



Dr. TRETTER



TOLERANCE RINGS



THE SMART SHAFT-HUB CONNECTION

**„WE CREATE MOVING SOLUTIONS
IN LINEAR AND DRIVE
TECHNOLOGY.“**



Dr. TRETTER



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TOLERANCE RING: THE EFFICIENT SHAFT-HUB CONNECTION

Tolerance sleeves enable fast, reliable and economical assembly of cylindrical components. They create a backlash-free connection that reliably transmits torques and axial forces. At the same time, they serve for positioning or as mechanical overload protection.

During press-fitting, the sleeve deforms elastically and adapts precisely to the tolerances between the bore and the shaft. This creates a force-fit connection that works reliably over the long term.

RELIABLE QUALITY

We develop and manufacture tolerance sleeves in a precisely coordinated process and subject each series to strict quality control. This enables us to guarantee consistent top quality – from small series to large quantities.

We consistently use high-quality materials such as rust-resistant spring steel or, depending on requirements, special materials. This means that our tolerance sleeves are also suitable for demanding conditions with high temperatures, aggressive media or dynamic loads.

WIDE RANGE OF APPLICATIONS

Our tolerance sleeves are used in drive technology, the automotive industry, robotics, pump construction and conveyor technology, among other areas – wherever precise alignment, elastic mounting or the compensation of tolerances and different thermal expansions are crucial.

Our tolerance sleeves made of corrosion-resistant steel (material 1.4310) are characterised by high mechanical strength. They retain their spring properties up to 250 °C and remain reliably functional even during short-term temperature peaks of up to 300 °C – ideal for applications with thermal cycling, such as in food processing, medical technology or offshore engineering.



NEED A CUSTOMISED SOLUTION?

Our experts will be happy to advise you on selecting and designing the optimum tolerance sleeve for your application. Together, we will develop precisely fitting components that make your connection technology more efficient and reliable.

ADVANTAGES OF A TOLERANCE RING



Tolerance compensation – backlash-free connection of components even with large tolerances in external dimensions



Overload protection through torque transmission and limitation



Temperature compensation – compensation for different thermal expansions of the components to be joined



Secure power connection – reliable connection despite large tolerances in the connecting parts



Cost savings – up to 40% cheaper than a keyed connection



Bearing alignment – compensation for angular misalignment, misalignment and centre misalignment



Easy assembly | Disassembly



THE SPRING FORCE PRINCIPLE

Our tolerance sleeves are made of slotted spring steel strip with a corrugated surface. When pressed into the bore, the corrugations flexibly adapt to the shape and act like many small pressure springs distributed all around. The result is a uniform, force-fit connection. Compared to traditional methods such as pressing and gluing, they offer clear added value:

- + Simple, time-saving installation without curing time
- + Can be dismantled and reused
- + Compensation for different thermal expansions
- + Compensation for misalignment and centre misalignment

WHY IT IS WORTH USING A TOLERANCE RING

Requirement: Three toothed belt pulleys are to be attached to a shaft with a diameter of 8 mm.

TWO OPTIONS:

TOLERANCE RING

Tolerance Ring BN08-515 - 5,7Nm

PARALLEL KEY

Parallel Key 12mm * 3mm - 5,8 Nm

THE COMPARISON

75,00 €
28,00 €
1,20 €
0,00 €

104,20 €

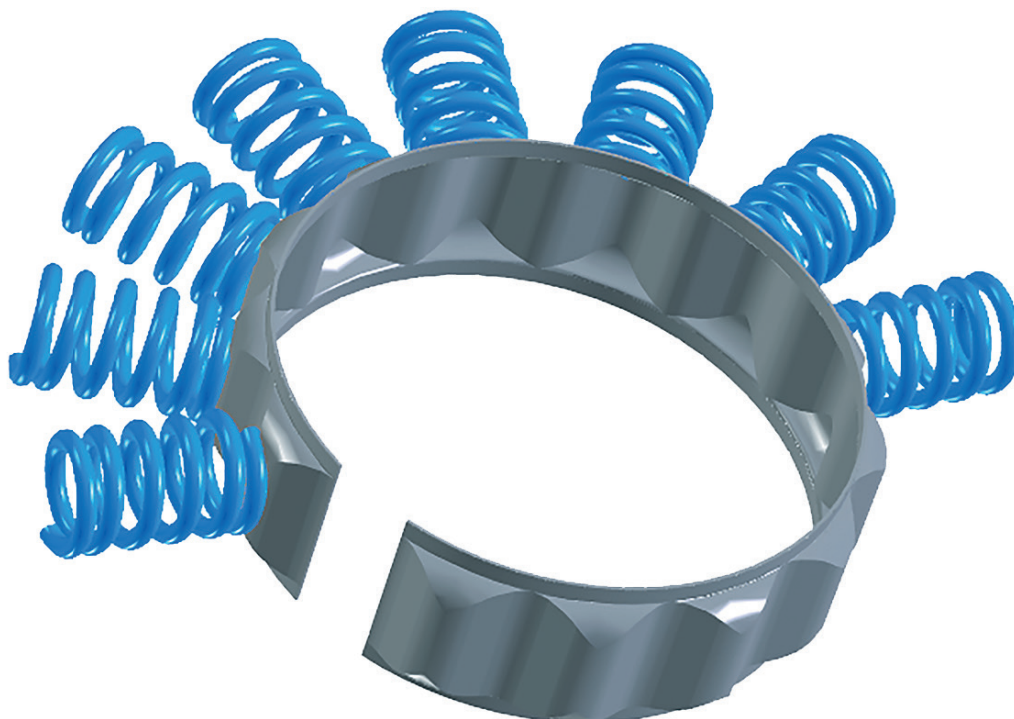
3x toothed belt pulley
Wave Ø 8 mm, 200 mm long
3x Tolerance ring | Parallel key
4x retaining ring

96,00 €
71,00 €
0,72 €
0,24 €

167,96 €

CONCLUSION

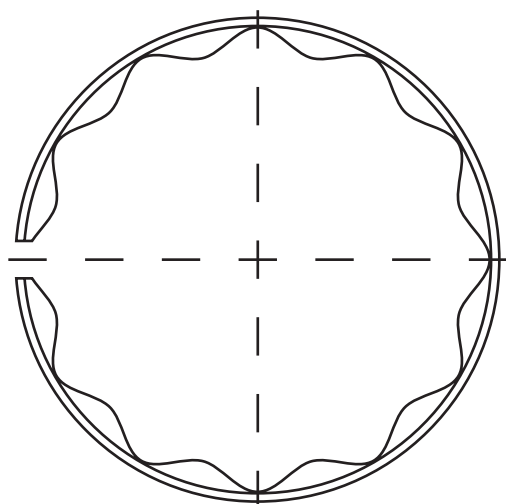
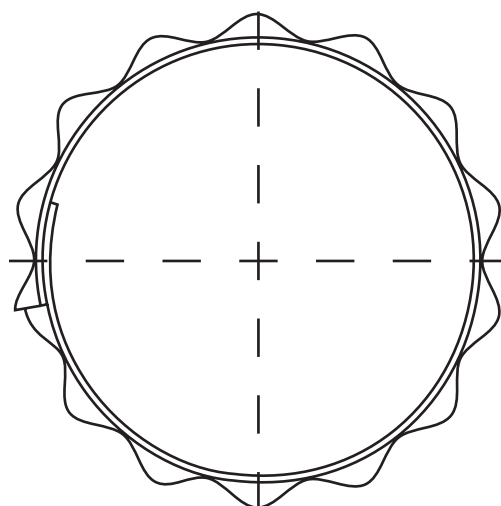
**THE TOLERANCE RING IS 38% CHEAPER
THAN THE CONVENTIONAL OPTION.**





FORM BN

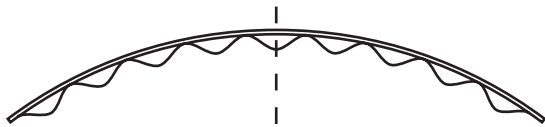
The flat, circumferential edges are located on the inner diameter of the tolerance sleeve. In the delivery state, the ends overlap so that the sleeve is closed. Only when it snaps onto the shaft does it open slightly, creating a gap and allowing the edges to fit tightly against the shaft. The shaft and mounted sleeve are then inserted into the prepared bore. For form BN, a maximum bore tolerance of H9 usually applies. The matching shaft seat is manufactured according to the table values for form BN to ensure proper functioning.



FORM AN

For shaft diameters with a standard tolerance of up to h9, the corresponding bore is manufactured in accordance with the table values for form AN. The tolerance sleeve is then inserted and, thanks to its special geometry, clamps itself automatically into the bore – its ends are further apart in the delivery state than after installation. The flat, circumferential edges on the outer diameter of the sleeve ensure uniform contact with the bore wall and also support centring.

PRECISELY TAILORED TO EVERY APPLICATION.



FORM AL

This curved design is a lightweight version of the AN series. It was specially developed for mounting the outer ring of smaller ball bearings so as not to reduce the bearing clearance.



INSTALLATION TYPES

FREE

In free installation, smooth shafts with through holes are connected cost-effectively. An assembly aid fixes the tolerance sleeve axially. The transmissible torque is reduced by up to 20% and a centre misalignment of up to 10% of the shaft height can occur.

CENTRED

Used when precise centring or radial shocks exceeding the permissible radial load occur. The precise fit between the shaft and bore ensures maximum concentricity and prevents deflection and damage to the tolerance rings.

SUPPORTED

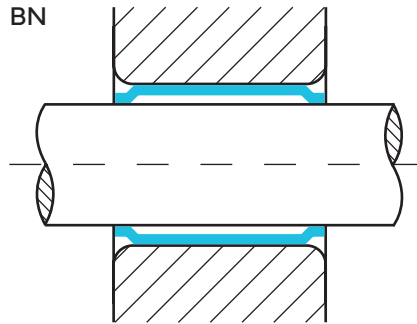
Used when cost-effective centring is required and 'wandering' under unfavourable radial loads is to be avoided. At the same time, it simplifies the installation of the ring.

