

TECHNICAL INFORMATION

**SD COMPATIBLE
HEAVY DUTY BEARINGS**



COOPER
SPLIT ROLLER BEARINGS

INTRODUCTION

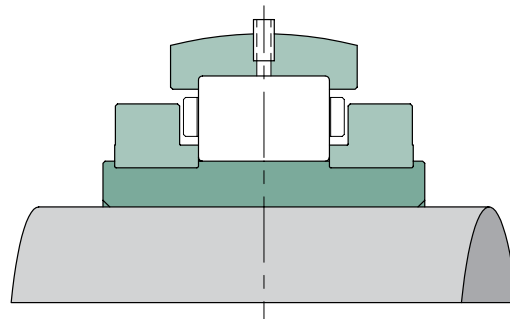
The range of Cooper fully-split Heavy Duty SDC Series roller bearing units is designed to replace solid bearings mounted in SD31 series pillow blocks where access is limited for assembly or maintenance. The Cooper Heavy Duty SDC Series is available in common bore sizes from 150mm to 240mm.

The 180mm bore size version uses standard Cooper 02 Series bearings and cartridges in a pedestal to match SD3140 bolt hole configuration and height to centre. Other sizes use 08 Series bearings with spherically-backed outer races mounted directly in the pedestals. These bearings are based on the Cooper 02 Series and have the same load ratings. The two halves of the outer race are screwed together and have alignment features to ensure that an accurate roller path is maintained across the outer race joint.

For lighter loadings a full range of pedestal-mounted units interchangeable with the SD31 series is available based on the Cooper 01 Series bearings and cartridges. Full details of the 01 Series based units can be found in the Cooper Product Catalogue.

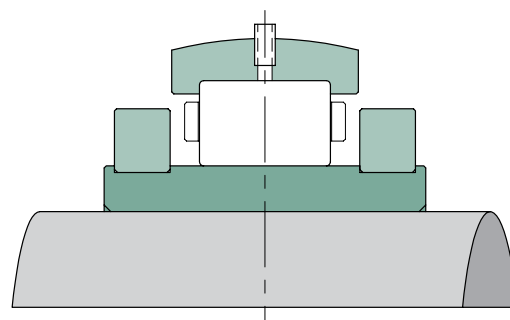
Bearing types

The 08 Series is supplied in two standard forms: the fixed (GR) type and the expansion (EX) type.



Fixed (GR) Bearing

The fixed (GR) type provides axial location and can sustain both radial and axial loading. The outer race has shoulders formed integrally with the roller track, while the inner race has shoulders formed by hardened lips on the clamping rings. The 02 Series 180mm size use a similar arrangement for roller guidance but has a cylindrical outer race mounted in a standard Cooper cartridge.



Expansion (EX) Bearing

The expansion (EX) type has a different inner race and clamping rings, with space between the clamping rings and the rollers. If axial expansion and contraction occur when the shaft is rotating, the Cooper bearing offers virtually no resistance to this axial movement, as the rollers spiral across the inner race with negligible sliding. This eliminates the 'false thrust' that is the cause of significant bearing life reduction in both the free and fixed positions with other bearing types.

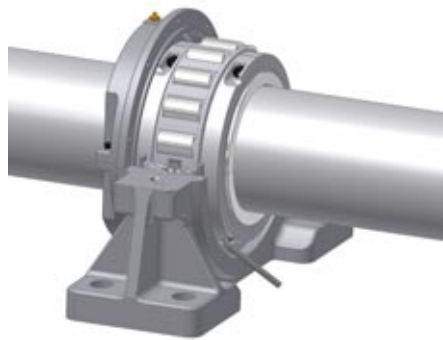
The 02 Series 180mm size uses a standard Cooper 'EX' bearing, which uses a plain outer race (without shoulders) and a similar inner race to the fixed (GR) type bearing, with guide lips on the clamping rings. This type offers similar free expansion of the shaft, but in this case the rollers spiral across the plain track of the outer race.

