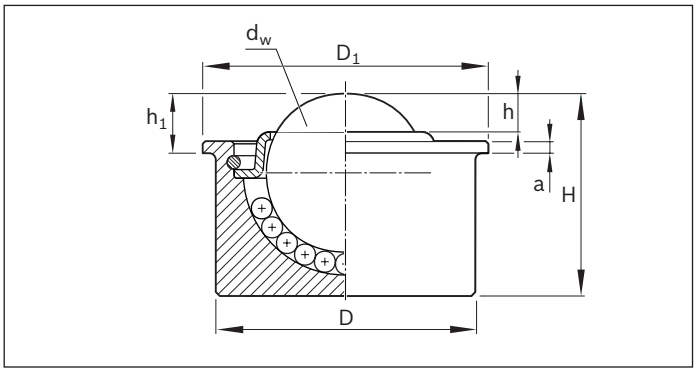
for	Dimensions (mm)	
d_w	H1) max	B1) max
15	0.6	6
22	0.6	8
30	0.8	10

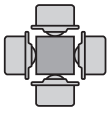
1) Suitable for the gaps in the supporting edge of the Ball Transfer Unit 0536–



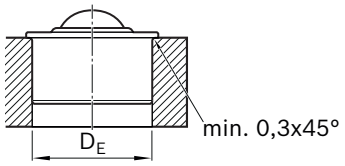
Ball Transfer Unit with solid steel housing – with low collar R0533 ...





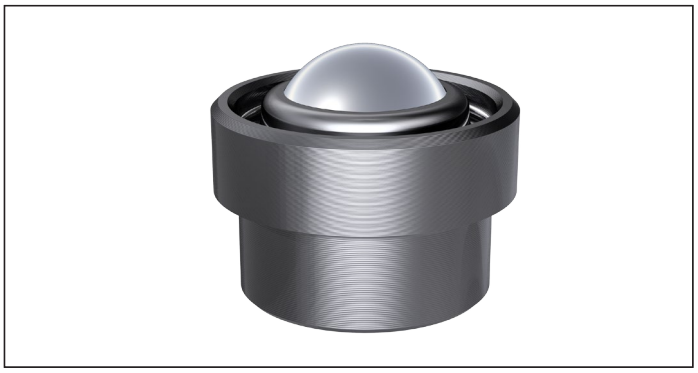
Version With solid steel housing. With low collar. Very smooth movement.	Size	Part number	Load capacity (N) 		Dimensions (mm)							Weight (kg)
			dyn. C	stat. C_0	d_w	D ±0.065	D_1 ±0.25	h	h_1 ±0.01	H	a	m
R0533 **KUM - A12 - NB - OFK** **Housing bright metal.** **Cover galvanized.** **Balls made from antifriction bearing steel 1.3505.** **Without felt seal.**	**12**	R0533 012 00	250	700	12	20	21.75	approx. 3	4.5	15	1	0.024

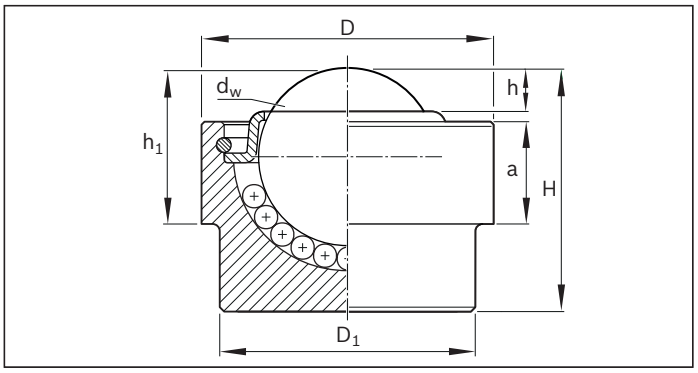
Installation suggestion for secure fit

Size	Installation dimensions D_E (mm) Sticking in [1] 
	$D_E^{+0.2}$
12	20.15

[1] For small gap dimensions in metal, we recommend single-component acrylate adhesive. Two-component acrylate adhesives are also possible. The technical data sheets of the manufacturer must be observed.

Ball Transfer Unit with solid steel housing – with high collar R0533 ...





Version **With solid steel housing.** **With high collar.** **Very smooth movement.**	**Size**	**Part number**	**Load capacity (N)**		**Dimensions (mm)**							**Weight (kg)**
			dyn. C	**stat. C_0**	**d_w**	**D ±0.1**	**D_1 ±0.1**	**h**	**h_1 ±0.1**	**H ±0.2**	**a ±0.1**	**m**
R0533 **KUM - A12 - HB - OFK** **Housing bright metal.** **Cover galvanized.** **Balls made from antifriction bearing steel 1.3505.** **Without felt seal.**	**12**	R0533 702 00	250	700	12	20	17.5	approx. 3	10.5	16.5	7	0.027

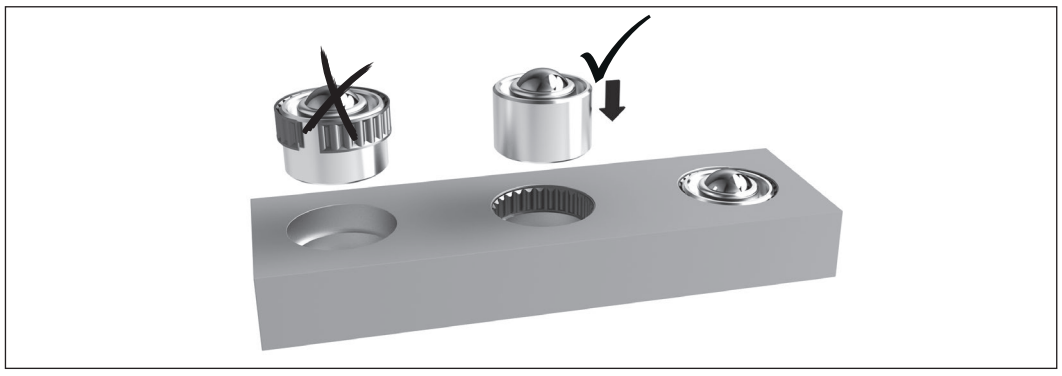
Installation suggestions for secure fit

Size	**Installation dimensions D_E (mm)** **With tolerance ring (TR)**				**Sticking in** [2]		
	Part number **Tolerance ring**	**D_2 +0.5**	**D_E +0.2**	**b ±0.1**	**D_2 +0.5**	**D_E +0.2**	**b ±0.1**
12	R0810 019 51 [1]	17.8	21.7	7	17.8	20.15	7

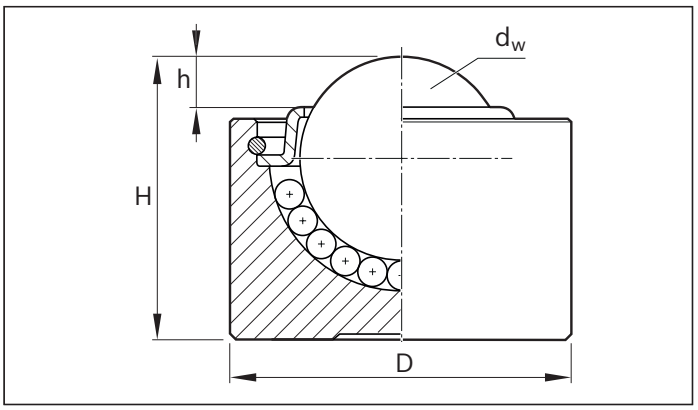
[1] made from corrosion-resistant steel 1.4310

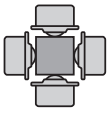
[2] for small gap dimensions in metal, we recommend single-component acrylate adhesive. Two-component acrylate adhesives are also possible. The technical data sheets of the manufacturer must be observed.

Assembling the Ball Transfer Units with tolerance ring

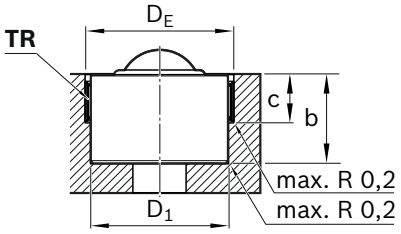
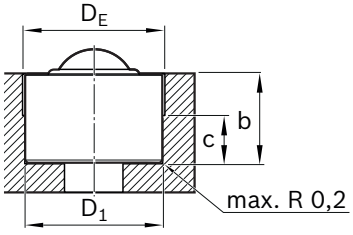


Ball Transfer Unit with solid steel housing – without collar R0533 ...



Version With solid steel housing. Without collar. Very smooth movement.	Size	Part number	Load capacities (N) 		Dimensions (mm)				Weight (kg)
			dyn. C	stat. C_0	d_w	D ±0.065	h	H ±0.2	m
R0533 7.. **KUM - A12 - OFK** **Housing bright metal.** **Cover galvanized.** **Balls made from antifriction bearing steel 1.3505.** **Without felt seal**	**12**	R0533 712 00	250	700	12.000	20	approx. 3	16.5	0.028

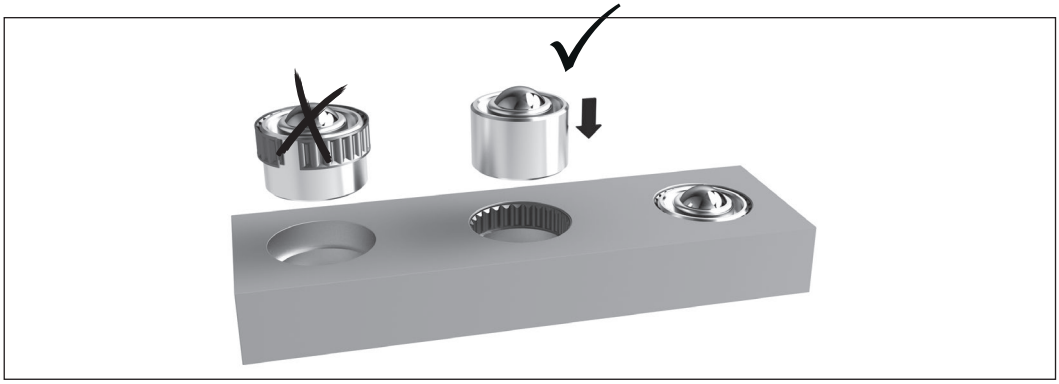
Installation suggestions for secure fit

Size	Installation dimensions D_E (mm) With tolerance ring (TR)  Part number Tolerance ring	D_1 +0.3	D_E +0.2	b ±0.2	c +0.2	Sticking in [2]  D_1 +0.3	D_E +0.2	b ±0.2	c +1
12	R0810 019 51 [1]	20.1	21.7	13.2	6.1	20.5	20.1	13	8

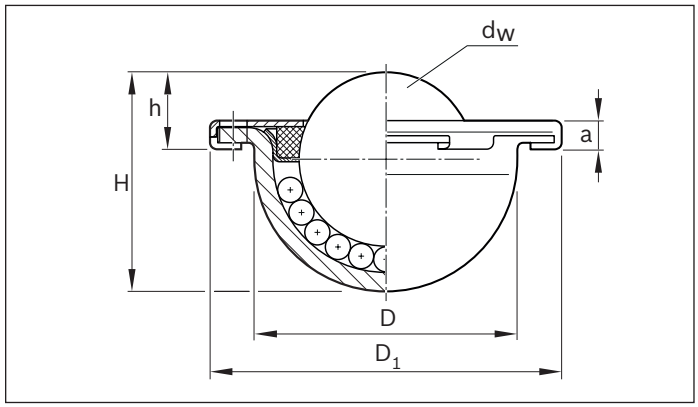
[1] Made from corrosion-resistant steel 1.4310

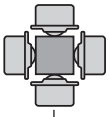
[2] For small gap dimensions in metal, we recommend single-component acrylate adhesive. Two-component acrylate adhesives are also possible. The technical data sheets of the manufacturer must be observed.

Assembling the Ball Transfer Units with tolerance ring



Ball Transfer Unit without housing R0534 ...