MULTIPLE

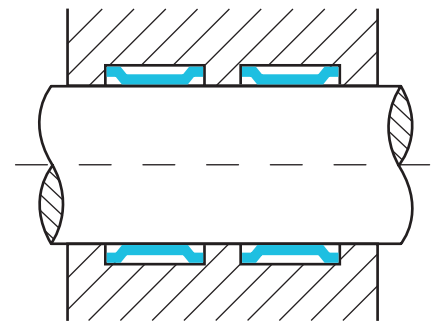
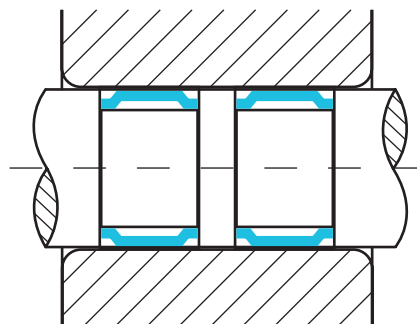
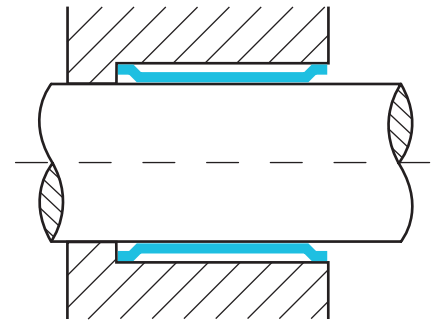
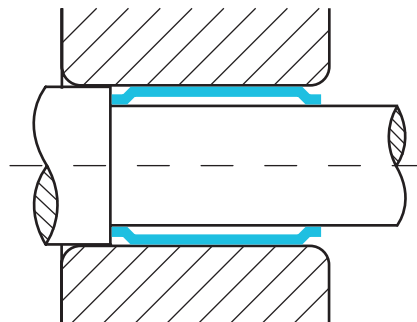
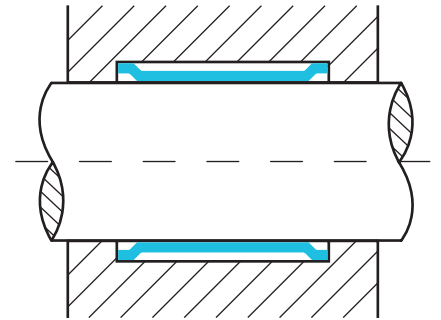
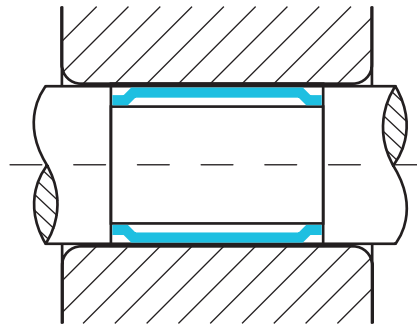
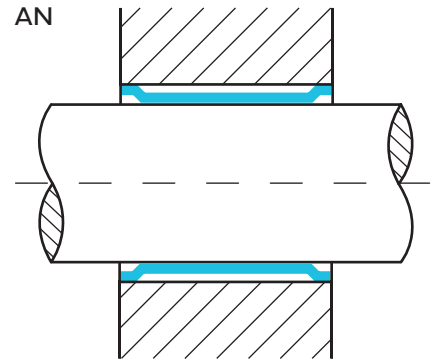
If the permissible load of a tolerance ring is insufficient, several can be installed side by side – the transferable loads add up, provided they are separated by webs to prevent them from sliding over each other.

THE CONNECTION OF SHAFT AND HUB

BN

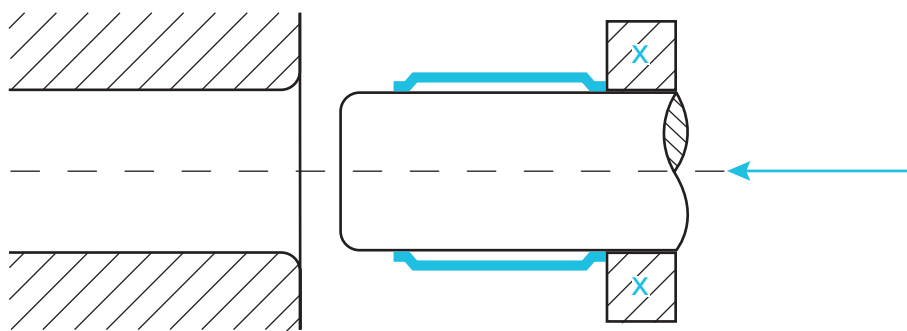


AN



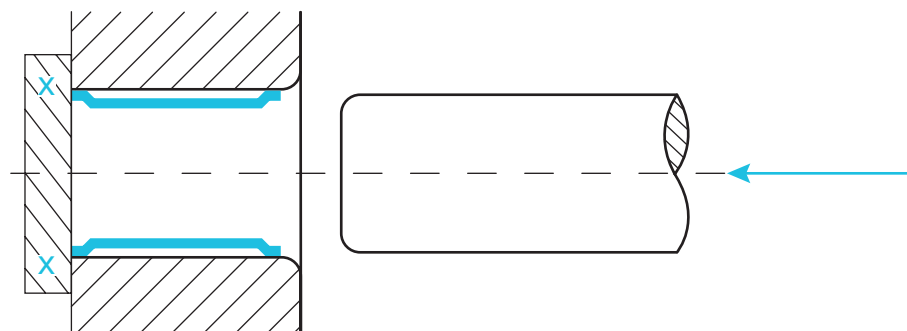
ASSEMBLY

Free Installation



BN

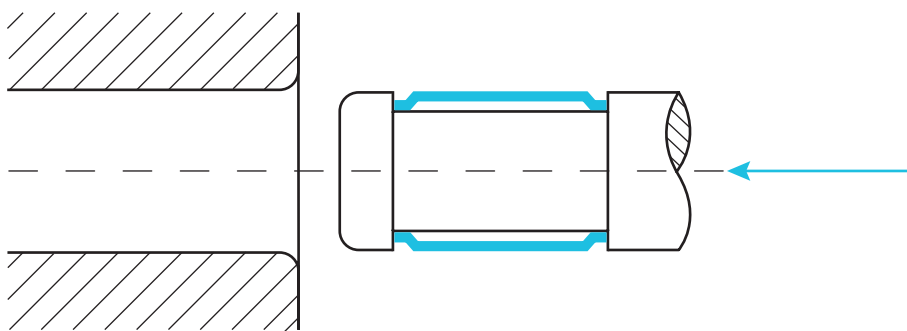
The sleeve is placed around the smooth shaft and must rest against an auxiliary contact surface (x) in order to be able to support itself against the pressing direction during pressing.



AN

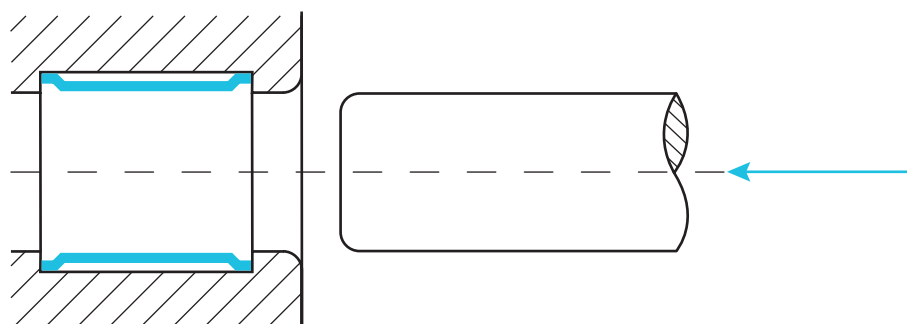
The sleeve is inserted into the smooth bore and positioned at the defined auxiliary contact surface (x). This surface prevents the ring from slipping in the press-fit direction when the shaft is pressed in.

Centred Installation



BN

The ring is first inserted into the shaft bore, then the shaft with the inserted ring is pressed into the bore.



AN

The ring is inserted into the housing and aligned with the designated contact surface. The shaft is then pressed into the recess, with the contact surface preventing the ring from slipping.

CALCULATION

TORQUE

For selecting the tolerance sleeve for a given drive.

M_{erf} = Torque to be transmitted (Nm)

P = Power in kW

n = Rotational speed in min^{-1}

s = Safety factor with

$s = 2,5 - 3$ Pulley

$s = 6$ Reverse operation

$s = 7 - 10$ Emergency stop

MOUNTING FORCE

The adjacent formulas can be used to obtain approximate values.

K = Mounting force in N

M = Torque value according to table (Nm)

D = Nominal diameter tolerance ring (mm)

AXIAL SEATING FORCE

Even with this formula, you only get approximate values.

S = Seating force in N

M = Torque value according to table (Nm)

D = Nominal diameter tolerance ring (mm)

Transmitted torque

$$M_{\text{erf}} = \frac{9000 \times P}{n} \times s$$

Torque transmission

$$K = \frac{7000 M}{D}$$

Roller bearing installation

$$K = \frac{2000 M}{D}$$

Torque transmission

$$S = \frac{2000 M}{D}$$

Roller bearing installation

$$S = \frac{1000 M}{D}$$

IMPORTANT NOTE:

The radial loads and transmissible torques listed in the tables are to be understood as guide values. They are based on typical conditions for stable constructions made of steel or grey cast iron. However, deviations from these values may occur, particularly depending on material strength, surface hardness, surface roughness and lubrication of the installed components. Manufacturing tolerances and mounting conditions can also influence the actual behaviour of the connection.

When tolerance sleeves are installed freely, a centre misalignment can occur, which can reduce the transmissible torque by up to approx. 20%. Under pulsating or alternating loads, a significant reduction in the permissible radial load is to be expected. To select a suitable tolerance sleeve for your specific application or if you are unsure, we recommend contacting our application engineering department.

TO PREVENT DAMAGE TO THE TOLERANCE RINGS DURING ASSEMBLY, THE CONNECTING PARTS MUST BE DESIGNED ACCORDINGLY.

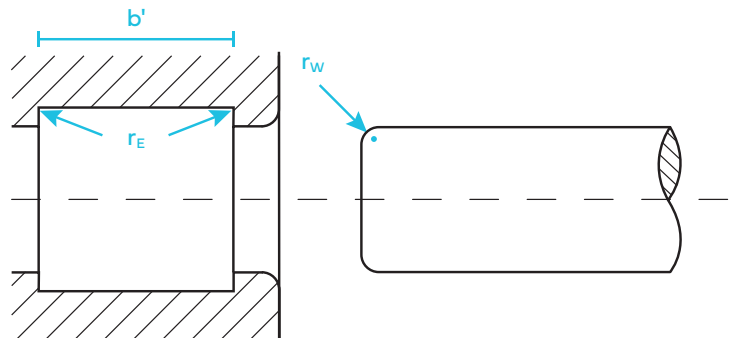
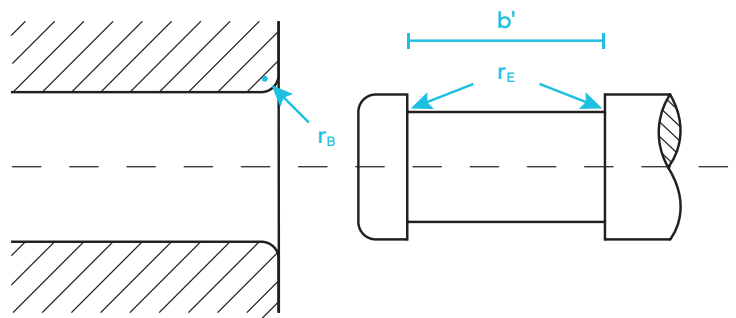
DESIGN OF THE CONNECTING PARTS

For form BN, radii r_B must be applied to the bore, while for forms AN and AL, the shaft ends must be provided with radii r_W .

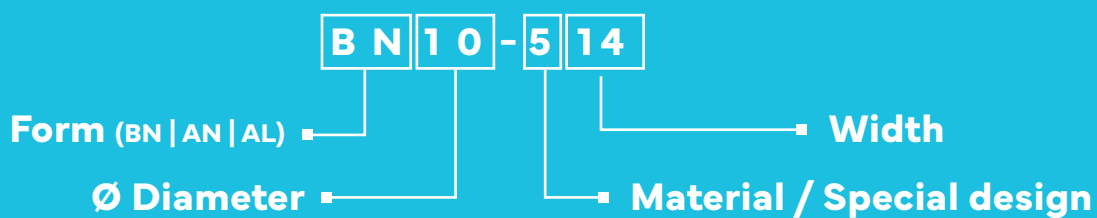
For the recesses in the bore and shaft during centred installation, the smallest possible radii r_E should be selected so that the tolerance rings fit optimally against the side surfaces of the recesses. To determine the recess width b' , the tolerance field C13 must be used.