Housings

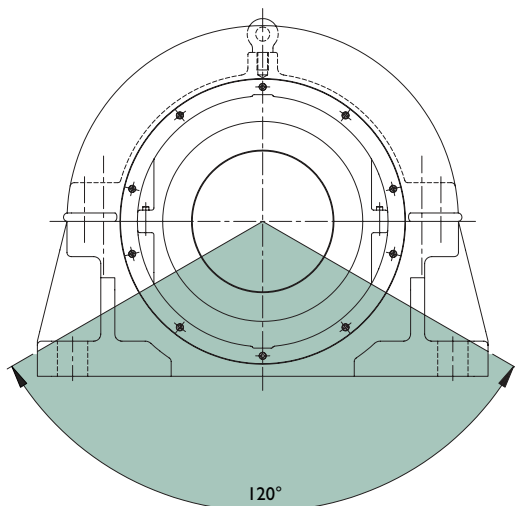
The Cooper SDC range of pedestal-mounted bearing units is designed to be interchangeable with industry-standard SD31 series units, having similar bolt-hole configuration and height to shaft centreline and being within the same footprint.

The housings for the 08 Series bearings are specially designed to give access to the bearing and seals for inspection and replacement of parts when required. Not only is the pedestal divided horizontally into a 'cap' and 'base', but it is provided with removable end covers. These covers can be removed to give access to the seals without disturbing the bearing, or to give access to the clamping ring screws if the shaft has to be stopped in an inconvenient orientation. These end covers can also be replaced with different versions if it is ever found desirable to change to a different seal type.

Generally, the direction of the radial load should be within



the shaded area of the diagram below. The full static rating of the bearing (C_{or}) can be applied if the load direction is within this area. If the load is outside this area, or if the axial load exceeds 50% of the axial rating (C_a) please consult our technical department.



Bearing Selection

Radial loading

Bearing ratings for dynamic radial capacity (C_r) and static radial capacity (C_{or}) shown on this leaflet are in accordance with ISO 281-1990 and ISO 76-1987 respectively. The axial load is considered independently of the radial load (i.e. an effective radial load taking into account the axial load is not required).

Expected bearing life is calculated by the following equation:

$$L_{10} = [C_r / (P \times f_d)]^{(10/3)}$$

where:

L_{10} = expected life of 90% of similar bearings under similar operating conditions

C_r = radial dynamic rating

P = applied radial load

f_d = dynamic or service factor; generally from 1 for steady loading to 3.5 for heavy shock, reciprocation or vibration

The method used to select bearings to achieve satisfactory life is explained more fully in the Cooper Product Catalogue. It is recommended that bearings are selected to give an L_{10} life of at least 10,000 hours (or more depending on application requirements).

In order to achieve satisfactory bearing operation the radial load must exceed a certain value. The general minimum loads are $C_r/65$ for GR bearings and $C_r/120$ for EX bearings. It may be possible to accommodate lower loads, as the minima are affected by factors such as lubrication type and bearing speed.

Axial loading

The suitability for axial load is considered separately to radial loading. The bearing must satisfy the following condition:

Expected bearing life is calculated by the following equation:

$$C_a > (f_{da} \times f_{dn} \times P_a)$$

where:

C_a = axial rating

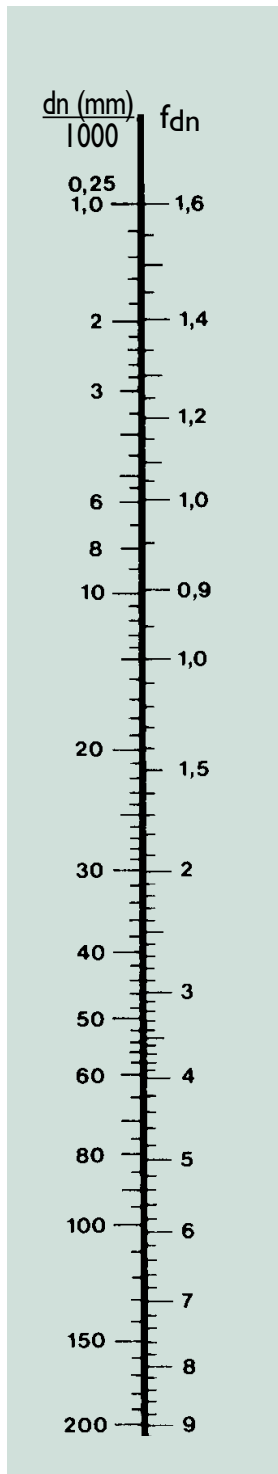
f_{da} = dynamic or service factor

P_a = calculated axial load

f_{dn} = velocity (dn) factor (see Figure 1)

f_b = bearing factor
 = 1 for $dn(\text{mm})$ up to 63,500
 = 1.25 for $dn(\text{mm})$ 63,500 and above