Version Without housing. Low space requirement. Simple mounting. Mounting via holes in the collar.	Size	Part number	Load capacities (N) 		Dimensions (mm)						Weight (kg)
			dyn. C	stat. C_0	d_w	D $^{-0.2}$	D_1	h $^{\pm 0.2}$	H	a	m
R0534 1.. **KUO - B22 - MFG** **Surface galvanized.** **Balls made from antifriction bearing steel 1.3505.** **With felt seal.**	**22**	R0534 122 10	1 200	1 200	22.225	33	45	9.8	27.7	3.8	0.1
R0534 2.. **KUO - C22 - MFG** **All parts galvanized.** **Balls made from corrosion-resistant Steel 1.3541 / 1.4034.** **With felt seal.**	**22**	R0534 222 10 R0534 223 10 [1]	900	900	22.225	33	45	9.8	27.7	3.8	0.1

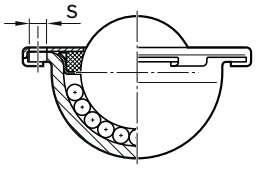
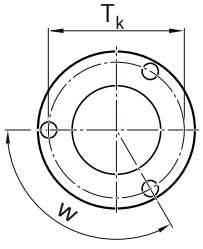
[1] Ball Transfer Unit with bottom hole

Explanation of short product name

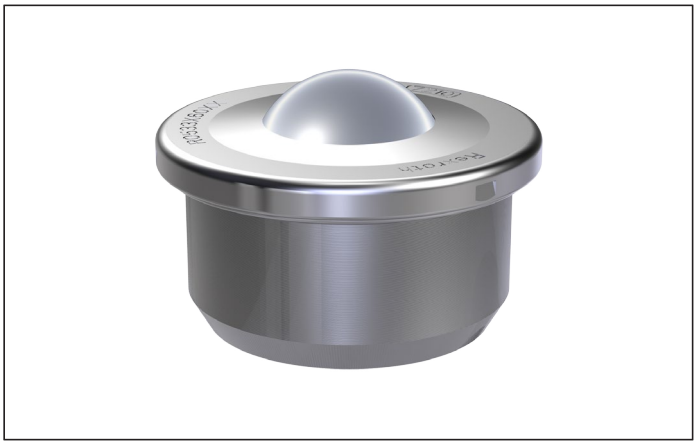
(Example: R0534 223 10 KUO-C22-BL-MFG)

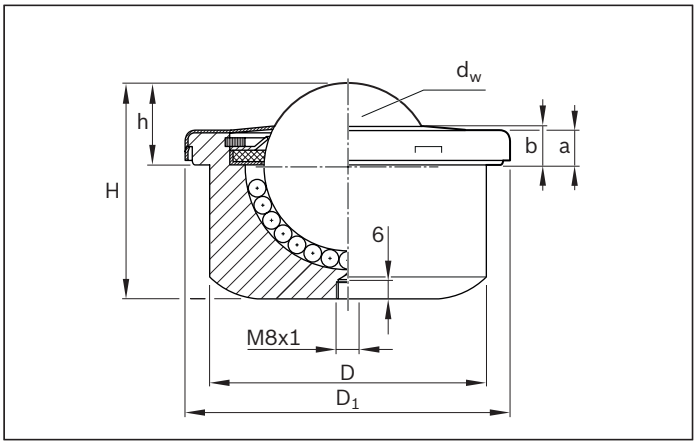
KUO	C	22	BL	MFG
Ball Transfer Unit without housing	All parts galvanized, balls made from corrosion-resistant steel	Size	Bottom hole	With felt seal, oiled

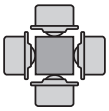
Installation suggestion

Size	Installation dimensions (mm)  		
	S	T_k	W
22	3.5	39	3 x 120°

Ball Transfer Units with solid steel housing R0533 .6.





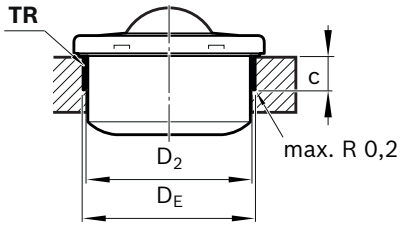
Version With solid steel housing. For high loads. Alternatively with polymer wiper seal.	Size	Part number	Load capacity (N) 		Dimensions (mm)							Weight (kg)
			dyn. C	stat. C_0	d_w	D ±0.11	D_1	h ±0.2	H	a	b	m
R0533 0 **Surface bright metal.** **Balls made from antifriction bearing steel 1.3505.** **With felt seal.**	**60**	R0533 060 00 KUM-A60-MFG	13 000	30 000	60.325	100	117	29.5	77.5	13	14.5	3.5
		R0533 061 00 [1] KUM-A60-BL-MFG-SA										
R0533 1 **Cover and housing galvanized.** **Balls made from antifriction bearing steel 1.3505** **With felt seal.**	**60**	R0533 160 10 KUM-B60-MFG-SA	13 000	30 000	60.325	100	117	29.5	77.5	13	14.5	3.5
		R0533 161 10 [1] KUM-B60-BL-MFG-SA										
R0533 2 **All parts galvanized.** **Balls made from corrosion-resistant steel 1.3541 / 1.4034** **With felt seal.**	**60**	R0533 260 10 KUM-C60-MFG	9 700	20 000	60.325	100	117	29.5	77.5	13	14.5	3.5
		R0533 261 10 [1] KUM-C60-BL-MFG-SA										

[1] Ball Transfer Unit with bottom hole and lube port

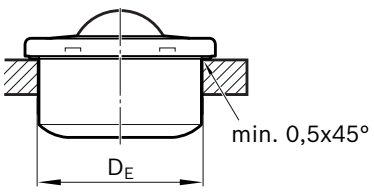
Installation suggestions for secure fit (installation dimensions for R0533 .6. .. and R0533 .05 10)

Installation dimensions D_E (mm)

With tolerance ring (TR)



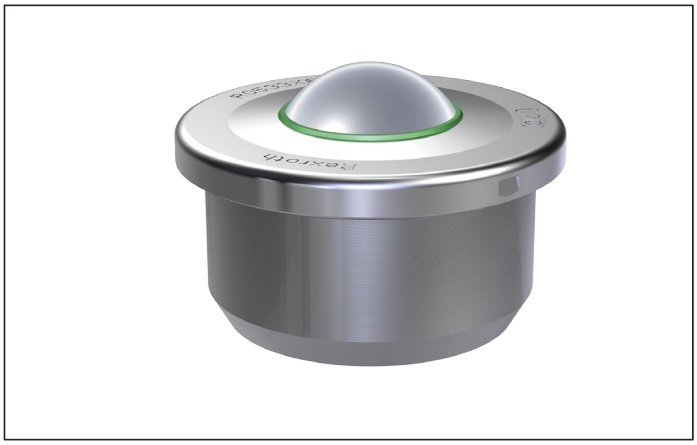
Sticking in [3]

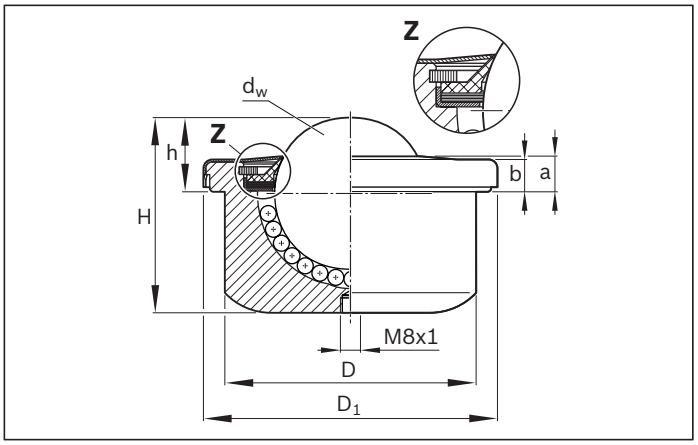


Part number Tolerance ring	D_2 +0.5	D_E +0.35	c +0.3	D_E +0.25
R0810 100 02 [2]	100.3	102.5	19.1	100.15

[2] Made from spring hinge 1.1248 alternative 1.8159

Ball Transfer Units with solid steel housing R0533 ..5, with polymer wiper seal





Version With solid steel housing. For heavy loads and coarse dirt	Size	Part number	Load capacity (N)		Dimensions (mm)							Weight (kg)
			dyn. C	stat. C_0	d_w	D ±0.11	D	h ±0.2	H	a	b	m
R0533 1.. **KUM-B60-MFG-AB** **Cover and housing galvanized.** **Balls made from antifriction bearing steel 1.3505.** **With felt seal and wiper.**	60	R0533 105 10	13 000	30 000	60.325	100	117	29.5	77.5	13	14.5	3.5
R0533 2.. **KUM-C60-MFG-AB** **All parts galvanized.** **Balls made from corrosion-resistant steel 1.3541 / 1.4034.** **With felt seal and wiper.**	60	R0533 205 10	9 700	20 000	60.325	100	117	29.5	77.5	13	14.5	3.5

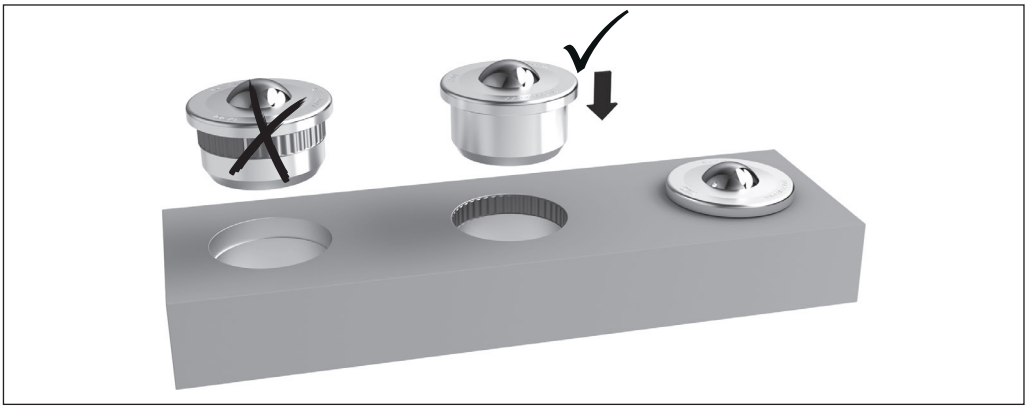
Ball Transfer Unit without lube port

Explanation of short product name

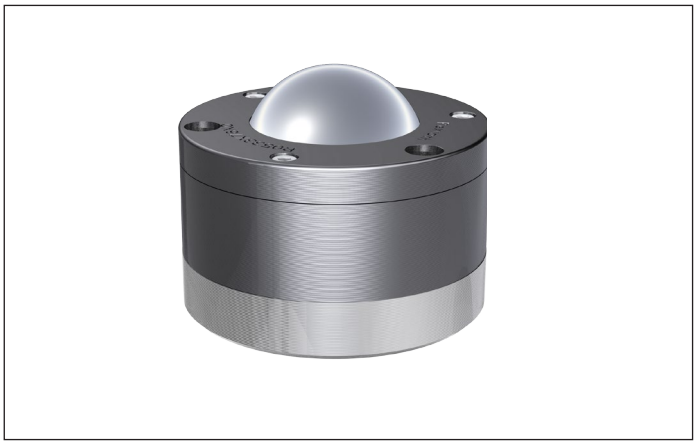
(Example: R0533 205 10 KUM-C60-MFG-AB)

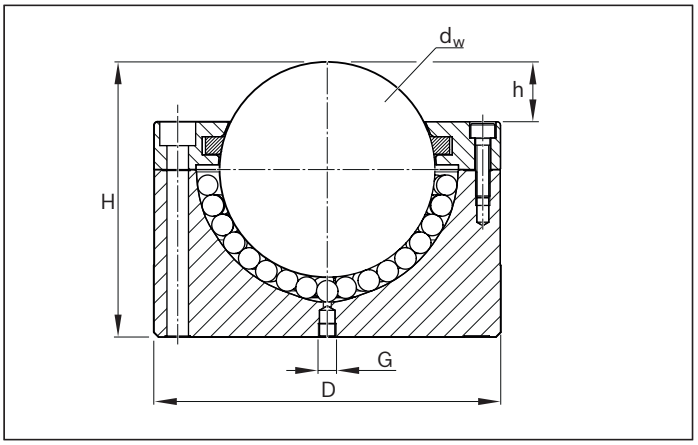
KUM	C	60	MFG	AB
Ball Transfer Unit with solid steel housing	All parts galvanized, balls made from corrosion-resistant steel	Size	With felt seal, oiled	With wiper

Assembling the Ball Transfer Units with tolerance rings



Ball Transfer Unit with solid steel housing R0533 ...





Version	Size	Part number	Load capacities (N)		Dimensions (mm)					Weight (kg)
			dyn. C	stat. C_0	d_w	D ±0.08	h	H	G	m
R0533 0.. **KUM-A..-MFG** **Surface bright metal.** **Balls made from antifriction bearing steel 1.3505.** **With felt seal.**	**76**	R0533 076 00 [1]	20 000	50 000	76.2	130	23	103 ±0.2	M8x1	8.6
	90	R0533 090 00 [2]	25 000	70 000	90.0	145	25	115 ±0.2	Rp 1/8	11.2
R0533 1.. **KUM-B..-BL-MFG-SA** **Cover and housing galvanized.** **Balls made from antifriction bearing steel 1.3505.** **With felt seal.**	**76**	R0533 177 10 [3]	20 000	50 000	76.2	130	23	103 ±0.2	M8x1	8.6
	90	R0533 191 10 [3]	25 000	70 000	90.0	145	25	115 ±0.2	Rp 1/8	11.2

[1] Upon request, available with lube hole
[2] Lube hole Rp1/8“ (at center of base) closed by screw plug
[3] Ball Transfer Unit with bottom hole and lube port

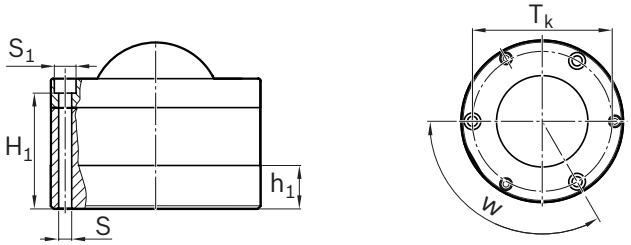
Explanation of short product name

(Example: R0533 177 10 KUM-B76-BL-MFG-SA)

KUM	B	76	BL	MFG	SA
Ball Transfer Unit with solid steel housing	Cover and housing galvanized, balls made from antifriction bearing steel	Size	Bottom hole	With felt seal, oiled	With lube port

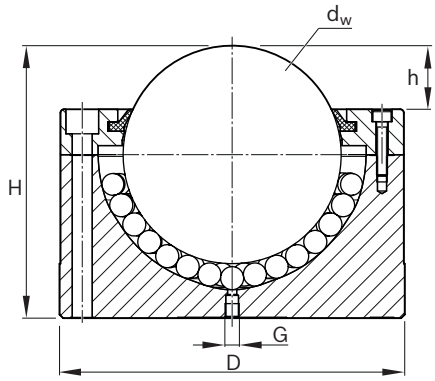
Installation suggestion

Size	Installation dimensions (mm)					
	H_1	h_1	S	S_1	T_k	W
76	69	25	9	15	110	3 x 120°
90	79	30	9	15	125	3 x 120°



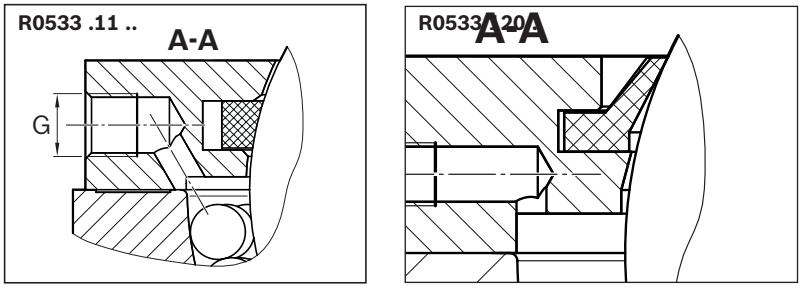
Ball Transfer Unit with solid steel housing R0533 ...,with polymer wiper seal

R0533 .11 .. R0533 120 ..