The required dimensions can be found in the following table.

Diameter shaft Bore	r_W r_B	r_E	Dimensions b' μm	
to 10	1,0	0,2	+80	+300
10 to 18	1,0	0,2	+95	+365
18 to 30	1,25	0,25	+110	+440
30 to 40	1,25	0,25	+120	+510
40 to 50	1,25	0,25	+130	+520
50 to 65	2,0	0,4	+140	+600
over 65	2,0	0,4	+150	+610



ORDER NUMBER STRUCTURE



FORM BN

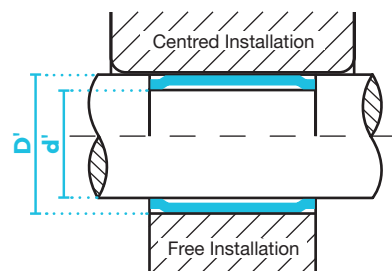
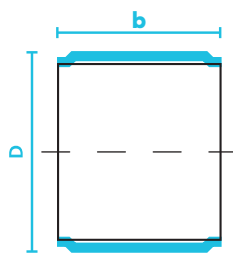
WAVES OVERLAPPING OUTWARD

COMMON USES

Bearing inner ring
Rotors
Fan wheels
Pump wheels

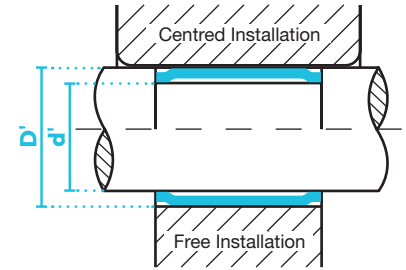
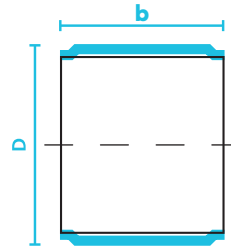


FORM BN



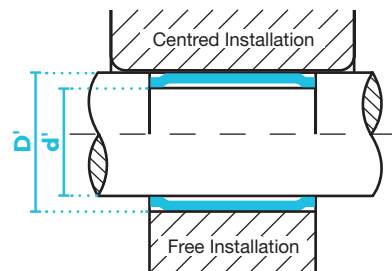
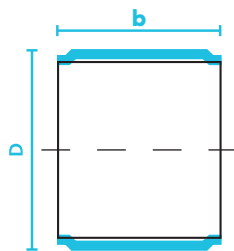
Type	Tolerance ring dimensions		Dimensions of the connecting parts			Load values		Weight
Item Nr.	D mm	b mm	Drilling D' (h9) mm	Shaft Roller bearing installation d' mm	Shaft Torque transmission d'' mm	Transmissible torque Nm	Permissible radial load P N	approx. kg/1000 pieces
BN06-506	6	6	6	5,01...5,06	5,14...5,18	0,33	380	0,12
BN06-508	6	8	6	5,01...5,06	5,14...5,18	0,45	575	0,17
BN06-510	6	10	6	5,01...5,06	5,14...5,18	0,9	690	0,21
BN06-512	6	12	6	5,01...5,06	5,14...5,18	1,25	940	0,25
BN08-507	8	7	8	6,51...6,57	6,65...6,71	0,68	780	0,24
BN08-508	8	8	8	6,51...6,57	6,65...6,71	0,8	1125	0,27
BN08-510	8	10	8	6,51...6,57	6,65...6,71	1	1400	0,34
BN08-514	8	14	8	6,51...6,57	6,65...6,71	1,3	1800	0,52
BN09-508	9	8	9	7,51...7,57	7,65...7,71	0,85	1070	0,30
BN10-506	10	6	10	8,51...8,57	8,65...8,71	1,8	950	0,29
BN10-510	10	10	10	8,51...8,57	8,65...8,71	3	1300	0,52
BN10-512	10	12	10	8,51...8,57	8,65...8,71	3,6	1650	0,52
BN10-514	10	14	10	8,51...8,57	8,65...8,71	3,9	2000	0,67
BN10-516	10	16	10	8,51...8,57	8,65...8,71	4,5	2100	0,69
BN11-510	11	10	11	9,51...9,57	9,65...9,71	4	1400	0,48
BN12-506	12	6	12	10,52...10,59	10,70...10,77	2,2	1075	0,32
BN12-508	12	8	12	10,52...10,59	10,70...10,77	3,2	1300	0,43
BN12-510	12	10	12	10,52...10,59	10,70...10,77	4,5	1700	0,53
BN12-512	12	12	12	10,52...10,59	10,70...10,77	5,3	2100	0,64
BN12-514	12	14	12	10,52...10,59	10,70...10,77	6,1	2400	0,82
BN12-518	12	18	12	10,52...10,59	10,70...10,77	7,9	3075	1,00
BN13-508	13	8	13	11,52...11,59	11,70...11,77	4	1650	0,46
BN13-512	13	12	13	11,52...11,59	11,70...11,77	5,6	2300	0,70
BN13-515	13	15	13	11,52...11,59	11,70...11,77	7,2	3000	0,87
BN14-508	14	8	14	12,52...12,59	12,70...12,77	4,2	1825	0,50
BN14-510	14	10	14	12,52...12,59	12,70...12,77	4,9	2000	0,62
BN14-514	14	14	14	12,52...12,59	12,70...12,77	6,8	2500	0,88
BN14-515	14	15	14	12,52...12,59	12,70...12,77	7,3	2700	0,94
BN14-520	14	20	14	12,52...12,59	12,70...12,77	8	4000	1,38
BN15-506	15	6	15	13,52...13,59	13,70...13,77	3,4	1200	0,41
BN15-508	15	8	15	13,52...13,59	13,70...13,77	3,9	1600	0,55
BN15-510	15	10	15	13,52...13,59	13,70...13,77	5,8	2025	0,68
BN15-512	15	12	15	13,52...13,59	13,70...13,77	6,8	2450	0,81
BN15-514	15	14	15	13,52...13,59	13,70...13,77	7,8	2950	0,96
BN15-516	15	16	15	13,52...13,59	13,70...13,77	11	3400	1,10
BN15-519	15	19	15	13,52...13,59	13,70...13,77	12,5	3900	1,30

FORM BN



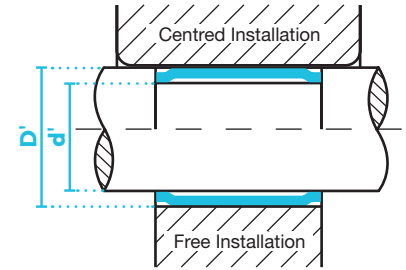
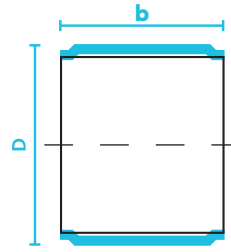
Type	Tolerance ring dimensions		Dimensions of the connecting parts			Load values		Weight
Item Nr.	D mm	b mm	Drilling D' (h9) mm	Shaft Roller bearing installation d' mm	Shaft Torque transmission d'' mm	Transmissible torque Nm	Permissible radial load P N	approx. kg/1000 pieces
BN16-505	16	5	16	14,52...14,59	14,70...14,77	3,2	1100	0,37
BN16-510	16	10	16	14,52...14,59	14,70...14,77	6,4	2200	0,73
BN16-516	16	16	16	14,52...14,59	14,70...14,77	10,6	3500	1,17
BN16-520	16	20	16	14,52...14,59	14,70...14,77	13,2	4370	1,46
BN17-505	17	5	17	15,52...15,59	15,70...15,77	2,9	1120	0,35
BN17-506	17	6	17	15,52...15,59	15,70...15,77	3,9	1500	0,47
BN17-510	17	10	17	15,52...15,59	15,70...15,77	8	2200	0,78
BN17-512	17	12	17	15,52...15,59	15,70...15,77	10	2800	0,93
BN17-514	17	14	17	15,52...15,59	15,70...15,77	12	3200	1,09
BN17-516	17	16	17	15,52...15,59	15,70...15,77	14	3600	1,24
BN18-506	18	6	18	16,52...16,59	16,70...16,77	4,6	1400	0,55
BN18-510	18	10	18	16,52...16,59	16,70...16,77	9	2650	0,91
BN18-516	18	16	18	16,52...16,59	16,70...16,77	15	3900	1,32
BN18-522	18	22	18	16,52...16,59	16,70...16,77	21	5600	1,83
BN19-506	19	6	19	17,52...17,59	17,70...17,77	4,8	1450	0,58
BN19-522	19	22	19	17,52...17,59	17,70...17,77	22	6000	1,93
BN20-506	20	6	20	18,02...18,11	18,25...18,33	7	1600	0,65
BN20-507	20	7	20	18,02...18,11	18,25...18,33	8	1900	0,84
BN20-508	20	8	20	18,02...18,11	18,25...18,33	9	2200	1,08
BN20-510	20	10	20	18,02...18,11	18,25...18,33	12	2900	1,36
BN20-512	20	12	20	18,02...18,11	18,25...18,33	15	3750	1,69
BN20-514	20	14	20	18,02...18,11	18,25...18,33	18	4600	1,94
BN20-515	20	15	20	18,02...18,11	18,25...18,33	19	5200	2,04
BN20-518	20	18	20	18,02...18,11	18,25...18,33	23	5900	2,45
BN20-520	20	20	20	18,02...18,11	18,25...18,33	25	6850	2,72
BN22-505	22	5	22	20,02...20,11	20,25...20,33	5,4	1340	0,75
BN22-506	22	6	22	20,02...20,11	20,25...20,33	7,5	2670	0,81
BN22-512	22	12	22	20,02...20,11	20,25...20,33	18	4450	1,81
BN22-515	22	15	22	20,02...20,11	20,25...20,33	26	5550	2,26
BN22-522	22	22	22	20,02...20,11	20,25...20,33	33	8250	3,31
BN24-505	24	5	24	22,02...22,11	22,25...22,33	6,9	2200	0,83
BN24-510	24	10	24	22,02...22,11	22,25...22,33	18,5	5860	1,65
BN24-515	24	15	24	22,02...22,11	22,25...22,33	30	9520	2,48
BN24-524	24	24	24	22,02...22,11	22,25...22,33	48	10800	3,91
BN25-508	25	8	25	23,02...23,11	23,25...23,33	15	3000	1,38
BN25-510	25	10	25	23,02...23,11	23,25...23,33	20	3850	1,73