Figure 1 **Velocity
Factor**



The dynamic or service factor f_{da} may be 1 for peak overload periods and 1.1 to 1.2 for general running (depending on smoothness), where the load is accurately known. An allowance for any inaccuracies in the calculated loads must be made to ensure that the bearing axial capacity is not exceeded.

The load should not exceed 50% of C_a unless the bearing is located in a shaft recess or by retaining rings, which will not generally be the case if converting an existing application with this type of bearing.

If the axial load exceeds 40% of the radial load, please consult our technical department.

The axial capacity is decreased by 50% if the lubricant does not have extreme pressure (EP) additives.

Temperature

The normal range for standard bearings is 0° to 100°C. Where the temperature rise is mainly from the shaft, increased diametric clearance may be necessary.

Above 100°C, special consideration must be given to material, design, lubrication and seals. Above 120°C, special heat treatment of the bearing parts is required. A reduction in radial capacity occurs at temperatures above (150°C) which can be seen below.

°C	170	200	250
% reduction	5	15	25

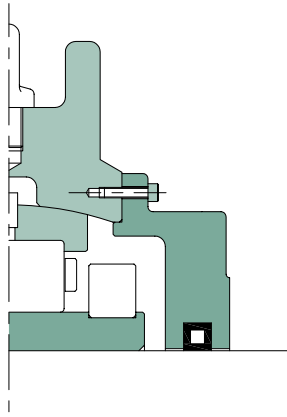
For temperatures above 100°C or below 0°C, please consult our technical department.

Sealing

The standard sealing arrangement fitted to the 180mm unit (which uses a standard O2 Series bearing and cartridge) is a single felt seal. Many other sealing arrangements are possible, as for other Cooper cartridges. Please refer to the Cooper Product Catalogue for further information.

The O8 Series is available with 3 sealing options as detailed below. The maximum misalignments specified below are the maximum misalignments between the pedestal bore (and therefore nominal seal bore) and shaft axis.

Flexible packing seal (FP)



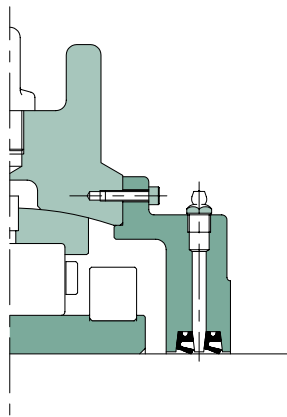
Aramid braid wound around a flexible polymeric core to accommodate misalignment between the shaft and pedestal. Suitable for general dry applications, including materials handling.

Temperature limits	-20°C to 100°C
Maximum speed	50,000 dn(mm)
Maximum misalignment	0.25°
Shaft surface finish	1.6µm Ra (max. roughness)

Synthetic rubber single lip (SRS)

High temperature version (SRS HT)

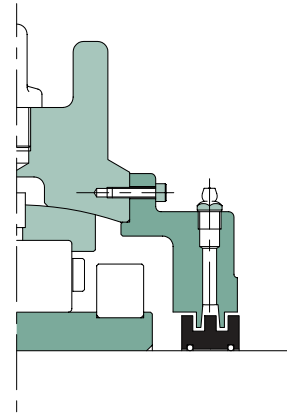
Low temperature version (SRS LT)



Suitable for wet but not submerged conditions.