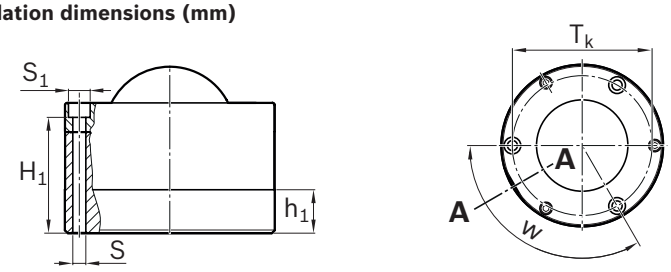
Version **With solid steel housing and cover.** **For very heavy loads and coarse dirt.** **With wiper.**	**Size**	**Part number**	**Load capacities (N)**		**Dimensions (mm)**					**Weight (kg)**
			dyn. C	**stat. C_0**	**d_w**	**D**	**h**	**H $^{+0.2}$**	**G**	**m**
R0533 ... **Surface bright metal.** **Balls made from antifriction bearing steel 1.3505.**	**90**	R0533 011 00 KUM-A90-BL-AB-SA	25 000	70 000	90	145 $^{\pm 0.08}$	25	115	Rp 1/8	11.2
	120	R0533 120 00 KUM-A120-BL-AB-SA	40 000	100 000	120	190 $^{\pm 0.10}$	35	150	M8x1	24.6
R0533 1.. **Cover and housing galvanized** **Balls made from antifriction bearing steel 1.3505.**	**90**	R0533 111 10 KUM-B90-BL-AB-SA	25 000	70 000	90	145 $^{\pm 0.08}$	25	115	Rp 1/8	11.2

Lube port in the cover and housing

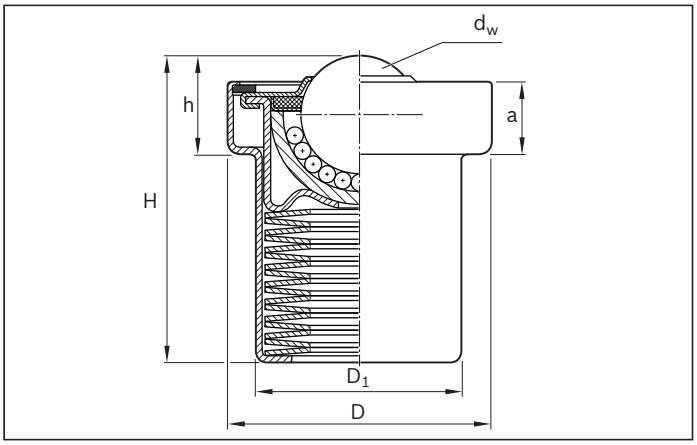


Installation suggestion

Size	**Installation dimensions (mm)**					
	H_1	**h_1**	**S**	**S_1**	**T_k**	**W**
90	80.0	30	9	15	125	6 x 60°
120	101.5	30	11	18	165	3 x 120°



Ball Transfer Units, spring-loaded R0532 1.., R0532 2..



Version Spring-loaded. Ball Transfer Units are supported on springs and mounted under preload in a housing. Ball Transfer Unit recedes into its housing under high loads.	Size	Part number	Preload (N)	Ultimate load [1] (N)	Tolerance for preload and ultimate load (%)	Dimensions (mm) d_w	D	D_1	h	H	a	Weight (kg)
R0532 1.. **KUF-B..-TF-MFG** **Cover and housing galvanized.** **With cup springs.** **Balls made from antifriction bearing steel 1.3505.** **With felt seal.**	**22**	R0532 122 10	730	860	+25 / -7.5	22.225	$50^{\pm 0.100}$	38.8	18.6	58.1	13.6	0.30
	30	R0532 130 10	1 350	1 600	+15 / -7.5	30.162	$62^{\pm 0.125}$	48.2	24.4	70.0	17.0	0.57
	45	R0532 145 10	2 280	2 770	+15 / -7.5	44.450	$85^{\pm 0.150}$	66.2	35.6	100.5	24.2	1.60
R0532 1.. **KUF-B..-SF-MFG** **Cover and housing galvanized.** **With helical spring.** **Balls made from antifriction bearing steel 1.3505.** **With felt seal.**	**22**	R0532 123 10	170	250	+15 / -7.5	22.225	$50^{\pm 0.100}$	38.8	18.6	58.1	13.6	0.24
	22	R0532 125 10	116.6	195	+27.1 / -27.1	22.225	$50^{\pm 0.100}$	38.8	18.6	58.1	13.6	0.24
R0532 2 **KUF-C..-TF-MFG** **All parts galvanized.** **With cup springs.** **Balls made from corrosion-resistant steel 1.3541 / 1.4034.** **With felt seal.**	**22**	R0532 222 10	730	860	+25 / -7.5	22.225	$50^{\pm 0.100}$	38.8	18.6	58.1	13.6	0.30
	30	R0532 230 10	1 350	1 600	+15 / -7.5	30.162	$62^{\pm 0.125}$	48.2	24.4	70.0	17.0	0.57
	45	R0532 245 10	2 280	2 770	+15 / -7.5	44.450	$85^{\pm 0.150}$	66.2	35.6	100.5	24.2	1.60

[1] Under ultimate load the Ball Transfer Unit recedes completely.

Explanation of short product name

(Example: R0532 145 10 KUF-B45-TF-MFG)

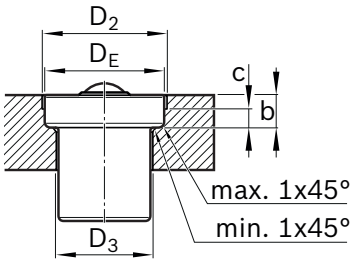
KUF	B	45	TF	MFG
Ball Transfer Unit, spring-loaded	Cover and housing galvanized, balls made from antifriction bearing steel	Size	Cup spring	With felt seal, oiled

Installation suggestions for secure fit

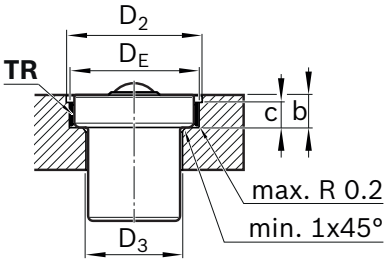
Size

Installation dimensions D_E (mm)

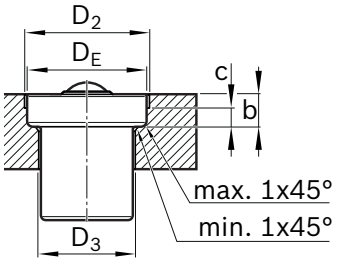
Press fit with steel



With tolerance ring (TR)



Sticking in [3]

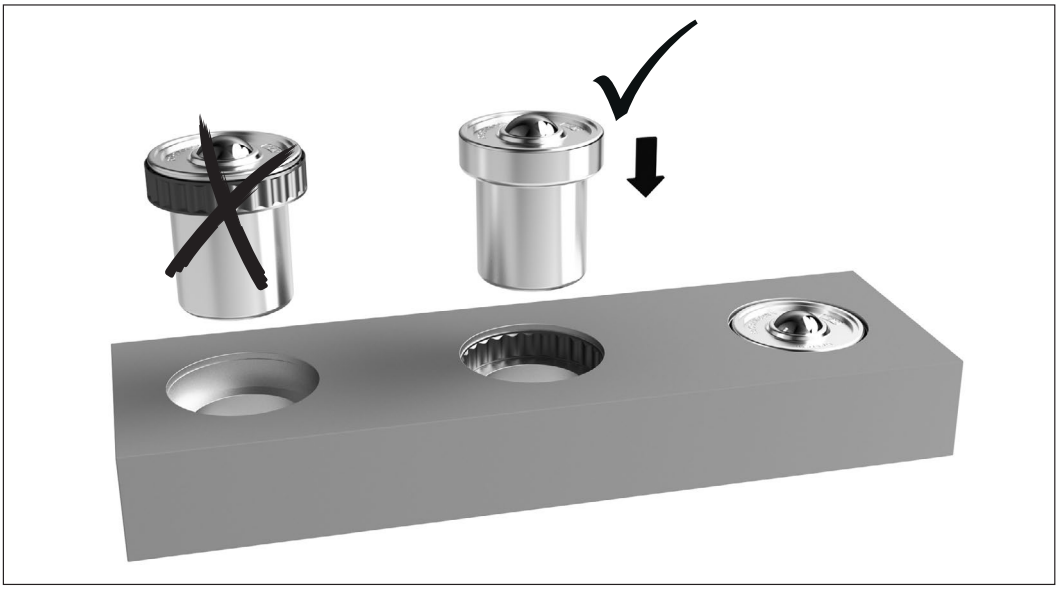


	Press fit with steel					With tolerance ring (TR)						Sticking in [3]				
	D_2 +0.5	D_E	D_3 +0.5	b ±0.2	c +1	Part number Tolerance ring	D_2 +0.5	D_E	D_3 +0.5	b ±0.2	c +0.2	D_2 +0.5	D_E +0.2	D_3 +0.5	b ±0.2	c +1
22	50.1	49.90 +0.05	39.2	13.6	7	R0810 050 08 [2]	52.5	52.10 +0.2	39.2	13.6	11.1	50.4	50.2	39.2	13.6	7
30	62.2	61.85 +0.05	48.7	17.0	10	R0810 062 03 [2]	64.5	64.10 +0.3	48.7	17.0	15.1	62.4	62.2	48.7	17.0	10
45	85.2	84.83 +0.07	66.8	24.2	13	R0810 085 01 [2]	88.0	87.55 +0.3	66.8	24.2	19.1	85.4	85.2	66.8	24.2	13

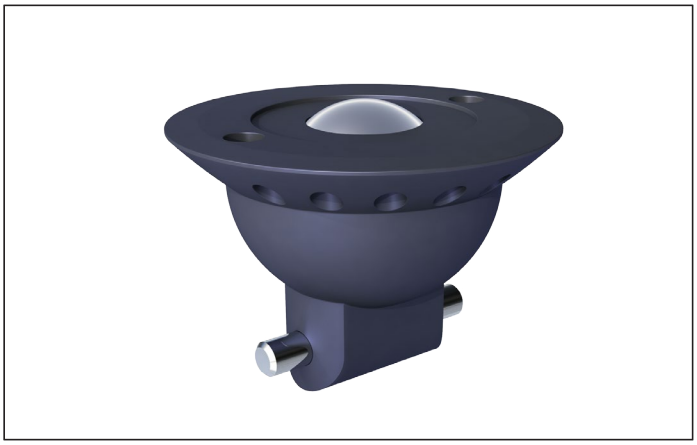
[2] Made from spring hinge 1.1248 alternative 1.8159

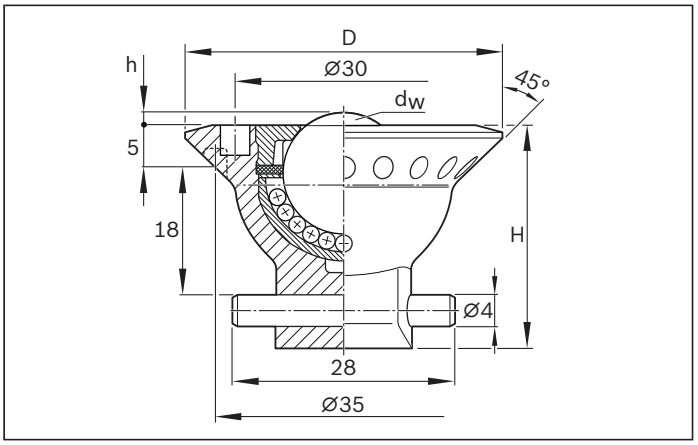
[3] For small gap dimensions in metal, we recommend single-component acrylate adhesive. Two-component acrylate adhesives are also possible. The technical data sheets of the manufacturer must be observed.