FORM BN



Type	Tolerance ring dimensions		Dimensions of the connecting parts			Load values		Weight
Item Nr.	D mm	b mm	Drilling D' (h9) mm	Shaft Roller bearing installation d' mm	Shaft Torque transmission d'' mm	Transmissible torque Nm	Permissible radial load P N	approx. kg/1000 pieces
BN25-512	25	12	25	23,02...23,11	23,25...23,33	22	4950	2,07
BN25-515	25	15	25	23,02...23,11	23,25...23,33	28	6450	2,58
BN25-518	25	18	25	23,02...23,11	23,25...23,33	38	7200	3,11
BN25-520	25	20	25	23,02...23,11	23,25...23,33	41	7575	3,46
BN25-525	25	25	25	23,02...23,11	23,25...23,33	53	10600	4,32
BN27-512	27	12	27	25,02...25,11	25,25...25,33	25,5	5350	2,23
BN28-520	28	20	28	26,02...26,11	26,25...26,33	53	10600	3,9
BN28-522	28	22	28	26,02...26,11	26,25...26,33	60	11300	4,29
BN28-525	28	25	28	26,02...26,11	26,25...26,33	71	12000	4,87
BN30-508	30	8	30	28,02...28,11	28,25...28,33	25	2800	1,67
BN30-510	30	10	30	28,02...28,11	28,25...28,33	29	4200	2,09
BN30-512	30	12	30	28,02...28,11	28,25...28,33	35	5400	2,51
BN30-515	30	15	30	28,02...28,11	28,25...28,33	45	7000	3,10
BN30-516	30	16	30	28,02...28,11	28,25...28,33	48	7460	3,30
BN30-520	30	20	30	28,02...28,11	28,25...28,33	60	10200	4,19
BN30-523	30	23	30	28,02...28,11	28,25...28,33	70	12200	4,82
BN30-530	30	30	30	28,02...28,11	28,25...28,33	95	18600	6,29
BN32-512	32	12	32	30,02...30,11	30,25...30,33	44	5800	2,69
BN32-516	32	16	32	30,02...30,11	30,25...30,33	56	8400	3,59
BN32-530	32	30	32	30,02...30,11	30,25...30,33	110	17000	6,74
BN33-520	33	20	33	31,03...31,13	31,25...31,40	71	11050	6,16
BN35-510	35	10	35	33,03...33,13	33,25...33,40	40	4000	3,26
BN35-512	35	12	35	33,03...33,13	33,25...33,40	48	4800	3,91
BN35-515	35	15	35	33,03...33,13	33,25...33,40	60	6000	4,90
BN35-516	35	16	35	33,03...33,13	33,25...33,40	64	6400	5,22
BN35-525	35	25	35	33,03...33,13	33,25...33,40	100	10000	8,17
BN35-530	35	30	35	33,03...33,13	33,25...33,40	120	12000	9,80
BN36-512	36	12	36	34,03...34,13	34,30...34,40	55	5100	4,53
BN36-515	36	15	36	34,03...34,13	34,30...34,40	63	8800	5,44
BN38-523	38	23	38	36,03...36,13	36,30...36,40	94	8075	8,96
BN40-510	40	10	40	38,03...38,13	38,30...38,40	55	3800	3,75
BN40-512	40	12	40	38,03...38,13	38,30...38,40	63	4500	4,51
BN40-515	40	15	40	38,03...38,13	38,30...38,40	83	5400	5,63
BN40-520	40	20	40	38,03...38,13	38,30...38,40	90	7390	8,20
BN40-523	40	23	40	38,03...38,13	38,30...38,40	104	8500	9,43
BN40-530	40	30	40	38,03...38,13	38,30...38,40	180	12000	11,27

FORM BN



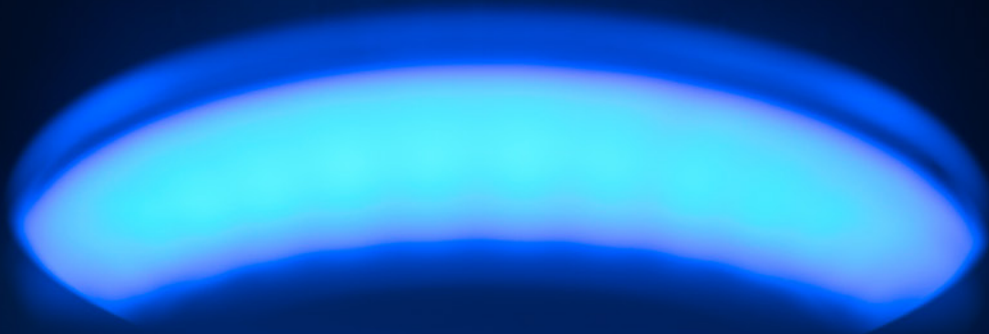
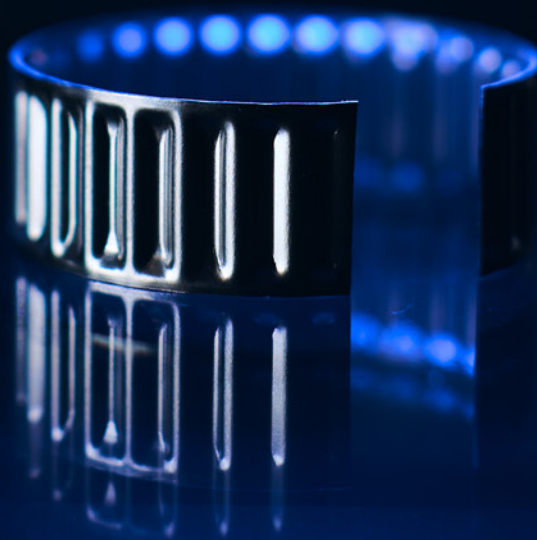
Type	Tolerance ring dimensions		Dimensions of the connecting parts			Load values		Weight
Item Nr.	D mm	b mm	Drilling D' (h9) mm	Shaft Roller bearing installation d' mm	Shaft Torque transmission d'' mm	Transmissible torque Nm	Permissible radial load P N	approx. kg/1000 pieces
BN44-532	44	32	44	42,03...42,13	42,30...42,40	232	14080	13,22
BN45-510	45	10	45	43,03...43,13	43,30...43,40	68	4250	5,00
BN45-515	45	15	45	43,03...43,13	43,30...43,40	102	6230	6,37
BN45-520	45	20	45	43,03...43,13	43,30...43,40	145	9400	8,5
BN45-523	45	23	45	43,03...43,13	43,30...43,40	160	10100	10,73
BN50-512	50	12	50	48,03...48,13	48,30...48,40	107	5750	5,69
BN50-516	50	16	50	48,03...48,13	48,30...48,40	141	7565	8,33
BN50-520	50	20	50	48,03...48,13	48,30...48,40	186	9575	9,48
BN50-523	50	23	50	48,03...48,13	48,30...48,40	220	11010	10,90
BN50-530	50	30	50	48,03...48,13	48,30...48,40	310	13400	14,22
BN50-540	50	40	50	48,03...48,13	48,30...48,40	350	18000	20,83
BN55-510	55	10	55	52,53...52,65	52,85...52,97	125	4900	6,48
BN55-514	55	14	55	52,53...52,65	52,85...52,97	175	6750	9,97
BN55-515	55	15	55	52,53...52,65	52,85...52,97	185	6880	10,03
BN55-529	55	29	55	52,53...52,65	52,85...52,97	330	12500	20,20
BN60-522	60	22	60	57,53...57,65	57,85...57,97	350	13200	15,62
BN60-528	60	28	60	57,53...57,65	57,85...57,97	420	18400	20,50
BN65-520	65	20	65	62,53...62,65	62,85...62,97	480	14800	19,40
BN65-533	65	33	65	62,53...62,65	62,85...62,97	650	21000	25,46
BN75-531	75	31	75	72,53...72,65	72,85...72,97	780	24000	29,00
BN80-512	80	12	80	77,53...77,65	77,85...77,97	550	15500	12,80
BN80-539	80	39	80	77,53...77,65	77,85...77,97	1120	31000	36,80
BN85-522	85	22	85	82,04...82,18	82,44...82,58	800	19000	26,72
B100-524	100	24	100	97,04...97,18	97,44...97,58	1350	28000	37,65

FORM AN

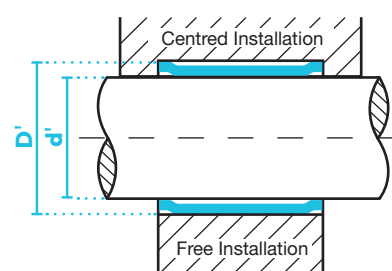
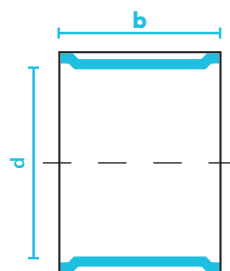
WAVY PEAKS INWARD
ENDS STANDING APART

COMMON USES

Bearing outer ring
Stator
Handles
Ball knobs
Magnetic rotary encoders

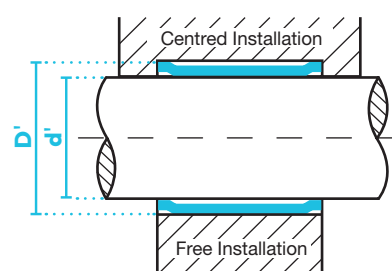
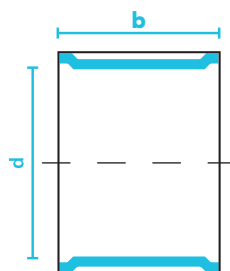


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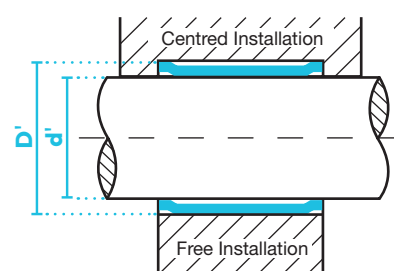
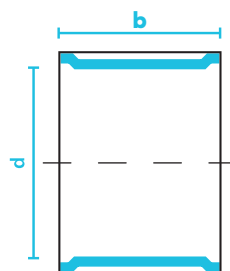
Type	tolerance ring dimensions		Dimensions of connecting parts			Load values		Weight
Item Nr.	d mm	b mm	Wave d' (h9) mm	Drilling Roller bearing installation D' mm	Bore Torque transmission D' mm	Transmissible torque Nm	Permissible radial load P N	approx. kg/1000 pieces
AN05-508	5	8	5	5,93...5,95	5,82...5,86	0,66	160	0,12
AN05-512	5	12	5	5,93...5,95	5,82...5,86	1,1	250	0,18
AN05-515	5	15	5	5,93...5,95	5,82...5,86	1,3	310	0,22
AN06-505	6	5	6	6,93...6,95	6,82...6,86	0,45	110	0,91
AN06-506	6	6	6	6,93...6,95	6,82...6,86	0,5	133	0,11
AN06-510	6	10	6	6,93...6,95	6,82...6,86	1	290	0,19
AN06-515	6	15	6	6,93...6,95	6,82...6,86	1,3	520	0,29
AN08-508	8	8	8	9,41...9,48	9,23...9,30	1,45	360	0,27
AN08-512	8	12	8	9,41...9,48	9,23...9,30	2	580	0,40
AN08-514	8	14	8	9,41...9,48	9,23...9,30	2,1	600	0,47
AN09-506	9	6	9	10,41...10,48	10,23...10,30	1,6	765	0,23
AN10-506	10	6	10	11,41...11,48	11,23...11,30	2	850	0,26
AN10-508	10	8	10	11,41...11,48	11,23...11,30	2,5	1100	0,34
AN10-510	10	10	10	11,41...11,48	11,23...11,30	3	1350	0,45
AN10-512	10	12	10	11,41...11,48	11,23...11,30	3,5	1650	0,57
AN10-514	10	14	10	11,41...11,48	11,23...11,30	4	2100	0,78
AN10-518	10	18	10	11,41...11,48	11,23...11,30	4,5	2900	0,98
AN12-506	12	6	12	13,41...13,48	13,23...13,30	3	1200	0,32
AN12-510	12	10	12	13,41...13,48	13,23...13,30	4	1825	0,58
AN12-512	12	12	12	13,41...13,48	13,23...13,30	6	2400	0,73
AN12-518	12	18	12	13,41...13,48	13,23...13,30	9	3350	1,10
AN13-518	13	18	13	14,41...14,48	14,23...14,30	10,5	3630	1,15
AN14-508	14	8	14	15,41...15,48	15,23...15,30	5	1800	0,54
AN14-512	14	12	14	15,41...15,48	15,23...15,30	7	2410	0,75
AN14-522	14	22	14	15,41...15,48	15,23...15,30	12,5	4420	1,37
AN15-505	15	5	15	16,41...16,48	16,23...16,30	2,8	915	0,34
AN15-508	15	8	15	16,41...16,48	16,23...16,30	5,5	1825	0,54
AN15-512	15	12	15	16,41...16,48	16,23...16,30	7,5	2500	0,72
AN15-514	15	14	15	16,41...16,48	16,23...16,30	11	2925	0,95
AN15-518	15	18	15	16,41...16,48	16,23...16,30	14	3760	1,21
AN16-505	16	5	16	17,41...17,48	17,23...17,30	4	1100	0,36
AN16-508	16	8	16	17,41...17,48	17,23...17,30	7	1900	0,58
AN16-510	16	10	16	17,41...17,48	17,23...17,30	8	2275	0,73
AN16-512	16	12	16	17,41...17,48	17,23...17,30	9	2800	0,88
AN16-516	16	16	16	17,41...17,48	17,23...17,30	14	3650	1,16
AN16-522	16	22	16	17,41...17,48	17,23...17,30	17	4500	1,61
AN18-506	18	6	18	19,89...19,98	19,67...19,75	6	1500	0,8