Temperature limits	SRS	-20°C to 100°C
	SRS HT	20°C to 175°C
	SRS LT	-60°C to 100°C
Maximum speed	150,000 dn(mm)	
Maximum misalignment	0.25°	
Shaft surface finish	0.8µm Ra (max. roughness)	

Aluminium triple labyrinth (ATL)



High temperature version (ATL HT)

Low temperature version (ATL LT)

Machined aluminium-bodied triple labyrinth seal capable of high speed operation. Often used on fans.

Temperature limits	ATL	-20°C to 100°C
	ATL HT	20°C to 175°C
	ATL LT	-60°C to 100°C
Maximum speed	Bearing maximum	
Maximum misalignment	0.5°	
Shaft surface finish	3.2µm Ra (max. roughness)	

Lubrication

Fittings

Lubrication points are tapped 1/8"NPT or 1/4"NPT and fitted with nipples for grease lubrication as standard. Nipples may be removed and replaced with other fittings or pipes.

Housings for flexible packing seals have one lubrication point only, for lubrication of the bearing. Housings for SRS or ATL seals also have a lubrication point in each end cover for lubrication of the seals.

Lubricant type

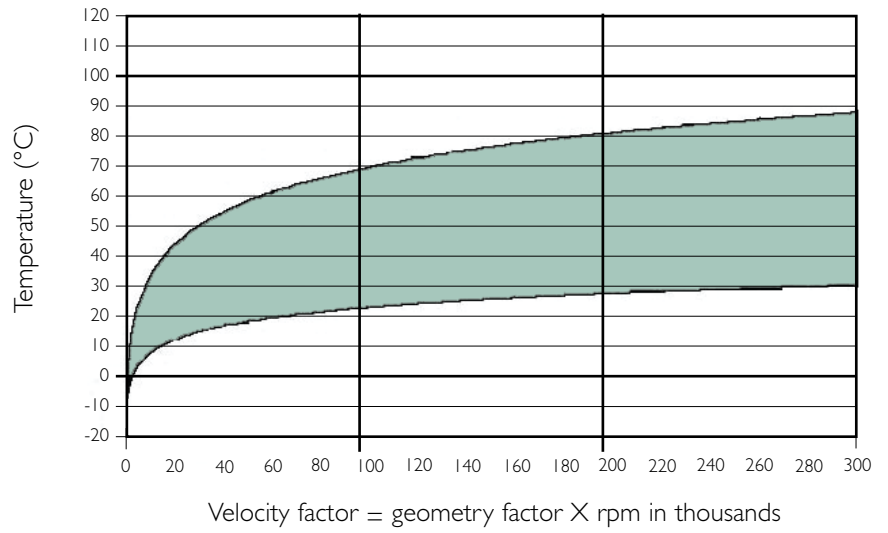
Cooper SD Series housings are designed for grease lubrication. Grease is easier to retain in the housing than oil, offering reduced lubricant loss and improved sealing. It also offers better protection against corrosion to the rolling surfaces.

Greases of NLGI No.2 designation are recommended for most applications. For centrally pumped systems a No.1 grease may be used for increased 'pumpability'.