Assembling the Ball Transfer Units with tolerance rings



Ball Transfer Unit with plastic housing R0530





Version With plastic housing. For special applications (e.g. for lightweight ball transfer tables).	Size	Part number	Load capacities (N) 	Dimensions (mm)				Weight (kg)
			dyn. C	d_w	D	h	H	m
R0530 .0 **KUL-15-MFG** **Mounting with quarter-turn fastener** **With felt seal.**	**15**	R0530 005 20	500	15	42	2	32	0.045

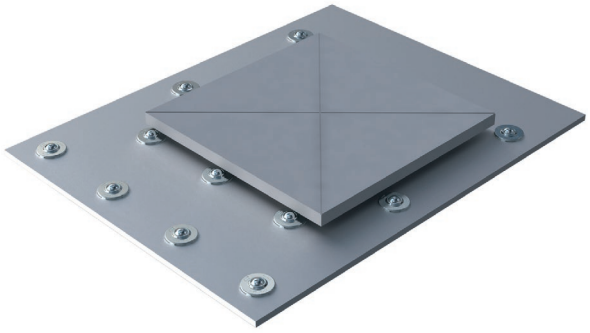
Ball Transfer Unit installation examples

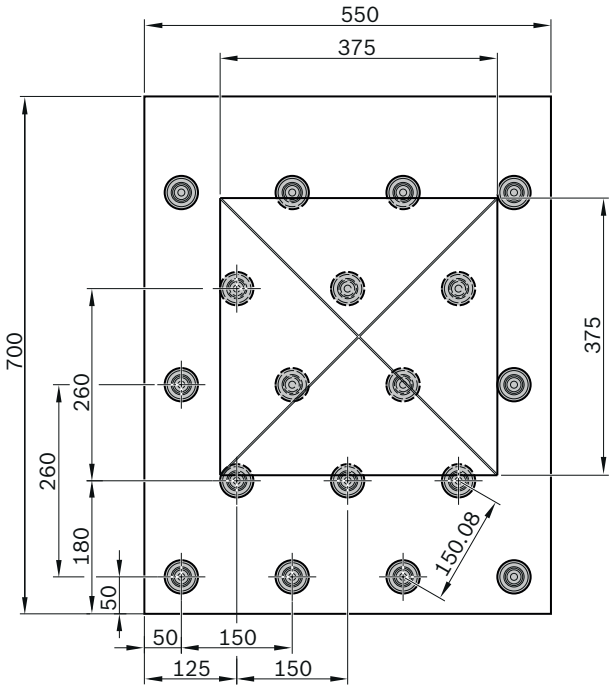
with arrangement and determination of the Ball Transfer Unit load

Scenario A

Arrangement as an equilateral triangle.

The square item to be transported (375 x 375 mm) has a central center of gravity and is supported by 5 Ball Transfer Units.
The distance of the Ball Transfer Units should not be larger than 150 mm (375 / 2.5 = 150 mm).
The mass[1)] (3500 N) is distributed over three Ball Transfer Units and is 1166.7 N per Ball Transfer Unit (3500 N / 3 = 1166.7 N).
Selected Ball Transfer Unit, e.g.: R0530 122 10.

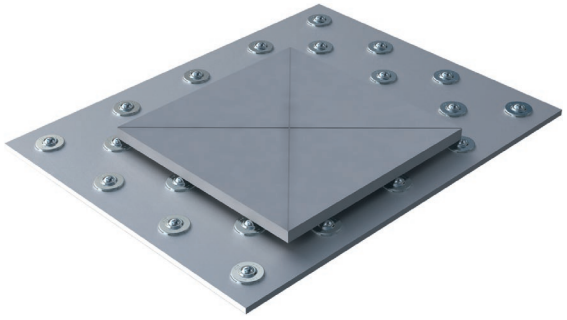


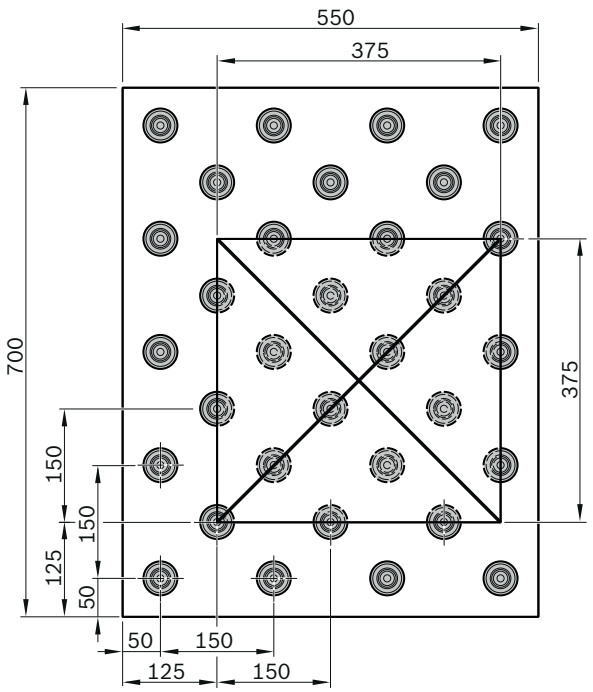


Scenario B

Arrangement as a right-angled triangle.

The square item to be transported (375 x 375 mm) does not have a central center of gravity and is supported by 8 Ball Transfer Units.
The distance of the Ball Transfer Units should not be larger than 150 mm (375 / 2.5 = 150 mm).
The mass[1)] (3500 N) is distributed over three Ball Transfer Units and is 1166.7 N per Ball Transfer Unit (3500 N / 3 = 1166.7 N).
Selected Ball Transfer Unit, e.g.: R0530 122 10.



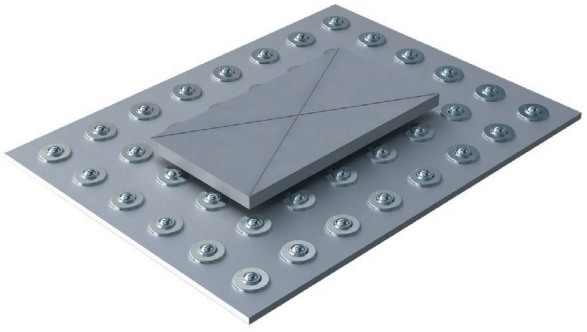


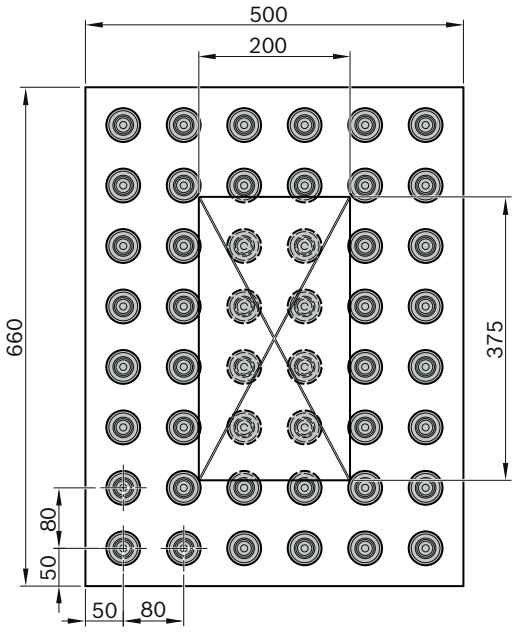
[1)] If the load ball height tolerances are well-correlated, it is possible, depending on the nature of the conveyed article, to also perform the calculation based on the total number of load-bearing Ball Transfer Units.

Scenario C

Arrangement as a square for different items to be transported.

The rectangular item to be transported (375 x 200 mm) has a central center of gravity and is supported by 8 Ball Transfer Units.
The distance of the Ball Transfer Units should not be larger than 80 mm (200 / 2.5 = 80mm).
The mass[1)] (3500 N) is distributed over three Ball Transfer Units and is 1166.7 N per Ball Transfer Unit (3500 N / 3 = 1166.7N).
Selected Ball Transfer Unit, e.g.: R0530 122 10.

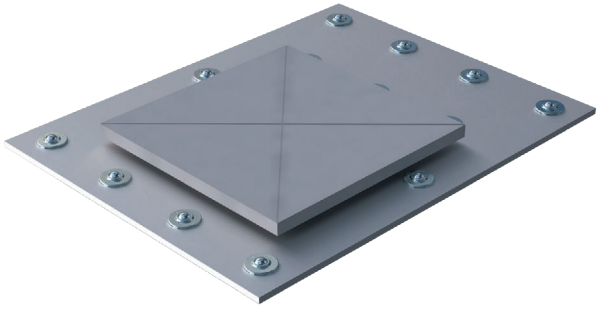


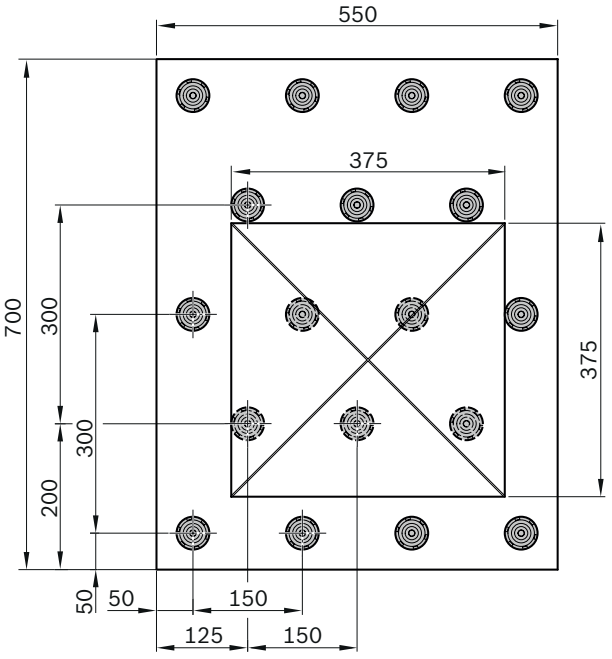


Scenario D

Arrangement as a isosceles triangle.

The square item to be transported (375 x 375 mm) has a central center of gravity and is supported by 5 Ball Transfer Units.
The distance of the Ball Transfer Units should not be larger than 150 mm (375 / 2.5 = 150 mm).
The mass[1)] (3500 N) is distributed over three Ball Transfer Units and is 1166.7 N per Ball Transfer Unit (3500 N / 3 = 1166.7 N).
Selected Ball Transfer Unit, e.g. R0530 122 10





Identification system for short product names

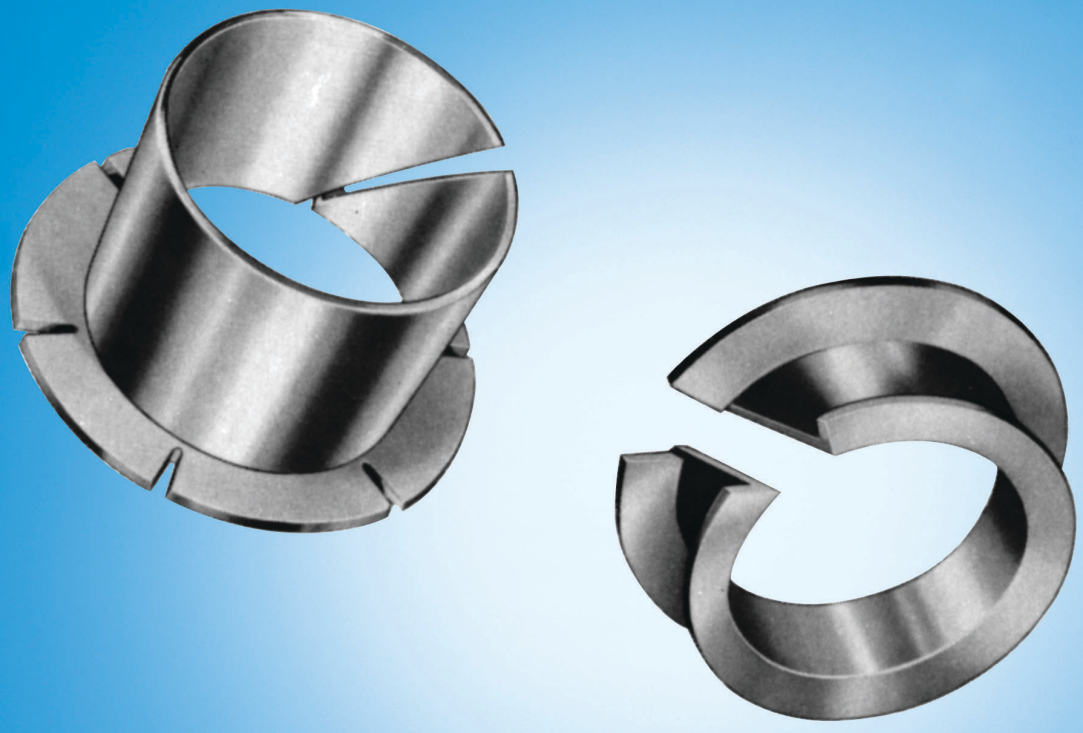
Short product name		Example:	**KUF**	**B**	**15**	**P**	**TF**	**MFG**	**AB**	**SA**
Type	Ball Transfer Unit	= **KU**								
	Ball Transfer Unit, spring-loaded	= **KUF**								
	Ball Transfer Unit with solid steel housing	= **KUM**								
	Ball Transfer Unit without housing	= **KUO**								
	Ball Transfer Unit with reinforced steel housing	= **KUS**								
	Ball Transfer Unit with clip as fastening element	= **KUK**								
	Ball Transfer Unit with plastic housing (lightweight)	= **KUL**								
Version	Bright metal, balls made from antifriction bearing steel	= **A**								
	Cover and housing galvanized, balls made from antifriction bearing steel	= **B**								
	All parts galvanized, balls made from corrosion-resistant steel	= **C**								
	All parts made from corrosion-resistant steel	= **N**								
	Ball cup, balls and ball retaining ring made from corrosion-resistant steel, other parts galvanized.	= **3**								
	Supporting ring and reinforcing ring galvanized, other parts made from corrosion-resistant steel	= **7**								
Load ball Ø	Size	= **15**								
Material	Load balls made from plastic	= **P**								
Variants	Cup spring	= **TF**								
	Helical spring	= **SF**								
	Bottom hole	= **BL**								
	High collar	= **HB**								
	Low collar	= **NB**								
	High load	= **HL**								
	Special version	= **SO**								
Option 1	With felt seal, lubricated	= **MFG**								
	Without felt seal, preserved	= **OFK**								
	With felt seal, preserved	= **MFK**								
	Without felt seal, all parts dry	= **OFT**								
	Without felt seal, lubricated	= **OFG**								
	With felt seal, all parts dry	= **MFT**								
	With felt seal, pre-lubricated	= **MFB**								
Option 2	With wiper	= **AB**								
	With high-temperature wiper	= **HT**								
Option 3	With lube port	= **SA**								

Table shows complete overview. For available versions/options, see Ball Transfer Unit types.