FORM AN



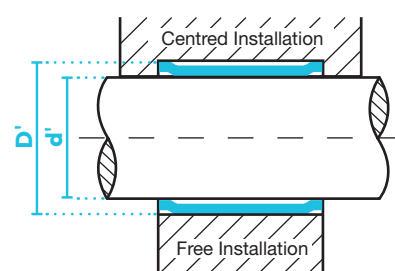
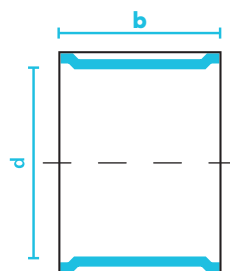
Type	tolerance ring dimensions		Dimensions of connecting parts			Load values		Weight
Item Nr.	d mm	b mm	Wave d' (h9) mm	Drilling Roller bearing installation D' mm	Bore Torque transmission D' mm	Transmissible torque Nm	Permissible radial load P N	approx. kg/1000 pieces
AN18-508	18	8	18	19,89...19,98	19,67...19,75	8,7	1975	1,06
AN18-510	18	10	18	19,89...19,98	19,67...19,75	11	2450	1,33
AN18-516	18	16	18	19,89...19,98	19,67...19,75	17	4100	1,94
AN19-505	19	5	19	20,89...20,98	20,67...20,75	5	1400	0,8
AN19-506	19	6	19	20,89...20,98	20,67...20,75	7	1875	0,97
AN20-512	20	12	20	21,89...21,98	21,67...21,75	18	3650	1,79
AN20-520	20	20	20	21,89...21,98	21,67...21,75	30	6100	2,72
AN20-526	20	26	20	21,89...21,98	21,67...21,75	34	7250	3,53
AN22-505	22	5	22	23,89...23,98	23,67...23,75	12	1650	0,75
AN22-507	22	7	22	23,89...23,98	23,67...23,75	16	2450	1,05
AN22-510	22	10	22	23,89...23,98	23,67...23,75	18	3525	1,65
AN22-512	22	12	22	23,89...23,98	23,67...23,75	21	4230	1,98
AN22-516	22	16	22	23,89...23,98	23,67...23,75	28	5450	2,41
AN23-505	23	5	23	24,89...24,98	24,67...24,75	13	1725	0,78
AN24-507	24	7	24	25,89...25,98	25,67...25,75	18	2715	1,15
AN24-512	24	12	24	25,89...25,98	25,67...25,75	29	5550	1,98
AN24-516	24	16	24	25,89...25,98	25,67...25,75	32	7800	2,65
AN25-510	25	10	25	26,89...26,98	26,67...26,75	24	4300	1,9
AN25-516	25	16	25	26,89...26,98	26,67...26,75	35	7800	2,76
AN25-520	25	20	25	26,89...26,98	26,67...26,75	47	9000	3,46
AN26-508	26	8	26	27,89...27,98	27,67...27,75	21	3425	1,44
AN26-520	26	20	26	27,89...27,98	27,67...27,75	52	9800	3,81
AN28-508	28	8	28	29,89...29,98	29,67...29,75	27	4000	1,56
AN28-512	28	12	28	29,89...29,98	29,67...29,75	39	6250	2,34
AN28-514	28	14	28	29,89...29,98	29,67...29,75	45	7300	3,05
AN30-508	30	8	30	31,89...31,98	31,67...31,75	28	4100	1,65
AN30-512	30	12	30	31,89...31,98	31,67...31,75	40	5700	2,51
AN30-530	30	30	30	31,89...31,98	31,67...31,75	95	15500	6,21
AN32-508	32	8	32	33,89...33,98	33,67...33,75	30	4200	2,37
AN32-510	32	10	32	33,89...33,98	33,67...33,75	35	4600	2,97
AN35-510	35	10	35	36,89...36,98	36,67...36,75	43	4800	3,28
AN35-514	35	14	35	36,89...36,98	36,67...36,75	58	5350	4,60
AN35-516	35	16	35	36,89...36,98	36,67...36,75	70	8200	5,22
AN36-512	36	12	36	37,89...37,98	37,67...37,75	55	4100	4,23
AN40-508	40	8	40	41,89...41,98	41,67...41,75	54	2600	3,30
AN40-510	40	10	40	41,89...41,98	41,67...41,75	62	3300	4,12
AN40-512	40	12	40	41,89...41,98	41,67...41,75	72	4450	4,54

FORM AN



Type	tolerance ring dimensions		Dimensions of connecting parts			Load values		Weight
Item Nr.	d mm	b mm	Wave d' (h9) mm	Drilling Roller bearing installation D' mm	Bore Torque transmission D' mm	Transmissible torque Nm	Permissible radial load P N	approx. kg/1000 pieces
AN40-516	40	16	40	41,89...41,98	41,67...41,75	91	6230	6,01
AN40-520	40	20	40	41,89...41,98	41,67...41,75	125	8450	7,51
AN40-530	40	30	40	41,89...41,98	41,67...41,75	180	12300	11,74
AN42-512	42	12	42	43,89...43,98	43,67...43,75	75	4900	4,74
AN45-512	45	12	45	46,89...46,98	46,67...46,75	90	6900	5,6
AN45-520	45	20	45	46,89...46,98	46,67...46,75	165	8700	8,5
AN47-506	47	6	47	48,89...48,98	48,67...48,75	65	2450	3,00
AN47-508	47	8	47	48,89...48,98	48,67...48,75	76	2850	4,00
AN47-512	47	12	47	48,89...48,98	48,67...48,75	100	5340	5,85
AN47-514	47	14	47	48,89...48,98	48,67...48,75	117	6230	6,83
AN47-522	47	22	47	48,89...48,98	48,67...48,75	220	10750	9,81
AN47-540	47	40	47	48,89...48,98	48,67...48,75	390	16100	17,84
AN50-512	50	12	50	52,35...52,47	52,03...52,15	120	4860	7,10
AN50-515	50	15	50	52,35...52,47	52,03...52,15	157	6080	8,81
AN50-520	50	20	50	52,35...52,47	52,03...52,15	215	10100	11,74
AN52-515	52	15	52	54,35...54,47	54,03...54,15	165	7120	9,17
AN55-512	55	12	55	57,35...57,47	57,03...57,15	166	5550	7,78
AN55-515	55	15	55	57,35...57,47	57,03...57,15	207	6335	9,72
AN58-520	58	20	58	60,35...60,47	60,03...60,15	273	11335	13,67
AN60-512	60	12	60	62,35...62,47	62,03...62,15	224	7040	8,52
AN60-515	60	15	60	62,35...62,47	62,03...62,15	280	8800	10,65
AN60-525	60	25	60	62,35...62,47	62,03...62,15	475	15500	17,75
AN62-510	62	10	62	64,35...64,47	64,03...64,15	215	5300	7,34
AN62-515	62	15	62	64,35...64,47	64,03...64,15	290	8450	11,02
AN64-510	64	10	64	66,35...66,47	66,03...66,15	229	5470	7,58
AN65-525	65	25	65	67,35...67,47	67,03...67,15	520	14900	19,29
AN70-525	70	25	70	72,35...72,47	72,03...72,15	550	16900	20,83
AN72-510	72	10	72	74,35...74,47	74,03...74,15	230	6000	8,57
AN72-517	72	17	72	74,35...74,47	74,03...74,15	420	13000	14,58
AN72-520	72	20	72	74,35...74,47	74,03...74,15	490	15000	17,15
AN75-510	75	10	75	77,35...77,47	77,03...77,15	325	8690	8,95
AN75-512	75	12	75	77,35...77,47	77,03...77,15	390	10400	10,73
AN75-516	75	16	75	77,35...77,47	77,03...77,15	520	13900	14,31
AN80-512	80	12	80	82,35...82,47	82,03...82,15	280	11000	12,6
AN80-520	80	20	80	82,35...82,47	82,03...82,15	630	18300	21,83
AN84-519	84	19	84	86,82...86,96	86,42...86,56	685	16800	22,8
AN85-519	85	19	85	87,82...87,96	87,42...87,56	700	17000	23,08