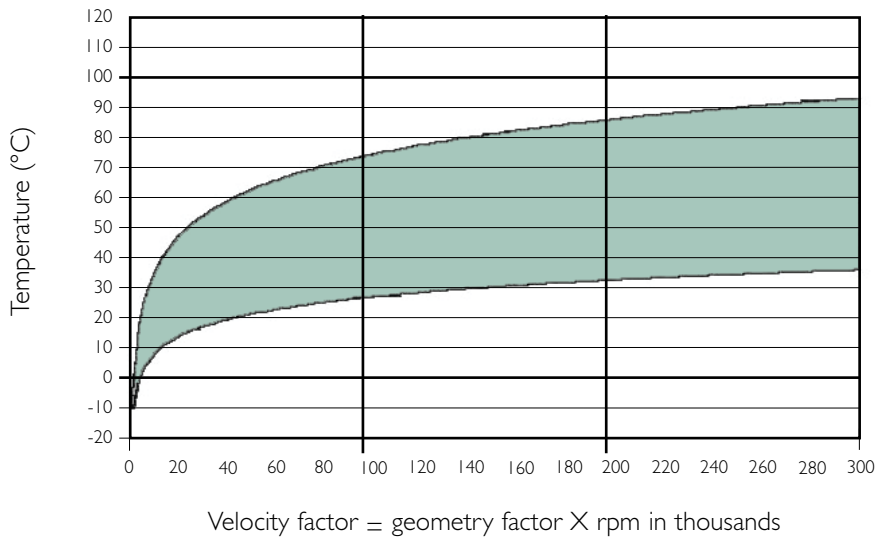
SD COMPATIBLE HEAVY DUTY BEARINGS

Figure 2

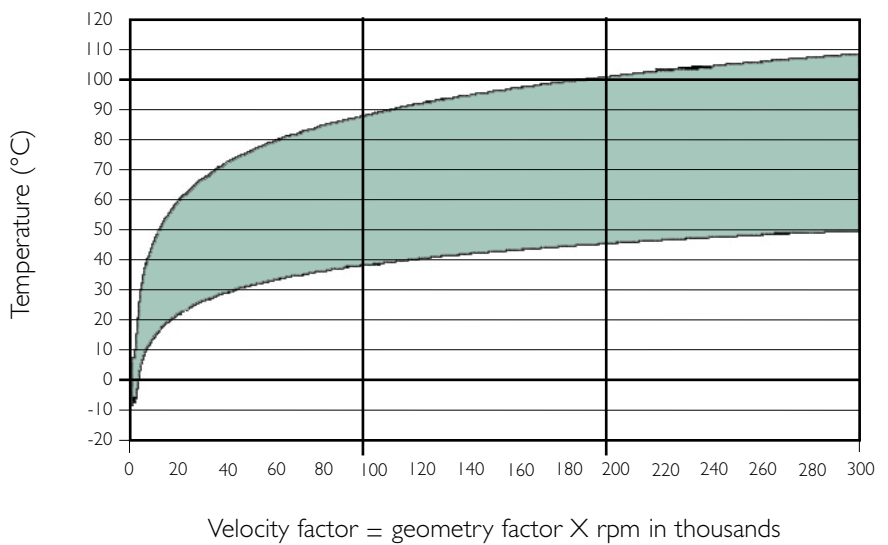
Cooper Bearing recommended speed and temperature range for VG 150 grease and oils



Cooper Bearing recommended speed and temperature range for VG 220 grease and oils



Cooper Bearing recommended speed and temperature range for VG 460 grease and oils



Greases with extreme pressure (EP) additives are recommended and are essential if the full axial load capacity of the bearing is to be used.

Grease with a lithium complex thickener is usually used for normal applications operating at temperatures between 0°C and 80°C. When water resistance is required a grease with aluminium complex thickener can be used. Aluminium complex greases are not compatible with some other types of grease. The bearing must therefore be solvent cleaned of other greases before adding an aluminium complex based grease.

For extreme temperatures, speeds and loads always obtain a lubricant recommendation from our technical department.

Selection of base oil viscosity

In order for the bearing to have a long service life the grease selected for bearing lubrication must have a base oil of sufficiently high viscosity to adequately separate the rolling elements and race parts under operating conditions.

The charts in Figure 2 show the recommended operating ranges for three common oil viscosities, for bearings under normal loading (up to Cr/10).

To use these charts, find the 'geometry factor' for the bearing from Table 1 and multiply this by the bearing speed in thousands of rpm to obtain the velocity factor.

For example, if a 200mm bearing is to be run at 600rpm:

The geometry factor is 258 from the table
Velocity factor = $258 \times (600/1000) = 154.8$

To determine the suitability of one of these oils, draw a vertical line from the horizontal axis at the calculated velocity factor, and draw a horizontal line from the vertical axis at the operating temperature.

If the lines intersect in the shaded area the viscosity of oil is suitable. If the lines intersect above the shaded area a higher viscosity oil is required. If the lines intersect below the shaded area the bearing may operate satisfactorily but it is suggested that a grease with a lower viscosity base oil is used.

The use of these charts is subject to the operating conditions being within the recommended ranges for the lubricant as specified by the lubricant manufacturer.

For conditions not covered by these charts please contact our technical department.