Rexroth
Bosch Group

Plastic Plain Bearings

The Drive & Control Company



Rexroth Linear Motion Technology

Ball Rail Systems	Standard Ball Rail Systems	
	Super Ball Rail Systems	
	Ball Rail Systems with aluminium Runner Block	
	High-Speed Ball Rail Systems	
	Corrosion-resistant Ball Rail Systems	
	Wide Ball Rail Systems	
	Ball Rail Systems with Integrated Measuring System	
	Clamp and Brake Units for Ball Rail Systems	
	Racks for Ball Rail Systems	
	Miniature Ball Rail Systems	
	Cam Roller Guides	
Roller Rail Systems	Standard Roller Rail Systems	
	Wide Roller Rail Systems	
	High-load Roller Rail Systems	
	Roller Rail Systems with Integrated Measuring System	
	Clamp and Brake Units for Roller Rail Systems	
	Racks for Roller Rail Systems	
Linear Bushings and Shafts	Linear Bushings, Linear Sets, Shafts, Shaft Support Rails, Shaft Support Blocks	
	Ball Transfer Units	
	Traditional Technical Parts	
Ball Screw Assemblies		
Linear Motion Systems	Linear Motion Slides	– Ball Screw – Toothed Belt
	Linear Modules	– Ball Screw – Toothed Belt – Gear Rack – Pneumatic Drive – Linear Motor
	Compact Modules	– Ball Screw – Toothed Belt – Linear Motor
	Precision Modules	– Ball Screw
	Ball Rail Tables	– Ball Screw – Linear Motor
	Controllers, Motors, Electrical Accessories	
	Elektric Cylinders	

Plastic Plain Bearings

Plastic Plain Bearings

Plastic Plain Bearings with compensation gap

Introduction

Plain bearing materials have to meet very stringent demands in terms of sliding capacity, toughness, resistance to wear, compression and heat as well as to lubricants and chemicals. Polyamides, the materials used to manufacture Plastic Plain Bearings, satisfy these requirements to a high degree.
If sufficient quantities are ordered, Star can also supply other thermoplasts on special request.

Properties of polyamide 6.6 as a bearing material

Since the majority of Plastic Plain Bearings are manufactured from polyamide 6.6 and very good test results have been obtained with this material, it seems appropriate to give a brief description of its properties at the outset.

Mechanical properties

The compression strength of polyamide 6.6 lies at around 6,000 N/cm^2. Experience has shown that average contact pressures of up to 2,500 N/cm^2 are permissible when the sliding velocity is not too high.
The elongation after fracture is about 120 - 220%. This is the measure of toughness. Tough plastics stand out for their high wear resistance.
Compared to metallic materials, polyamide 6.6 has a very high deformation capacity. This property is a favorable one in plastic plain bearings, which cannot be sealed absolutely dust-free. Any dirt particles penetrating the bearing will become embedded in the plastic and rendered virtually harmless. Polyamide 6.6 also has a very high internal mechanical damping capacity and can thus effectively absorb shaft vibrations. The damping pro-perties of polyamide 6.6 peak at temperatures between 50 and 80° C, the range in which bearings are most commonly used. This is the reason for the smooth and quiet running characteristics of Plastic Plain Bearings. Compared to metallic materials, polyamides have a low modulus of elasticity. This is an advantage in terms of the maximum load capacity of the bearing material. Since shafts under load tend to press into the bearings, better conformity is achieved along with a reduction in maximum contact pressure and edge pressure.

Thermal properties

Polyamide 6.6 is a thermoplast, i.e. the material softens on heating and eventually melts. The melting point lies around 250-255°C.
Wherever possible, the continuous thermal load of polyamide plain bearings should not be allowed to rise above 80°C. Sustained exposure to higher temperatures renders the material brittle, and the bearings wear out very quickly as a consequence.

Polyamide 6.6 has a linear thermal expansion coefficient six times higher than that of metallic plain bearing materials. Special note should be taken of this fact when designing machinery.
By contrast, the thermal conductivity of polyamide 6.6 is substantially lower than that of metals. This is of crucial importance in Plastic Plain Bearings as their bearing capacity is in part determined by the amount of frictional heat that can be dissipated through the given wall thickness.

Absorption of moisture

The rate of absorption and release of atmospheric moisture is so low that the moisture content of saturated parts will not change significantly in the event of rapid changes in the normal climate. Any swelling is, however, easily compensated for by the special design of Plastic Plain Bearings.

Properties of Polyamide 6.6		**Unit**	
Density	**DIN 53 479**	**g/cm³**	**1.12-1.15**
Tensile strength[1)]	DIN 53 455	N/cm²	5,500-6,000
Elongation after fracture[1)]	DIN 53 455	%	120-220
Modulus of elasticity[1)]		N/cm²	170,000
Notch impact toughness[1)]	DIN 53 453	Ncm/cm²	150-200
Cone thrust hardness[1), 4)]		Ncm/cm²	9,000-10,000
Elongation due to static tensile loading[2)]			
at 20°C and 500 N/cm² after 100h		%	0.3
500 N/cm² after 1,000h		%	0.4
1,000 N/cm² after 100h		%	0.7
1,000 N/cm² after 1,000h		%	0.9
2,000 N/cm² after 100h		%	1.8
2,000 N/cm² after 1,000h		%	2.3
Maximum logarithmic damping decrement			
(DIN 53 445) [3)] in the range 20-50°C		-	0.14
50-80°C		-	0.44
Permissible continuous service temperature	High	°C	80-100
	Low	°C	-20
Melting point		°C	250-255
Coefficient of linear thermal expansion		1/K	$7 \cdot 10^{-5}$
Thermal conductivity		W/K · m	0.23
Specific electrical resistance[1)]		Ω cm	1012
Maximum absorption of moisture at 20°C and 65% relative humidity		%	3.4-3.8

Table 1

1) After 4 months storage in a normal climate 20/65 DIN 50014
2) After saturation with moisture at 20°C and 65% relative humidity
3) Dry
4) After 10 impressions at 250 N load

Values as supplied by manufacturer.

Plastic Plain Bearings

Chemical resistance of polyamide 6.6

Polyamide 6.6 is resistant to a great number of chemicals. Plastic Plain Bearings are insoluble in common organic solutions and are not attacked by the majority of weak organic and inorganic acids.
Plastic Plain Bearings are resistant to most of the lubricating oils and greases in use today.

Medium	Concentration %	Resistance	Medium	Concentration %	Resistance
Aluminum chloride, aqueous	10	((1)) to +	Sodium chloride	10	+
Formic acid, aqueous	85	O	Sod. hydroxide sol., aqueous	10	+
Formic acid, aqueous	10	-	Petroleum		+2
Ammonia, aqueous	10	+8	Hydrochloric acid, aqueous	2	-
Gasoline		+	Sulfur		+
Butyric acid		+	Sulfuric acid, aqueous	2	-
Calcium chloride, aqueous	10	+9	Soap solution, aqueous		+
Chlorine gas	100	-	Silicone oil		+
Chlorine water		-	Edible fat		+
Diesel oil		+	Edible oil		+
Acetic acid, conc.		-	Tallow		+
Acetic acid, aqueous	5	+7	Water (sea, river, drinking and condensate)		+7.5
Milk		+			
Lactic acid, aqueous	10	+	Water, hot		((1)) to ((2))
Mineral oil		+0	Wine		+

Table 2

\+ = Resistant, no or only slight changes in weight and dimensions

((1)) = Limited resistance; after prolonged exposure, major changes in weight and dimensions, possible discoloration, weakening, possible slight embrittlement

((2)) = Not resistant; may still be usable under certain conditions (e.g. temporary exposure)

\- = Not resistant; strong attack within a very short period

O = Soluble

The figures alongside the symbols indicate the maximum increase in weight and length in %.

Example: + 11/3 = resistant; 11% max. in-crease in weight, 3% elongation.

Friction and Wear

When mated with steel or other polyamides, polyamide 6.6 exhibits very good sliding properties and wear resistance. This is especially true in the case of dry or mixed friction.
These two types of friction are defined in the usual way, i.e.

Dry friction

Lubricants are, if at all, applied once on installation to improve running in conditions.

Mixed friction

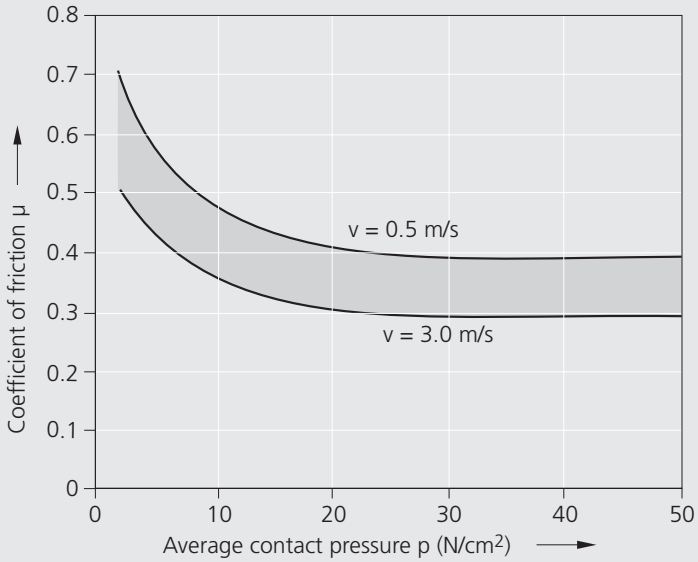
Oil lubrication, but with insufficient dynamic lubrication pressure, resulting in tearing of the lubricant film.

Coefficient of friction

This is influenced by many different factors. The average contact pressure, sliding velocity, temperature, bearing clearance, and running time, as well as the properties of the mating material, the finish of the surfaces sliding relative to each other, the quality and amount of lubricant applied, and the wall thickness of the plastic plain bearings – all of these contribute to the coefficient of friction.

Contact pressure and sliding velocity and their effect on friction

Figure 1 shows that the coefficient of friction declines rapidly with increasing bearing load. It is less dependent on the sliding velocity and decreases at a much slower rate as the sliding velocity rises.

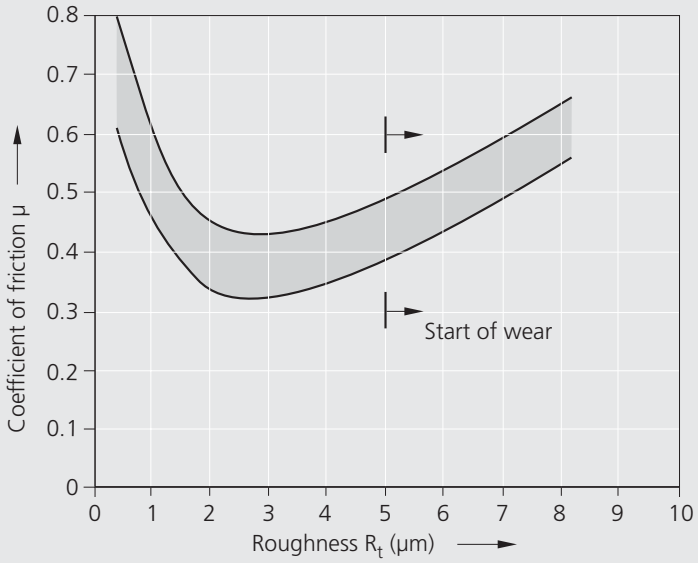


Coefficient of friction as a function of contact pressure. Dry running. Polyamide 6.6 mated with hardened and ground case hardening steel 16MnCr5. Roughness R_t 2.5 µm, sliding velocity v = 0.5-3 m/s, temperature at bearing surface = 20-30°C.