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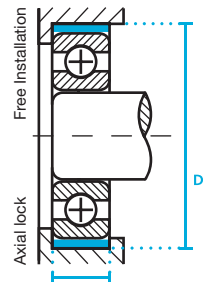
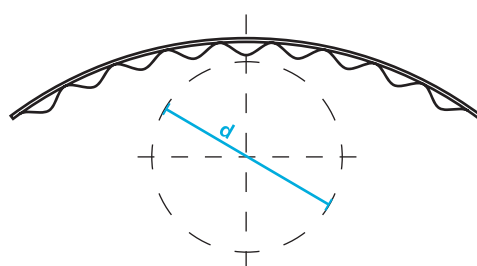
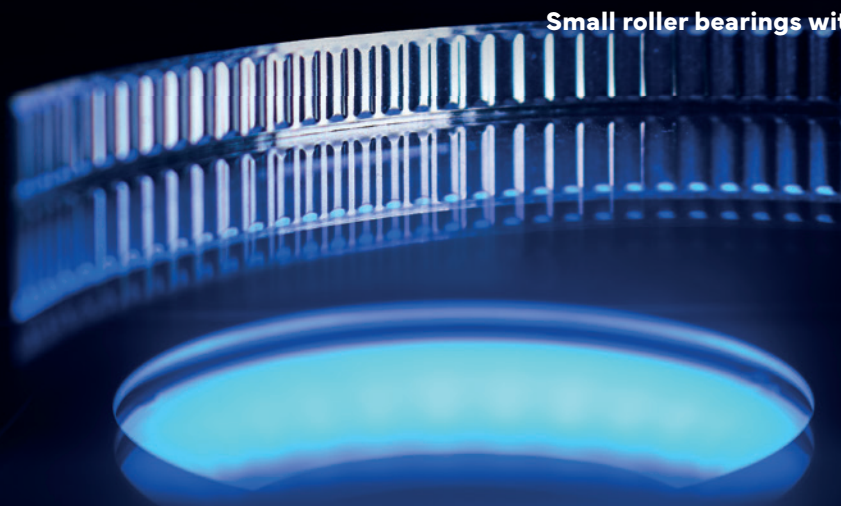
Type	tolerance ring dimensions		Dimensions of connecting parts			Load values		Weight
Item Nr.	d mm	b mm	Wave d' (h9) mm	Drilling Roller bearing installation D' mm	Bore Torque transmission D' mm	Transmissible torque Nm	Permissible radial load P N	approx. kg/1000 pieces
AN86-512	86	12	86	88,82...88,96	88,42...88,56	450	10860	14,75
AN90-515	90	15	90	92,82...92,96	92,42...92,56	560	14000	20,4
AN90-525	90	25	90	92,82...92,96	92,42...92,56	950	22500	35,38
AN96-520	96	20	96	98,82...98,96	98,42...98,56	850	19900	29,5
A100-525	100	25	100	102,82...102,96	102,42...102,56	1300	25000	35,9
A110-515	110	15	110	112,82...112,96	112,42...112,56	1150	16500	26
A110-519	110	19	110	112,82...112,96	112,42...112,56	1350	20900	33
A110-525	110	25	110	112,82...112,96	112,42...112,56	1650	27500	43,48
A120-512	120	12	120	122,82...122,96	122,42...122,56	820	14400	22,7
A125-515	125	15	125	128,80...128,96	128,42...128,48	1550	26500	34,46
A132-512	132	12	132	135,80...135,96	135,32...135,48	1500	26500	29,16
A140-515	140	15	140	143,80...143,96	143,32...143,48	1100	20000	35,25
A149-516	149	16	149	152,80...152,96	152,32...152,48	2370	35750	44
A150-516	150	16	150	153,80...153,96	153,32...153,48	2400	36000	44,33
A165-515	165	15	165	168,80...168,96	168,32...168,48	1530	23570	41,55
A190-516	190	16	190	193,80...193,96	193,32...193,48	3850	45600	56,1
A199-520	199	20	199	202,80...202,96	202,32...202,48	5280	59700	73,43

FORM AL

WAVE CRESTS INWARD CURVED

CUSTOM USES

Small roller bearings with high rotational speeds



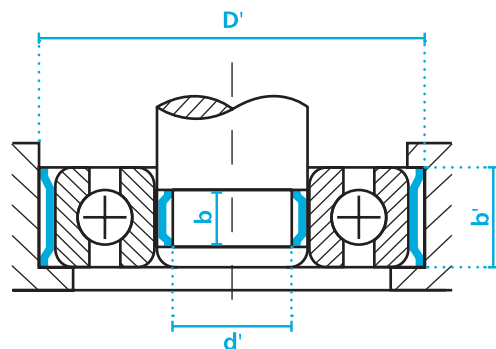
FORM AL

Dimensions of connecting parts Bore						
Item Nr.	d mm	b mm	Rolling bearing Diameter mm	Drilling D' mm	Groove width b1 mm	Permissible radial load P N
AL13-505	13	5	13 (± 624)	13,60...13,65	5	125
AL16-505	16	5	16 (± 625)	16,60...16,65	5	150
AL19-506	19	6	19 (± 626)	19,60...19,65	6	220
AL22-507	22	7	22 (± 608)	22,60...22,65	7	300
AL26-508	26	8	26 (± 629)	26,60...26,65	8	400
AL28-508	28	8	28 (± 6001)	28,60...28,65	8	440
AL30-509	30	9	30 (± 6200)	30,60...30,65	9	520
AL32-510	32	10	32 (± 6201)	32,60...32,65	10	620
AL35-510	35	10	35 (± 6003)	35,60...35,65	10	750
AL35-515	35	15	35 (± 6202)	35,60...35,65	15	1050
AL52-515	52	15	52 (± 6205)	52,60...52,65	15	1600

ROLLER BEARING INSTALLATION

In addition to the AL tolerance rings, a light-weight series for series installation described on the previous page, the AN and BN shapes are used for repairs, but also in accordance with the technical conditions in the original installation.

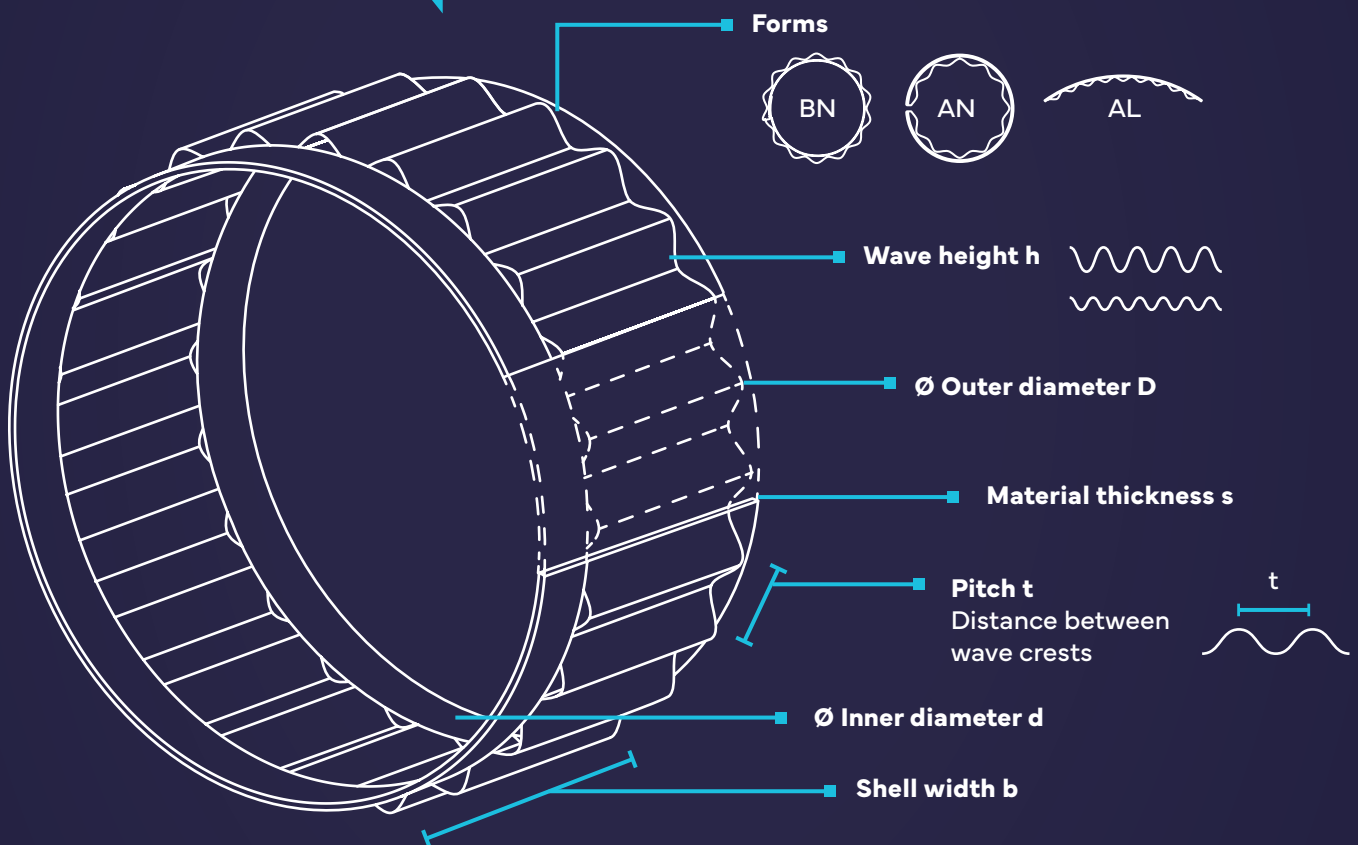
The following table lists common ball bearings and the corresponding tolerance sleeves.



Bearing type	Dimensions	Tolerance ring for inner ring	Wave measurement d' [mm]	Groove width b (C13) [mm]	Tolerance ring for outer ring	Bore dimension D' [mm]	Groove width b' (C13) [mm]
6000	(10×26×8)	BN10-505	8,51...8,57	5	AN26-508	27,89...27,98	8
6200	(10×30×9)	BN10-505	8,51...8,57	5	AN30-508	31,89...31,98	8
6300	(10×35×11)	BN10-505	8,51...8,57	5	AN35-510	36,89...36,98	10
6001	(12×28×8)	BN12-506	10,52...10,59	6	AN28-508	29,89...29,98	8
6201	(12×32×10)	BN12-506	10,52...10,59	6	AN32-510	33,89...33,98	10
6002	(15×32×8)	BN15-506	13,52...13,59	6	AN32-508	33,89...33,98	8
6202	(15×35×11)	BN15-506	13,52...13,59	6	AN35-510	36,89...36,98	10
6302	(15×42×13)	BN15-506	13,52...13,59	6	AN42-512	43,89...43,98	12
6003	(17×35×10)	BN17-506	15,52...15,59	6	AN35-510	36,89...36,98	10
6203	(17×40×12)	BN17-506	15,52...15,59	6	AN40-512	41,89...41,98	12
6303	(17×47×14)	BN17-508	15,52...15,59	8	AN47-514	48,89...48,98	14
6004	(20×42×12)	BN20-506	18,02...18,11	6	AN42-512	43,89...43,98	12
6204	(20×47×14)	BN20-508	18,02...18,11	8	AN47-514	48,89...48,98	14
6304	(20×52×15)	BN20-508	18,02...18,11	8	AN52-515	54,35...54,47	15
6005	(25×47×12)	BN25-508	23,02...23,11	8	AN47-508	48,89...48,98	8
6205	(25×52×15)	BN25-510	23,02...23,11	10	AN52-515	54,35...54,47	15
6305	(25×62×17)	BN25-512	23,02...23,11	12	AN62-515	64,35...64,47	15
6006	(30×55×13)	BN30-508	28,02...28,11	8	AN55-512	57,35...57,47	12
6206	(30×62×16)	BN30-510	28,02...28,11	10	AN62-515	64,35...64,47	15
6306	(30×72×19)	BN30-512	28,02...28,11	12	AN72-519	74,35...74,47	19
6007	(35×62×14)	BN35-508	33,03...33,13	8	AN62-510	64,35...64,47	10
6207	(35×72×17)	BN35-510	33,03...33,14	10	AN72-517	74,35...74,47	17
6307	(35×80×21)	BN35-512	33,03...33,15	12	AN80-521	82,35...82,47	21
6008	(40×68×15)	BN40-510	38,01...38,13	10	AN68-515	70,35...70,47	15
6208	(40×80×18)	BN40-512	38,01...38,13	12	AN80-518	82,35...82,47	18
6308	(40×90×23)	BN40-515	38,01...38,13	15	AN90-523	92,82...92,96	23
6009	(45×75×16)	BN45-510	43,03...43,13	10	AN75-516	77,35...77,47	16
6209	(45×85×19)	BN45-510	43,03...43,13	10	AN85-519	87,82...87,96	19
6309	(45×100×25)	BN45-515	43,03...43,13	15	A100-525	102,82...102,96	25
6010	(50×80×16)	BN50-512	48,03...48,13	12	AN80-516	82,35...82,47	16
6210	(50×90×20)	BN50-512	48,03...48,13	12	AN90-520	92,82...92,96	20
6310	(50×110×27)	BN50-516	48,03...48,13	16	A110-527	112,82...112,96	27

WE WILL FIND THE RIGHT SOLUTION FOR YOUR PROJECT.