Note that the lubrication film thickness is not particularly sensitive to load, so for heavier loading the lubricant selection as provided by these charts is usually sufficient provided that the lines drawn on the chart as explained above do not intersect at the upper edge of the shaded area.

Grease quantity for initial lubrication

The quantity of grease required on initial lubrication is dependent upon operating speed and temperature.

If the operating temperature is below 80°C the quantity of grease may be determined directly according to the bearing reference and operating speed from Table 2. If the operating temperature is above 80°C a 25% pack of grease should be used regardless of operating speed (refer to the right hand column of the table).

With a 'full pack' of grease the space within the housing (i.e. surrounding the bearing components) in the assembled unit is completely filled with grease.

The table assumes normal density grease (about 0.85 g/cm³).

TABLE 1 - GEOMETRY FACTOR

Shaft Diameter (mm)	Bearing Reference	Geometry factor
150	08 B 150M EX	176
	08 B 150M GR	
160	08 B 160M EX	176
	08 B 160M GR	
180	02 B 180M EX	216
	02 B 180M GR	
200	08 B 200M EX	258
	08 B 200M GR	
220	08 B 220M EX	297
	08 B 220M GR	
240	08 B 240M EX	343
	08 B 240M GR	

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TABLE 2 - INITIAL LUBRICANT QUANTITIES

Shaft Diameter (mm)	Pedestal Reference	Speed (rpm) up to	Grease (full pack) kg	Speed (rpm)		Grease (75% full pack) kg	Speed (rpm)		Grease (50% full pack) kg	Speed (rpm)		Grease (33% full pack) kg	Speed (rpm) over	Grease (25% full pack) kg
				from	to		from	to		from	to			
150	08 SDC3134	328	2.10	328	656	1.57	656	984	1.05	984	1312	0.69	1312	0.53
160	08 SDC3136	328	2.04	328	656	1.53	656	984	1.02	984	1312	0.67	1312	0.50
180	02 SDC3140	281	2.00	281	562	1.5	562	844	1.00	844	max.	0.66	-	0.50
200	08 SDC3144	246	3.50	246	492	2.63	492	738	1.75	738	max.	1.16	-	0.88
220	08 SDC3148	219	3.62	219	437	2.72	437	656	1.81	656	max.	1.20	-	0.90
240	08 SDC3152	197	5.17	197	394	3.88	394	591	2.59	591	max.	1.71	-	1.30

Routine Greasing

If possible, the bearing should be re-greased as it rotates. Lubricate the bearing via the lubrication point in the pedestal cap.

Expansion bearings (EX): Lubricate every 400 hours. This frequency may be increased to weekly if desired. For 150mm and 160mm sizes use approximately 4ml of grease (generally 2 shots of grease from a conventional grease gun) For larger sizes use approximately 8ml of grease (generally 4 shots).

Fixed bearing (GR): Lubricate the bearing weekly (i.e. approximately every 150hours operation). For 150mm and 160mm sizes use approximately 4ml of grease (generally 2 shots of grease from a conventional grease gun). For larger sizes use approximately 8ml of grease (generally 4 shots). If the bearing is used for location only (i.e. there is no nominal axial load) it may be treated as per the expansion bearing of the same size for lubrication purposes.

Seals: If end covers with seal lubrication points are fitted the seals of both types of bearing should be lubricated with 2ml (one shot) of grease via each seal lubrication point every time the bearing is relubricated.

Pumped systems should be metered to supply equivalent quantities of lubricant to those specified above.

Frequency Data

Bearing frequency data are included in this document for two purposes:

- to allow machine designers to check excitation frequencies against resonant frequencies in the machine,
- to allow correct input into condition monitoring equipment that uses these data.

A roller bearing will excite vibrations at certain frequencies related to the number, size and pitch circle diameter of the rollers. To some extent this excitation is present even with new bearings in perfect condition, as the load is carried on discrete, elastic, rolling elements which are constantly changing in angular position.

Table 3 indicates the frequencies of bearing parts per shaft revolution, which can be used to calculate excitation frequencies directly by multiplying the tabulated frequencies by the shaft speed.