Figure 1

Roughness of the mating material and its effect on friction

Figure 2 shows that the roughness of the shaft surface has a pronounced effect on the coefficient of friction. The curve clearly illustrates that both very smooth and very rough surfaces produce high sliding friction, while the friction reaches a definite low at between 2 and 3 µm roughness.



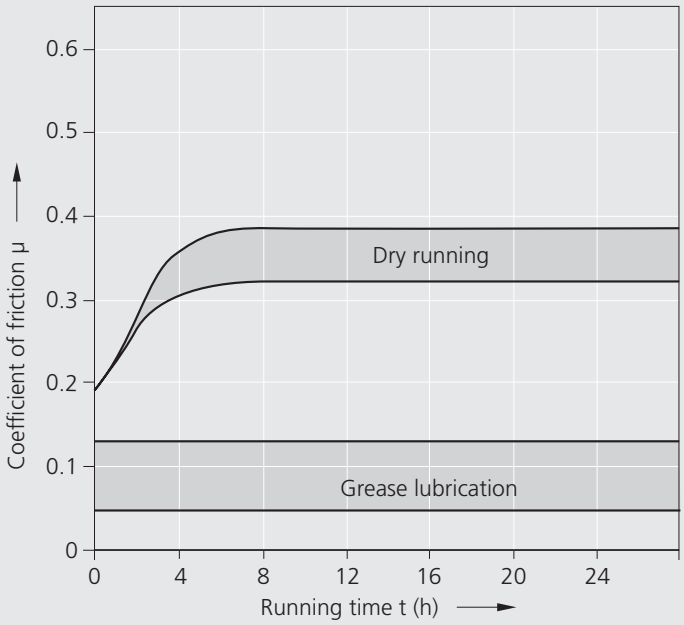
Coefficient of friction as a function of roughness of the steel surface. Dry running. Polyamide 6.6 mated with hardened and ground case hardening steel 16MnCr5. Sliding velocity v = 1 m/s, temperature at bearing surface = 20-30°C, average contact pressure p = 15 N/cm².

Figure 2

Plastic Plain Bearings

Time and its effect on friction

Figure 3 shows that, for dry running, the steady state value is reached after a running in period of about 5 hours.
No running in period is required when the bearing is grease lubricated.



Coefficient of friction as a function of running time for dry running and grease lubrication. Polyamide 6.6 mated with hardened and ground case hardening steel 16MnCr5. Roughness R_t 2.5 µm, for dry running
$p \cdot v = 6$ N/cm² · m/s, when greased
$p \cdot v = 18$ N/cm² · m/s, bearing temperature 60°C.

Figure 3

Coefficient of friction values

The load capacity calculations (see page 11) are based on average conditions. The following values are recommended:

Type of lubrication	Coefficient of friction µ
Dry running	0.35
Non-recurring grease lubrication	0.12
Sustained release grease lubrication	0.09
Oil mist	0.09
Water lubrication (mixed friction)	0.04
Oil lubrication (mixed friction	0.04

Table 3

Wear

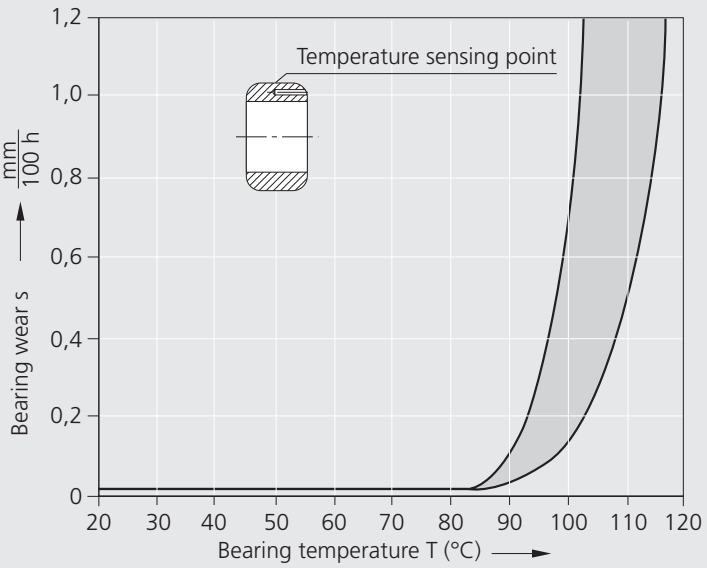
Provided the wall thickness has been properly dimensioned, the bearing temperature does not exceed 80°C, and the shaft surface has a roughness of 2 to 4 µm with a surface hardness of 45 Rockwell C, the wear on Plastic Plain Bearings will be virtually undetectable.
Softer shafts, smoother or rougher surfaces (Figure 2) or bearing temperatures above 80°C will cause a higher wear rate. If Plastic Plain Bearings are to run under corrosive conditions, corrosion-resistant steel is a more appropriate choice for the shaft material than brass or bronze, as the latter materials tend to wear too rapidly.

Temperature and its effect on wear

Figure 4 shows that the rate of bearing wear is minimal up to a temperature of 80°C. At temperatures above 80°C, Plastic Plain Bearings wear very quickly as the bearing surface embrittles at these high temperatures and is rapidly abraded.

Wall thickness and its effect on wear

As polyamide 6.6 is a poor thermal conductor, increasing wall thickness would cause heat to build up, with a consequent sharp rise in the bearing surface temperature. This would result in premature wearing of the bearings.



Bearing wear as a function of bearing temperature.
Polyamide 6.6 mated with hardened and ground steel.

Figure 4

Design Options and Dimensions

Plastic Plain Bearings are manufactured in two designs.
Type 1320-5 .. and Type 1320-7..

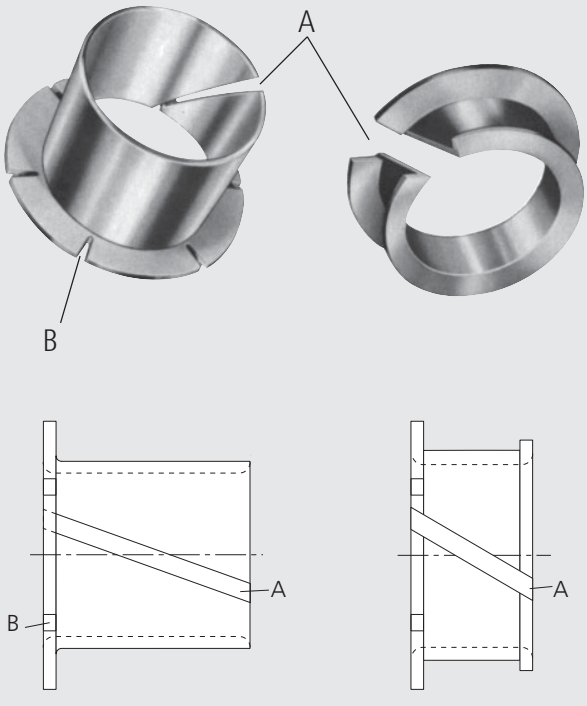


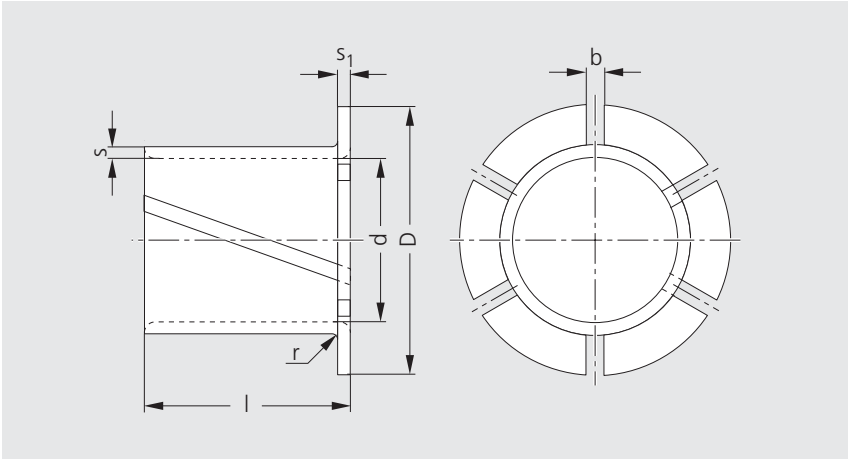
Figure 5

Plastic Plain Bearings

Both types have been provided with a so-called compensating gap "A" in the longitudinal axis (see Figure 5).
This compensating gap balances out almost all dimensional deviations due to absorption of moisture or changes in temperature.
It also accumulates lubricant in greased bearings and helps to distribute the grease throughout the bearing.
Type 1320-5.. is a plastic plain bearing with one collar. The collar is intended as a simple holding device to guard against axial shifting, but it can also take up any arising axial forces. The radial slits "B" (Figure 5) in the collar have the same function as the compensating gap "A".
Type 1320-7.. is equipped with two collars of different size. This type was specifically designed for installation in metal bearing plates up to a maximum thickness of 2 mm. The two collars ensure that the Plastic Plain Bearing remains securely lodged within the bearing plates. When installing this type, care must be taken to fit the bearing with the large collar on the side subjected to axial forces. The compensating gap "A" allows Plastic Plain Bearings to be compressed until the smaller collar can be easily twisted into the mounting bore of the metal bearing plate. When installing the bearing, make sure the gap is uppermost and insert the bearing into the mounting bore beginning with the left-hand end. When the bearing is twisted to the right it will automatically draw itself the bore. If they have been installed correctly, Plastic Plain Bearings will recover their shape and sit snugly within the plate.

Dimensions

Type 1320-5..-00

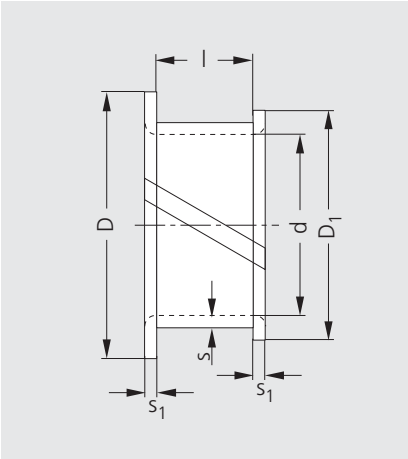


Part number	Dimensions (mm)								
	d	D	l[1)]	s	Permissible deviation	s_1	Permissible deviation	b	r max
1320-504-00	4	7	4.6	0.6	-0.06	0.6	-0.06	0.9	0.25
1320-505-00	5	8	5.6	0.6	-0.06	0.6	-0.06	0.9	0.25
1320-506-00	6	9.5	6.6	0.6	-0.06	0.6	-0.06	0.9	0.25
1320-508-00	8	12	8.8	0.8	-0.06	0.8	-0.06	1.3	0.4
1320-510-00	10	15	10.8	0.8	-0.06	0.8	-0.06	1.3	0.4
1320-512-00	12	18	12.8	0.8	-0.07	0.8	-0.06	1.3	0.4
1320-514-00	14	21	14.8	0.8	-0.07	0.8	-0.06	1.3	0.4
1320-516-00	16	24	16.8	0.8	-0.07	0.8	-0.06	1.3	0.4
1320-520-00	20	30	20.8	0.8	-0.08	0.8	-0.06	1.3	0.4
1320-525-00	25	37.5	26.2	1.2	-0.08	1.2	-0.06	1.8	0.5

Table 4

1) Use length l-s_1 for calculations

Type 1320-7..-00



Part number	Dimensions (mm)							
	d	D	D_1	l	s	Deviation	s_1	Deviation
1320-703-00	3	6	4.8	2	0.6	-0.06	0.6	-0.06
1320-704-00	4	7	5.9	2	0.6	-0.06	0.6	-0.06
1320-705-00	5	8	6.8	2	0.6	-0.06	0.6	-0.06
1320-706-00	6	11	7.8	2	0.6	-0.06	0.6	-0.06
1320-708-00	8	13	10.4	2	0.8	-0.06	0.8	-0.06
1320-710-00	10	15	12.4	2	0.8	-0.06	0.8	-0.06
1320-712-00	12	17	14.4	2	0.8	-0.07	0.8	-0.06

Table 5

Calculating the Bearing Load Capacity, Nominal Life and Clearance

When calculating the load capacity and the nominal life of Plastic Plain Bearings, the following factors, among others, have to be taken into account:

- Sliding velocity
- Average contact pressure
- Frictional heat
- Wear
- Bearing clearance.

The average contact pressure is calculated using the equation

$$p = \frac{F}{l \cdot d} \ [N/cm^2] \qquad (1)$$

where

F = bearing load (N)
l = width of the Plastic Plain Bearing (cm)
For Type 1320-5.. the value l should be substituted by ($l-s_1$).
d = bearing diameter (cm)

Plastic Plain Bearings

At low sliding velocities, the average contact pressure is 2,500 N/cm^2.
This value is used as $p_{perm.}$ in the load capacity calculations.

$$p_{perm.} = 2{,}500 \text{ N/cm}^2 \quad (2)$$

For bearings with higher sliding velocities, $p_{perm.}$ has to be limited according to equation (5) or (6).