FROM STANDARD
TO CUSTOM DESIGNS



At Dr. TRETTER, we develop the right solution for every project quickly, precisely and economically. Our tolerance sleeves enable backlash-free, form-fitting connections without time-consuming reworking. Whether gear wheels, pulleys, fans or sensors – our tolerance sleeves are easy to assemble and disassemble, ensure a secure fit and compensate for manufacturing tolerances and temperature fluctuations.

For series production as well as for individual designs. Put your trust in proven technology and our expert advice! We will help you select the optimal tolerance sleeve for your application.

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SPECIAL DESIGNS

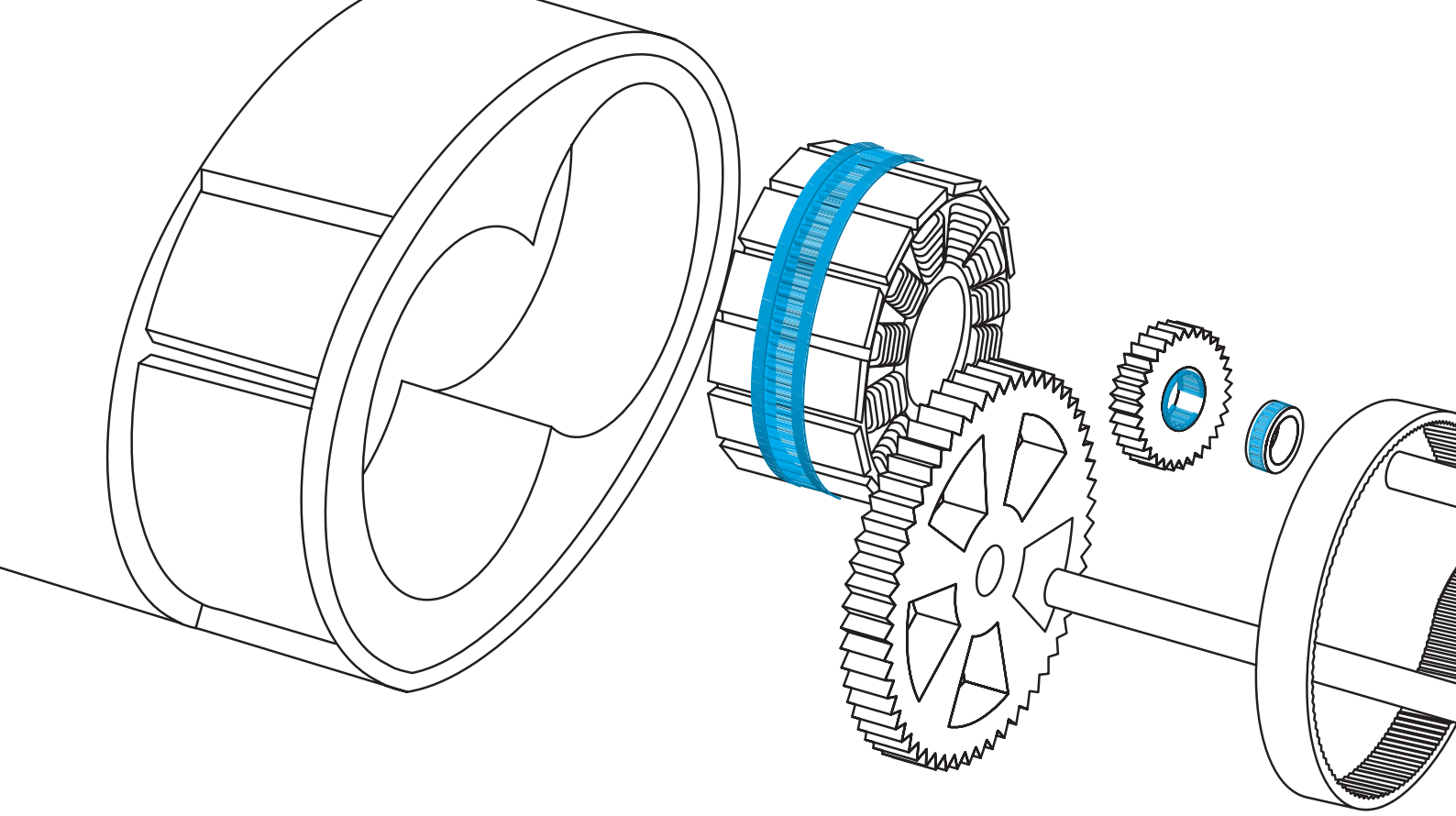
The table shows the standard values for material thickness, wave height, pitch and possible sleeve width for standard tolerance sleeves not listed in the catalogue, depending on the nominal diameter. Such special sizes can also be manufactured in medium quantities.

By varying the material thickness, wave height and pitch, Dr. TRETTER can also manufacture customer-specific special

tolerance sleeves that are tailored to specific requirements in terms of mounting force, transmissible torque and axial seating force.

In addition to the standard NiRo material 1.4310, materials such as Hastelloy C-276, Hayns 230, stainless steel 1.4471 or 1.4571 can also be used on request, for example at high temperatures or with aggressive media.

Shape and dimensions AN d	Shape and dimensions BN D	Material thickness s	Wave height h	Division t	Shell width b
0 - 7,5	0 - 7,5	0,15	0,5	1,5	4 5 6 7 8 9 10 12 15 16
7,6 - 16,0	7,6 - 19,0	0,2	0,75	2,5	4 5 6 7 8 9 10 11 12 14 15 16 18 20 22 24 25
16,1 - 30,0	19,1 - 32,0	0,3	1	3,5	6 7 8 9 10 11 12 14 15 16 18 19 20 22 24 25 30 33 35
30,1 - 48,0	32,1 - 52,0	0,4	1	5	6 7 8 9 10 12 14 15 18 19 20 21 22 24 25 30 33 35 40 60
48,1 - 80,0	52,1 - 82,0	0,5	1,25	6,3	9 10 12 14 15 16 19 20 21 24 25 30 40 65
80,1 - 120,0	82,1 - 123,0	0,6	1,5	7,5	12 15 19 20 24 25 35 40
> 120,1	> 123,1	0,7	2	9,4	12 15 20 24 25 30
Form AL	All dimensions	0,15	0,33	3,14	5 6 7 8 9 10 11 15 16



TORQUE TRANSMISSION

FORM-FIT AND FORCE-FIT FIXATION OF THE STATOR IN ELECTRIC MOTORS

In modern electric drive manufacturing, tolerance sleeves are an efficient alternative to gluing. Instead of time-consuming application, curing and reworking, simple press-fitting is sufficient – immediate, reproducible and without waiting time.

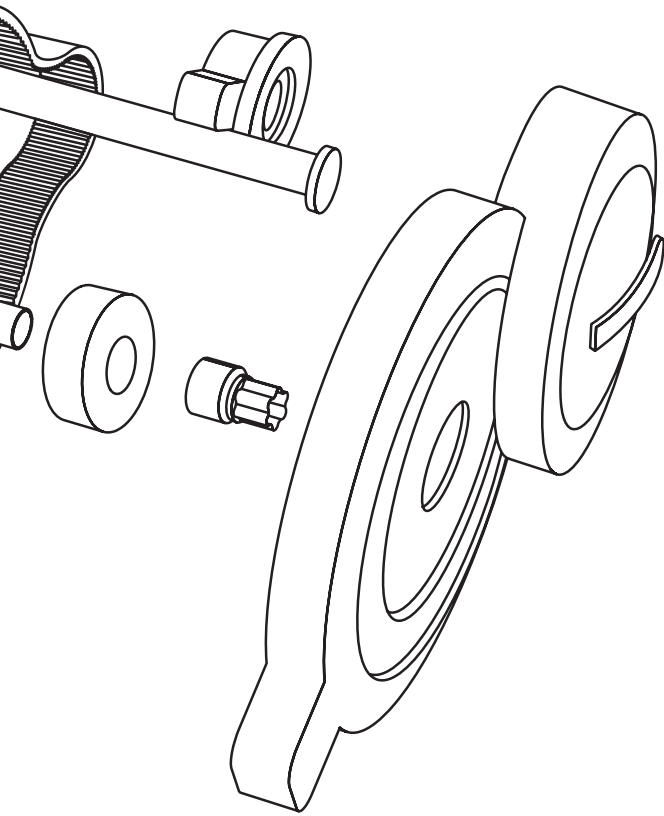
The targeted design of the tolerances between the sleeve, housing and stator allows for greater manufacturing flexibility. This reduces costs, increases process reliability and reliably compensates for differences in thermal expansion. This keeps the position of the stator stable even when temperatures change.

The possible applications are diverse: in addition to fixing stators, rotors can also be securely fastened to drive shafts. Especially in dynamic applications with high torques, the press fit connection impresses with its stability, cost-effectiveness and safety. The absence of solvent-based adhesives also improves environmental and occupational safety.

Conclusion: Tolerance sleeves speed up assembly, reduce production times and increase quality – a clear advantage for the series production of electric drives.

- + TIME SAVING: NO CURING TIMES
- + REDUCED MANUFACTURING COSTS
- + GREATER PROCESS RELIABILITY
- + COMPENSATION FOR THERMAL EXPANSION
- + VERSATILE AND MODULAR
- + NO CHEMICALS