The frequencies listed are explained as follows:

- 'Cage' – the frequency at which a point on the cage enters and leaves the loaded zone of the bearing
- 'Roller' – the frequency at which a point on a given roller passes into contact with either the inner or outer race
- 'Outer' – the frequency at which a point on the outer race comes into contact with successive rollers
- 'Inner' – the frequency at which a point on the inner race comes into contact with successive rollers

The table also lists the pitch circle diameters and number of rollers, for use with condition monitoring equipment that accepts this information.

Note that the contact angle is 0 in all cases.

TABLE 3 - BEARING FREQUENCIES

Shaft Diameter (mm)	Bearing Reference	Part Frequencies (per shaft rev.)				Roller Details		
		Cage	Roller	Outer	Inner	PCD (mm)	No.	Diameter (mm)
150	08 B 150M EX 08 B 150M GR	0.421	3.103	6.743	9.257	222.25	16	34.93
160	08 B 160M EX 08 B 160M GR	0.421	3.103	6.743	9.257	222.25	16	34.93
180	02 B 180M EX 02 B 180M GR	0.425	3.258	6.800	9.200	254.00	16	38.10
200	08 B 200M EX 08 B 200M GR	0.428	3.389	6.844	9.156	285.75	16	41.28
220	08 B 220M EX 08 B 220M GR	0.434	3.703	7.806	10.194	311.15	18	41.28
240	08 B 240M EX 08 B 240M GR	0.435	3.792	7.833	10.167	342.90	18	44.45

TABLE 4 - TIGHTENING TORQUES

Shaft Diameter (mm)	Pedestal Reference	Bearing type	Clamping ring screw			Outer race joint location strip screw		
			Screw size	Key size A/F (mm)	Torque (Nm)	Screw size	Key size A/F (mm)	Torque (Nm)
150	08 SDC3134	EX or GR	M8 x 30	6	35	M4 x 12	2.5	2.7
160	08 SDC3136	EX or GR	M8 x 30	6	35	M4 x 12	2.5	2.7
180	02 SDC3140	EX or GR	M10 x 45	8	70	M10 x 45 (1)	8 (1)	52.5 (1)
200	08 SDC3144	EX or GR	M12 x 55	10	120	M4 x 12	2.5	2.7
220	08 SDC3148	EX or GR	M12 x 55	10	120	M4 x 12	2.5	2.7
240	08 SDC3152	EX	M16 x 65	14	300	M4 x 12	2.5	2.7
		GR	M12 x 55	10	120	M4 x 12	2.5	2.7