The heat developing in the bearing is calculated as follows from the work consumed by friction:

$$Q_1 = p \cdot l \cdot d \cdot v \cdot \mu \quad (3)$$

v = sliding velocity (m/s)
μ = coefficient of friction

The values for the coefficient of friction can be taken from Table 3.

The heat that can be dissipated from the bearing due to the temperature differential is partly dissipated through the plastic plain bearing
and partly through the steel shaft.

$$Q_2 = K_1 \cdot \frac{\pi \cdot l \cdot d}{s} \cdot \lambda \cdot \Delta\vartheta + K_2 \cdot \frac{2\pi \cdot d^2}{4 \cdot d} \cdot \lambda_s \cdot \Delta\vartheta \quad (4)$$

K_1 and K_2 are dimensionless factors indicating the way in which the bearing heat components dissipated through the Plastic Plain Bearing and the shaft are affected by the bearing construction. Generally the following values can be expected:

K_1 = 1/2
K_2 = 1/24
λ = thermal conductivity of polyamide
= 0.23 W/K · m
λ_s = thermal conductivity of steel
= 46 W/K · m
s = wall thickness of Plastic Plain Bearings
$\Delta\vartheta$ = temperature differential (K or °C).

Equations (3) and (4) are used to derive the conditions under which the frictional heat can be dissipated from the bearing at a temperature differential of $\Delta\vartheta$:

$$(p \cdot v)_{perm.} = \frac{K_1 \cdot \pi \cdot \lambda \cdot \Delta\vartheta}{\mu \cdot s} + \frac{K_2 \cdot \pi \cdot \lambda_s \cdot \Delta\vartheta}{\mu \cdot 2 \cdot l} \quad (5)$$

This calculation cannot be applied to bearings with continuous water or oil lubrication.

Equation (5) is a quantity equation.

This results in the following numerical-value equation:

$$(p \cdot v) \leqq 37.3 \cdot 10^{-3} \cdot \frac{\Delta\vartheta}{\mu} \cdot \left(\frac{1}{s} + \frac{8.33}{l}\right)$$

[N/cm^2 · m/s] (6)

μ = coefficient of friction (as per Table 3)
s = wall thickness of Plastic Plain Bearings in mm (Tables 4 and 5)
l = width of Plastic Plain Bearings in mm. (For Type 1320-5.. the value l should be substituted by (l-s_1)).

The p · v values thus obtained for plastic plain bearings at an ambient temperature of 20°C or $\Delta\vartheta$ of 60°C can be read off from Table 6.
At higher ambient temperatures, the $\Delta\vartheta$ value reduces, as does the p · v value in accordance with equation (6).

Permissible p · v values for an ambient temperature of 20°C

Part number	$(p \cdot v)_{perm.} \left[\frac{N}{cm^2} \cdot \frac{m}{s}\right]$		
	Dry running	Non-recurring grease lubrication	Continuous grease lubrication
1320-504-00	24	70	93
1320-505 00	21	62	83
1320-506-00	20	57	76
1320-508-00	15	43	57
1320-510-00	13	39	52
1320-512-00	12	36	48
1320-514-00	12	34	46
1320-516-00	11	33	44
1320-520-00	11	31	42
1320-525-00	7	21	29
1320-703-00	37	110	150
1320-704-00	37	110	150
1320-705-00	37	110	150
1320-706-00	37	110	150
1320-708-00	35	100	135
1320-710-00	35	100	135
1320-712-00	35	100	135

Table 6

The specific bearing pressure p in N/cm² can be read off from the chart (Figure 6) for the circumferential velocity relating to the permissible p · v value. A specific bearing pressure of p = 1,400 N/cm² was selected for the static load capacity.

Bearing wear

If the bearing temperature does exceed 80°C, hardened and ground steel shafts are used, and the bearing wear is virtually undetectable.
As the wear "S" increases when the temperature climbs above 80°C and presumably rises proportionately with the length of running time, it can be calculated as follows:

$$S = k \cdot \left(\frac{\vartheta - \vartheta_0}{\vartheta_0}\right)^{\chi} \cdot t \quad [mm] \qquad (7)$$

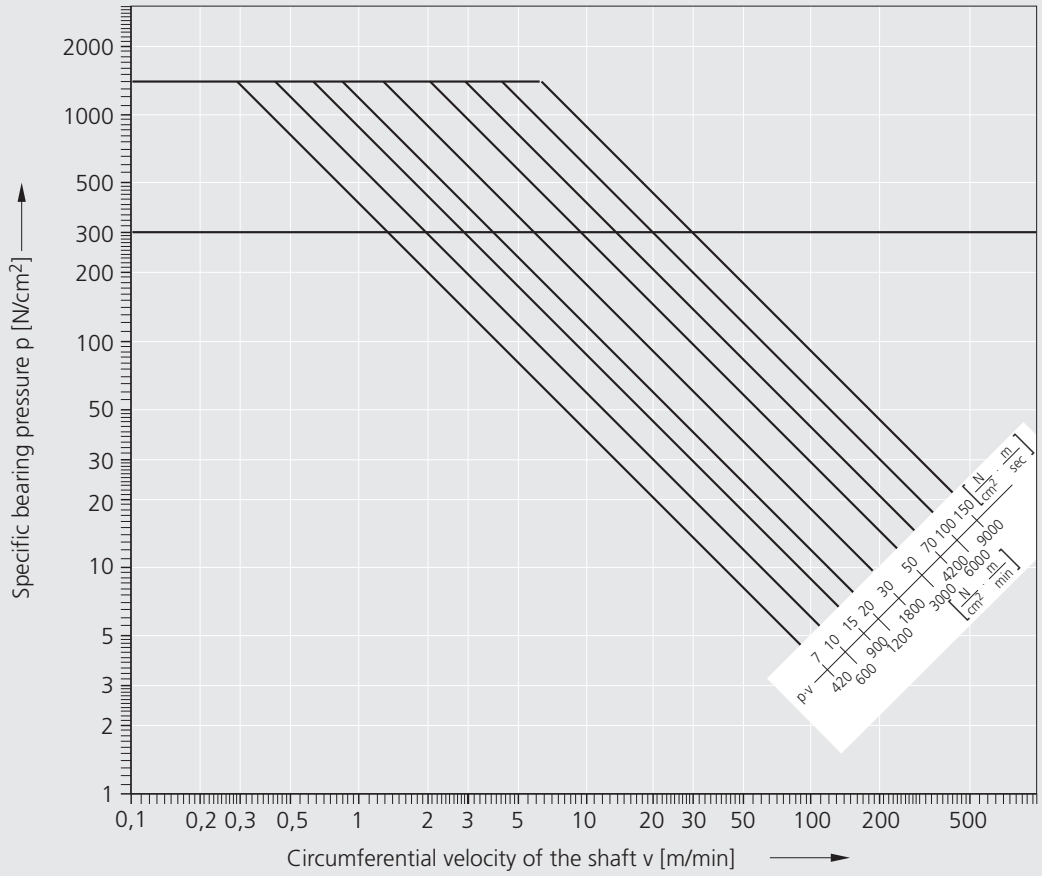
where

k = 1/6 (constant)
x = 3 (constant)
ϑ = service temperature
ϑ_0 = 80°C
t = time in hours

The maximum permissible wear rate to be expected with Plastic Plain Bearings is

$$S = 0.2 \text{ mm} \qquad (8)$$

Plastic Plain Bearings



Load capacity of Plastic Plain Bearings as a function of the circumferential velocity of the shaft and the p · v value.

Figure 6

Nominal life

The nominal life of Plastic Plain Bearings can be calculated from equation (7) as follows:

$$t = \frac{S_{perm.}}{k \cdot \left(\frac{\vartheta - \vartheta_o}{\vartheta_o}\right)^{\chi}} \text{ [hours]} \qquad (9)$$

This equation is valid for $\vartheta > 80°C$. Calculating the nominal life for $\vartheta < 80°C$ would serve no useful purpose as the bearing wear is hardly detectable and thus not reproducible.

Bearing clearance

The bearing clearance must be dimensioned such that the bearing will not jam in the event of excessive enlargement of Plastic Plain Bearings as a result of temperature rises or changes in the moisture content. Conversely, the clearance must not be unnecessarily wide, as this would cause irregular running characteristics.
Experience has shown that, even in the worst case, there should still be a minimum clearance of

$$h_0 = 0.004 \cdot d \text{ [mm]} \qquad (10)$$

For an increase in temperature of $\Delta\vartheta_1$ and a relative change in the linear dimensions due to a rise of ε_f in the moisture content, the volume of Plastic Plain Bearings will increase by

$$\Delta V = 3\,(\varepsilon_f + \alpha \cdot \Delta\vartheta_1) \cdot V \qquad (11)$$

where

ε_f = linear expansion factor for the moisture content:
= 0.003 for non water lubricated bearings
= 0.020 for water lubricated bearings

α = Coefficient of linear expansion according to Table 1
$= 7 \cdot 10^{-5} \ \frac{1}{K}$

$\Delta\vartheta_1 = \vartheta_{max}$ -20°C

ϑ_{max} is the maximum temperature arising at the bearing point. This is arrived at by adding $\Delta\vartheta$ according to equation (6) to the ambient tem-perature. ϑ_{max} should not exceed 80°C. If the ambient temperature is 20°C, then $\Delta\vartheta_1 = \Delta\vartheta$.
Equation (11) applies when expansion is not restricted in any direction. However, even assuming that the full volume change will occur and that the material will expand exclusively to the detriment of the bearing clearance, the calculation still provides an additional safety margin. The clearance would in this case narrow by

$$3 \cdot s \cdot (\varepsilon_f + \alpha \cdot \Delta\vartheta_1)$$

Taking the minimum permissible clearance into consideration and remembering that a great proportion of the change in volume is taken up by the compensating gap in Plastic Plain Bearings, the minimum permissible clearance can be calculated as follows:

$$h = 0.004 \cdot d + 3s\,(\varepsilon_f + \alpha \cdot \Delta\vartheta_1)\ [mm] \qquad (12)$$

Load capacity

Type 1320-5..-00
Radial load capacity [N]

Part number	Static load capacity	50 rpm			100 rpm			250 rpm		
		Dry running	Grease lubrication		Dry running	Grease lubrication		Dry running	Grease lubrication	
	(N)		once	cont.		once	cont.		once	cont.
1320-504-00	220	220	220	220	180	220	220	70	210	220
1329-595-99	359	350	350	350	200	350	350	80	235	315
1320-506-00	500	450	500	500	225	500	500	90	260	350
1320-508-00	900	450	900	900	225	655	870	90	260	350
1320-510-00	1400	510	1400	1400	255	745	990	100	300	395
1320-512-00	2000	565	1650	2000	285	825	1100	115	330	440
1320-514-00	2750	630	1820	2470	315	910	1230	125	365	495
1320-516-00	3600	690	2020	2690	345	1010	1340	140	405	540
1320-520-00	5600	815	2370	3210	410	1180	1600	160	475	640
1320-525-00	8750	705	2060	2770	350	1030	1380	140	410	550

Table 7

The axial load that can be taken up by the bearing collar must never exceed 25% of the radial load capacity. The shaft collar diameter must also correspond to dimension "D" in Table 4.

The values given are valid for a bearing temperature of ≦ 80°C and an ambient temperature of 20°C.

Plastic Plain Bearings

Type 1320-7..-00
Radial load capacity [N]

Part number	Static load capacity	50 min-1			100 min-1			250 min-1		
		Dry running	Grease lubrication		Dry running	Grease lubrication		Dry running	Grease lubrication	
	(N)		once	cont.		once	cont.		once	cont.
1320-703-00	85	85	85	85	85	85	85	57	85	85
1320-704-00	112	112	112	112	112	112	112	57	112	112
1320-705-00	140	140	140	140	140	140	140	57	140	140
1320-706-00	168	168	168	168	143	168	168	57	166	168
1320-708-00	225	225	225	225	133	225	225	53	154	205
1320-710-00	280	265	280	280	133	280	280	53	154	205
1320-712-00	335	265	335	335	133	335	335	53	154	205

Table 8

The axial load that can be taken up by the bearing collar must never ex-ceed 25% of the radial load capacity.
The shaft collar diameter must also correspond to dimension "D" in Table 5.
The values given are valid for a bearing temperature of ≦ 80°C and an ambient temperature of 20°C.

Calculation example

A gear drive shaft is to run in Plastic Plain Bearings. The shaft diameter is 20 mm and the drive speed is 100 min^{-1}. Two Plastic Plain Bearings 1320-520-00 have been selected. The load per bearing is 1,000 N. The bearings are to be greased once on installation. The permissible bearing wear is assumed to be 0.2 mm.
In order to achieve long service life the bearing temperature should not exceed 80°C (at 20°C ambient temperature).
The task is to check whether the chosen bearing type is adequate, what service life can be expected and what bearing clearance is required.

Average contact pressure

According to equation (1), the average contact pressure is:

$$p = \frac{F}{l \cdot d} = \frac{1000}{2.0 \cdot 2.0} = 250 \text{ N/cm}^2$$

Permissible p · v value

According to Table 6, the perm. p · v value for non-recurring greasing of the Plastic Plain Bearing 1320-520-00 is 31 [$N/cm^2 \cdot m/s$].