WHERE TOLERANCE RINGS ARE USED



APPLICATIONS A SELECTION

Conveyor technology
Powered rollers

Electric motors
Fastening of stator | Fan roller bearings | Rotary encoders

Motor vehicles
Sensor | Sensor disc

Ventilation and air conditioning units
Installation of fans

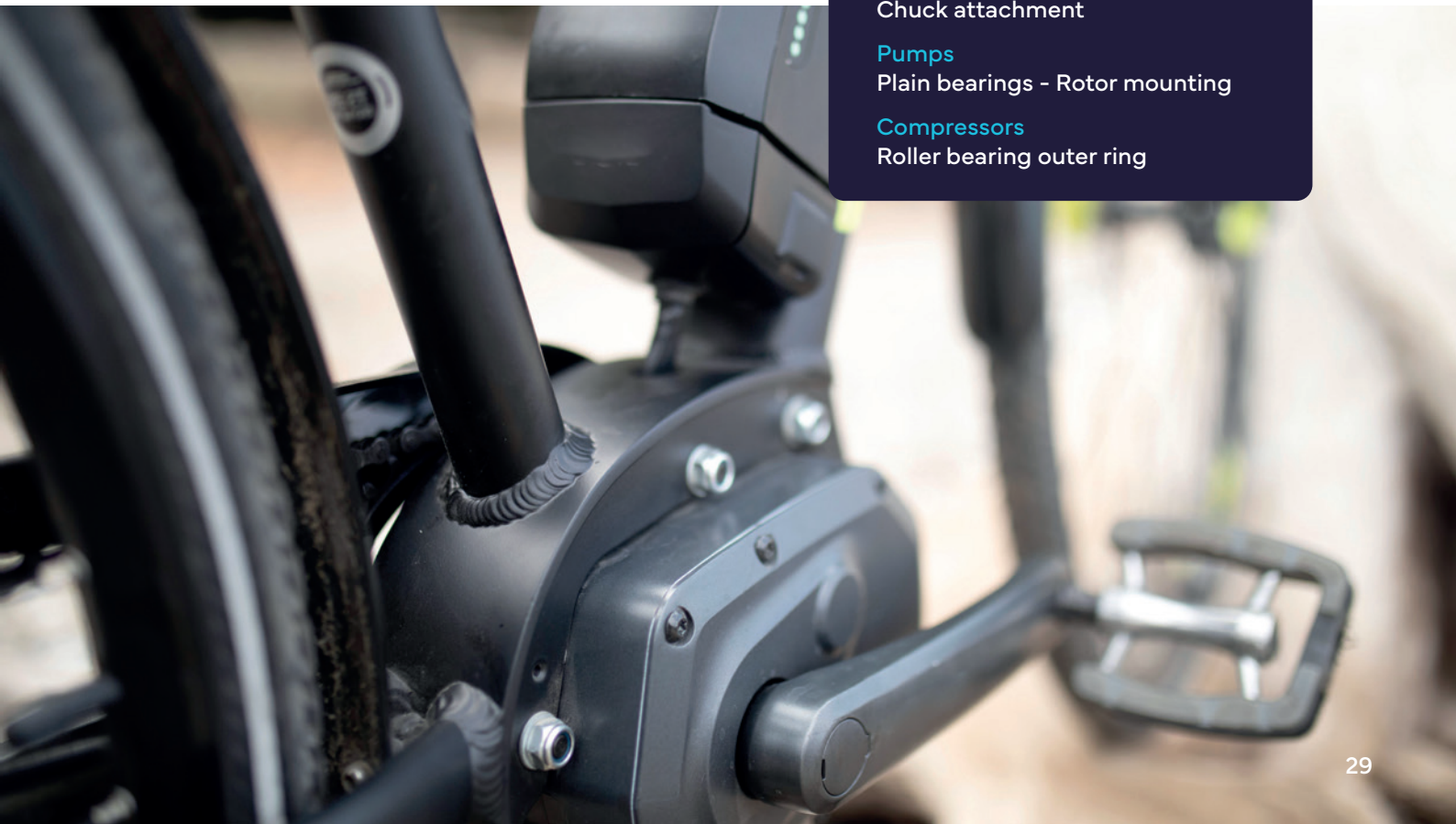
Construction machinery
Hydraulic systems | Pulleys

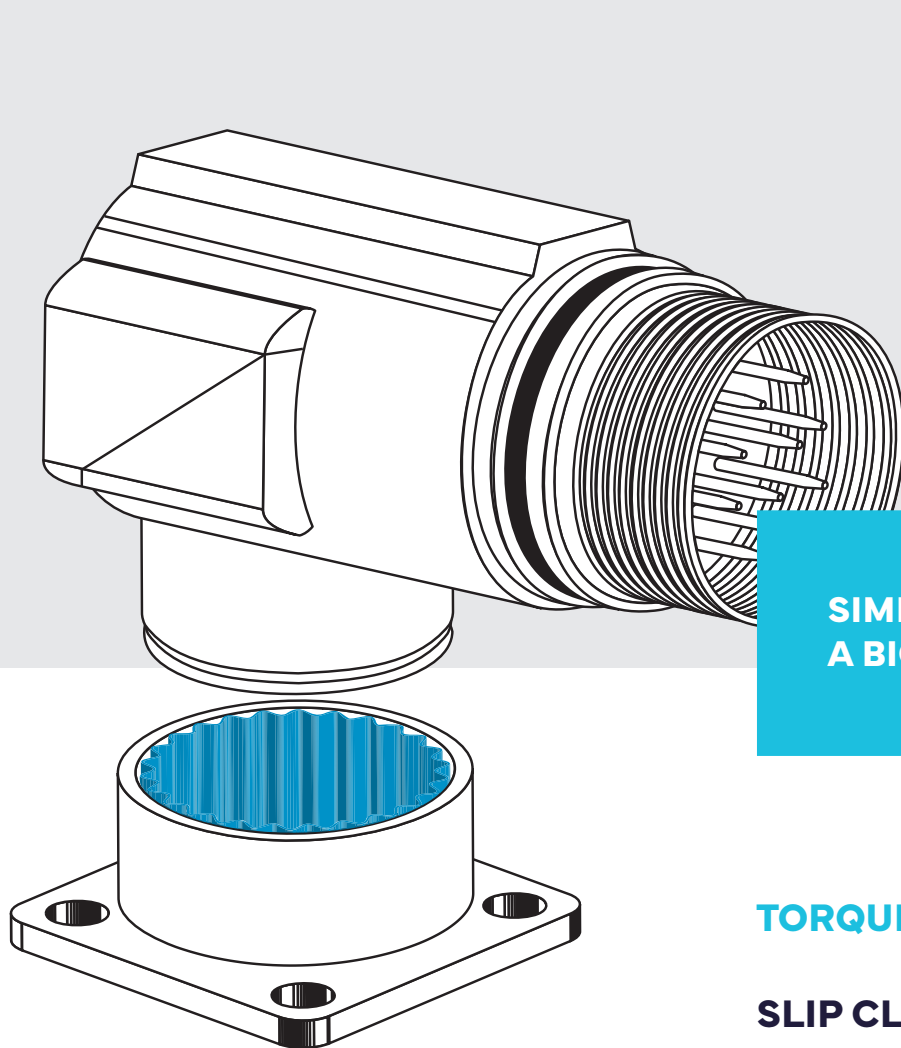
Agricultural machinery
Mowers | Drive systems

Power tools
Chuck attachment

Pumps
Plain bearings - Rotor mounting

Compressors
Roller bearing outer ring





**SIMPLE AIDS WITH
A BIG IMPACT**

TORQUE TRANSMISSION

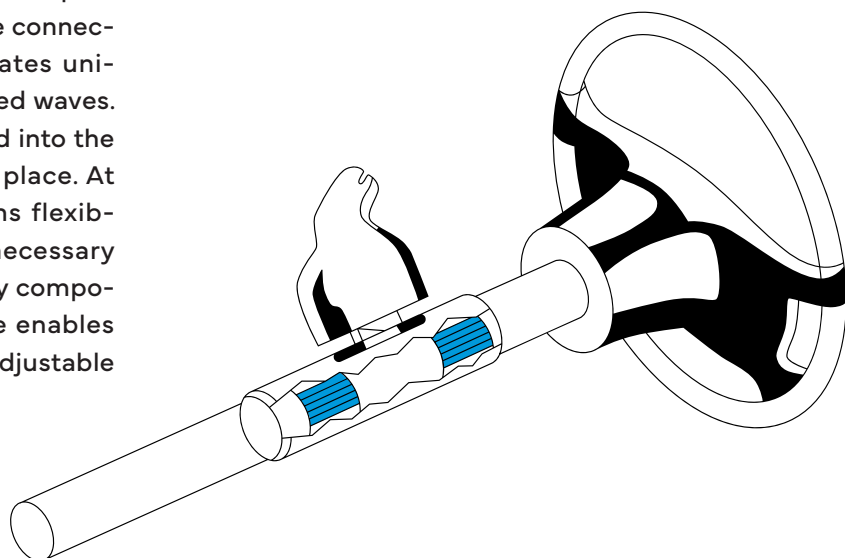
SLIP CLUTCH IN THE STEERING SYSTEM

Tolerance rings can also be used as slip clutches. The illustration shows how they function as anti-theft devices in a vehicle's steering system. If the steering wheel is turned jerkily and with a lot of force in one direction, the locking bolt breaks off and the steering spindle slips through. In addition, the torque is too high to be able to steer the vehicle.

POSITIONING

POSITIONING OF THE CABLE OUTLET FOR ANGLED PLUGS

In the case of angled connectors, the tolerance sleeve ensures that the cable outlet can be precisely aligned. It is inserted between the connector housing and the insert and generates uniform pressure thanks to its spring-loaded waves. This allows the cable outlet to be turned into the desired position and securely fixed in place. At the same time, the connection remains flexible enough to readjust the position if necessary without having to loosen or damage any components. In this way, the tolerance sleeve enables precise, stable and, at the same time, adjustable positioning of the cable outlet.





OVERLOAD PROTECTION

SAFETY IN THE EVENT OF A FALL

Self-retracting safety belts usually cause a sharp jolt when the brake is activated in the event of a fall. A tolerance ring acting as a fall damper between the belt brake and the belt roller provides a remedy: it allows the connection to slip briefly and in a controlled manner during braking, significantly dampening the jolt and thus reducing the forces acting on the body.

After a fall, the tolerance sleeve can be quickly replaced with the connecting parts, while the rest of the belt remains in use. This increases safety and reduces follow-up costs.

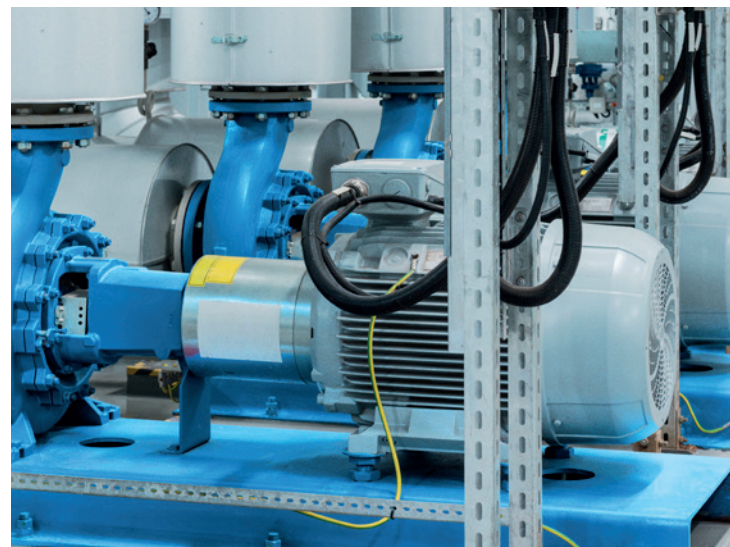
FASTENING

COMPENSATION FOR MANUFACTURING TOLERANCES AND TEMPERATURE DIFFERENCES DURING PUMP ASSEMBLY

Different materials in an assembly expand at different rates when exposed to temperature changes. This leads to stress, fitting problems and, in the worst case, damage.

Ceramic plain bearings are particularly affected by tolerance differences in pumps: critical forces arise between silicon carbide and shafts made of brass or stainless steel in rigid press fits. Tolerance sleeves solve this problem.

As spring-elastic, force-fit connecting elements, they reliably compensate for manufacturing tolerances and thermal expansion differences and hold the components in position with low tension. They are suitable for bearing mounting as well as for mounting impellers and rotors on drive shafts. Assembly remains simple and reproducible, and components can be dismantled and reused as required. This increases operational reliability and



availability – while reducing maintenance costs and overall costs.



Dr. TRETTER AG
Schaffhauserstr. 96
CH-8222 Beringen
www.tretter.ch

T: +41 52 670 06 10
info@tretter.ch

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