For p = 250 N/cm^2 and the permissible p · v value 31 [$N/cm^2 \cdot m/s$] a circumferential velocity of 7.5 [m/min] can be read off from the chart (Figure 6).

The circumferential velocity of the drive shaft is:
$v = d \cdot \pi \cdot n = 0.02 \cdot 3.14 \cdot 100$
$= 6.28$ m/min

The calculated value is less than the value of 7.5 m/min read off from the chart, i.e. the proposed lubrication method is adequate. The actual p · v value is:

$$p \cdot v = 250 \cdot \frac{6.28}{60}$$

$$= 26.2 \ [N/cm^2 \cdot m/s]$$

Calculation of the actual bearing temperature $\Delta\vartheta$

After entering the appropriate values in equation (6), the arising bearing temperature can be calculated as follows:

$$\Delta\vartheta = \frac{p \cdot v \cdot \mu}{37.3 \cdot 10^{-3} \cdot \left(\frac{1}{s} + \frac{8.33}{l}\right)}$$

According to Table 3, a value of 0.12 is to be substituted for μ

$$\Delta\vartheta = \frac{26.2 \cdot 0.12}{37.3 \cdot 10^{-3} \cdot \left(\frac{1}{0.8} + \frac{8.33}{20}\right)}$$

$= 51$ K or °C

Calculating the nominal life

In this case, calculating the nominal life would not serve any useful purpose since the arising bearing tem-perature does not exceed 80°C. The actual p · v value of 26.2 [$N/cm^2 \cdot m/s$] lies below the perm. p · v value of 31[$N/cm^2 \cdot m/s$].

Calculation of the required bearing clearance

According to equation (12), the required bearing clearance can be calculated as follows:

$h = 0.004 \cdot d + 3 \cdot s \, (\varepsilon_f + \alpha \cdot \Delta\vartheta)$
ε_f is replaced by 0.003
$\alpha = 7 \cdot 10^{-5}$
$h = 0.004 \cdot 20$
$+ 3 \cdot 0.8 \, (0.003 + 7 \cdot 10^{-5} \cdot 51°)$
$= 0.096$ mm.

The bearing clearance after mounting should be 0.096 mm. Alternatively, the housing bore should be dimensioned as follows:

Housing bore $= (d + 2 \cdot s + h)^{H7}$
$= (20 + 2 \cdot 0.8 + 0.096)^{H7} = 21.7^{H7}$

Mounting Instructions for Plastic Plain Bearings

When mounting Plastic Plain Bearings, the nominal dimension of the shaft should ideally be equal to the bearing bore "d". We recommend a tolerance of "h7". The housing bore is then calculated using d + 2s and the required bear-ing clear-ance, the recommended tolerance being H 7. Alternatively, one can start with the housing bore, i.e. d + 2s, and go on to calculate the shaft diameter in accordance with the required bearing clearance. When installing the bearings care should be taken not to stress them, as this will prevent full compensation of any changes in volume. Plastic Plain Bearings should never be bonded to shafts or in the housing.

Mounting examples

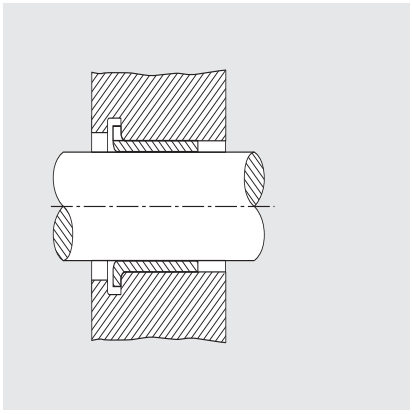


Figure 7: Cylindrical shaft.
The collar of the Plastic Plain Bearing snap-fits into a groove milled into the housing. The groove must be wider than dimension s_1 as per Table 4.

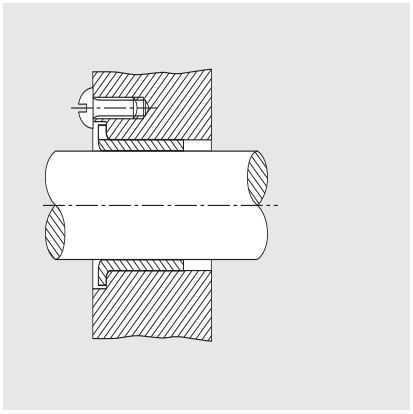


Figure 9: Cylindrical shaft.
Axial retention by means of a screw. The recess in the housing must be deeper than dimension s_1 as per Table 4.

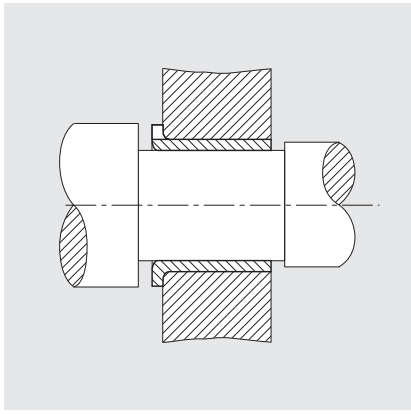


Figure 11: Cylindrical housing bore. Axial retention by means of a recessed shaft with large collar on one side. Absorption of axial forces possible.

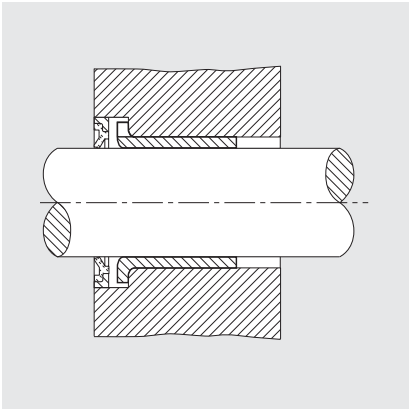


Figure 8: Cylindrical shaft.
Axial retention by means of end seal. The recess in the housing must be deep enough to ensure that the collar of the Plastic Plain Bearing will not be pinched.

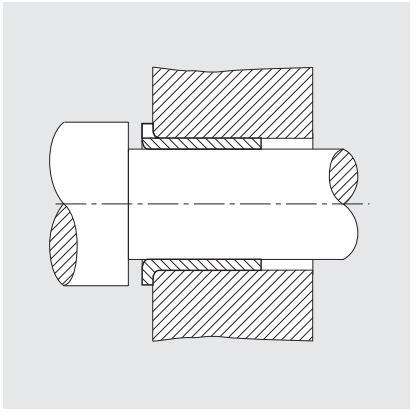


Figure 10: Cylindrical housing bore. Axial retention by means of the collar in the stepped shaft.
Absorption of axial forces possible.

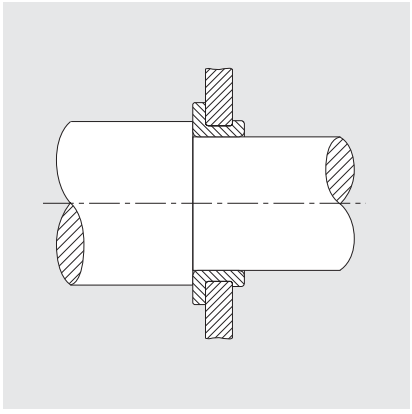


Figure 12: Type 1320-7.. with stepped shaft. The larger shaft diameter is on the side of the larger-diameter collar of the Plastic Plain Bearing. Absorption of axial forces possible.

Plastic Plain Bearings

Mounting examples

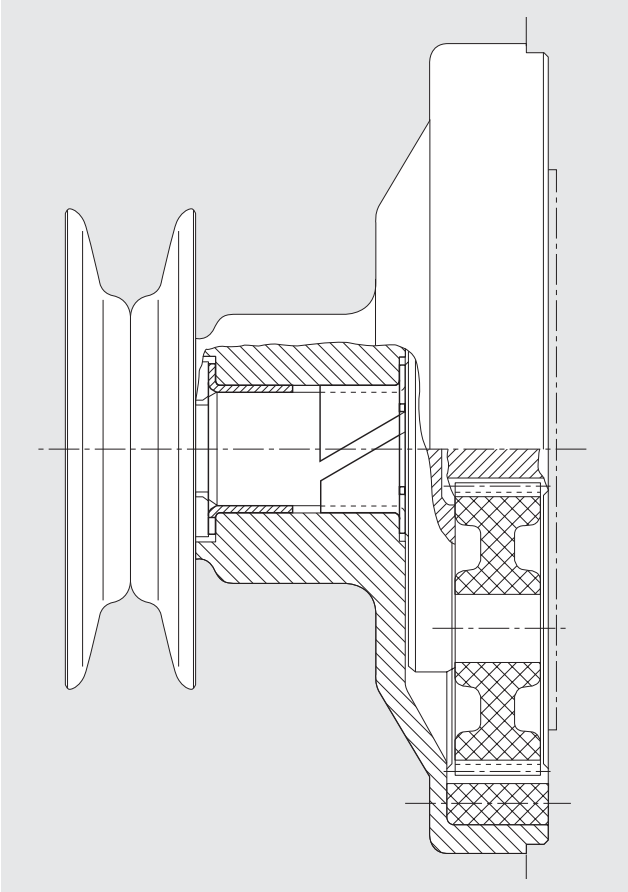


Figure 13: Gear for washing machine
with Plastic Plain Bearing Type 1320-5..

Input speed	1,330 min^{-1}
Output speed	130 min^{-1}
Drive torque	520 Ncm
Belt tension on belt pulley	400 N

$p \cdot v_{max} = 64\ N/cm^2 \cdot m/s$

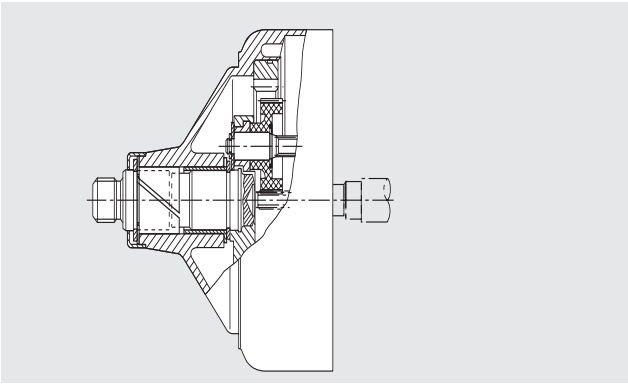


Figure 14: Gear for ironing machine
with Plastic Plain Bearing Type 1320-5..

Input speed	1,400 min^{-1}
Output speed	5.83 min^{-1}
Drive torque	20 Nm

$p \cdot v_{max} = 2.8\ N/cm^2 \cdot m/s$

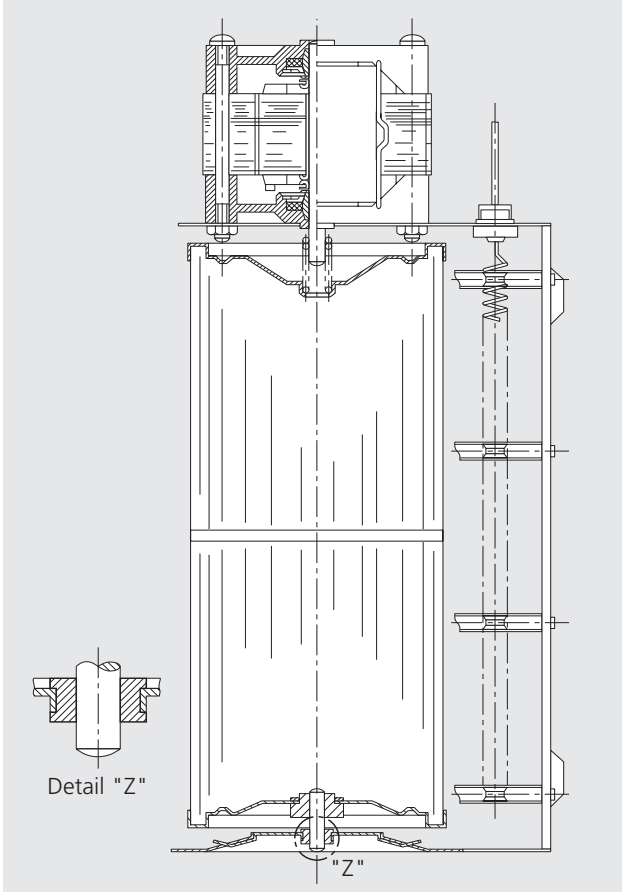


Figure 15: Cross flow fan
with Plastic Plain Bearing Type 1320-7..

Speed	approx. 1,600 min^{-1}
Load	very low
Temperature	max. 85°C

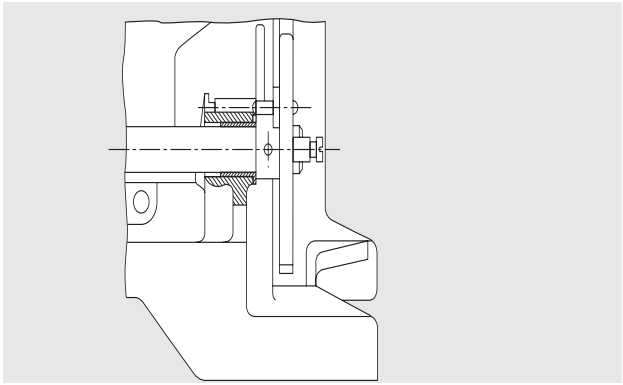


Figure 16: Typewriter shift shaft fitted with a
Plastic Plain Bearing Type 1320-5..

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