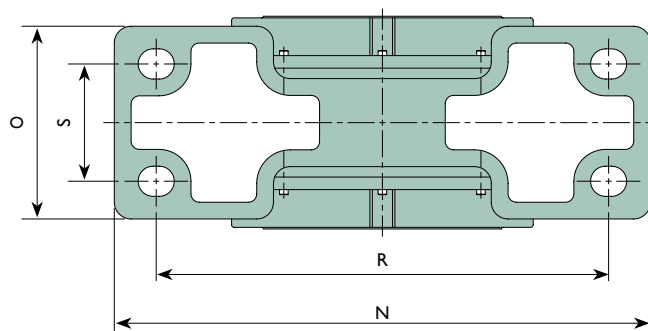
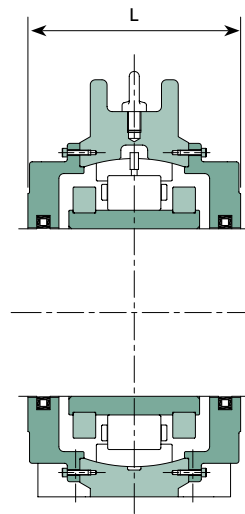
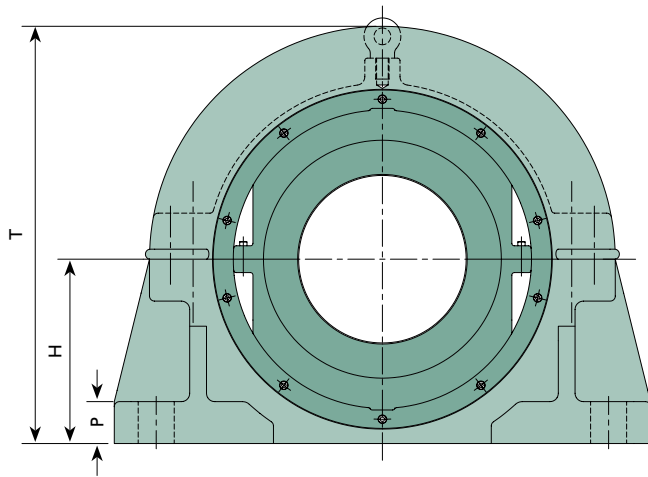
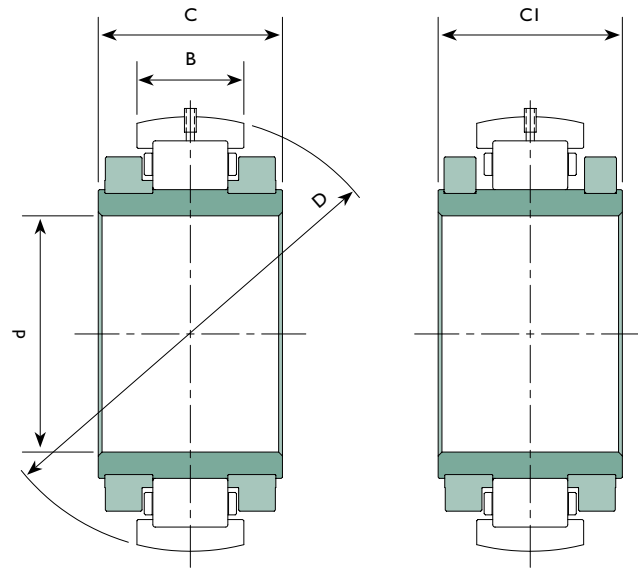
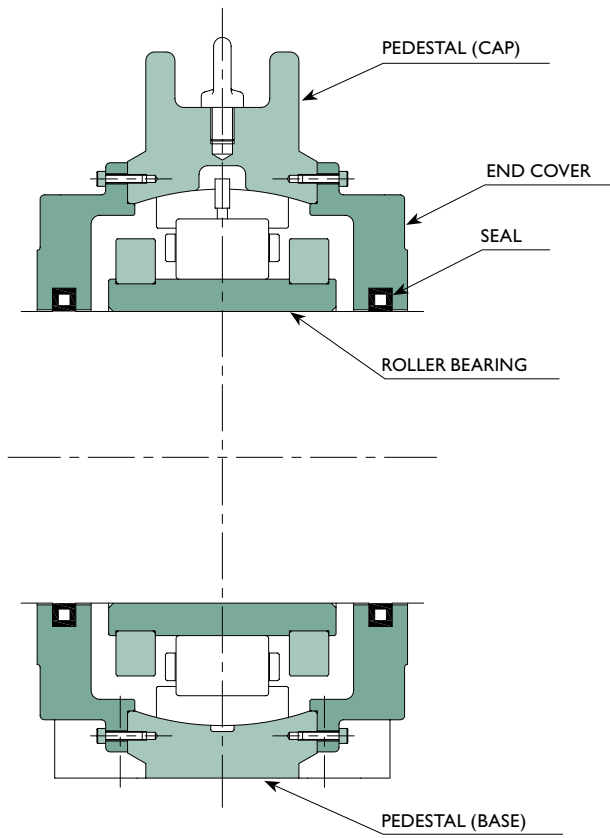
Tightening Torques

The tightening torques for the assembly of the bearings and housing are given in Table 4. Full assembly instructions are packed with the bearings, and are available separately if required.

- 1) Refers to cartridge joint screw
- 2) Refers to cartridge radial screw
- 3) Refers to cartridge side screw

Shaft Diameter (mm)	Pedestal Reference	Bearing type	Outer race joint screw			End cover to pedestal screw			End cover joint screw			Pedestal joint screw		
			Screw size	Key size A/F (mm)	Torque (Nm)	Screw size	Key size A/F (mm)	Torque (Nm)	Screw size	Key size A/F (mm)	Torque (Nm)	Screw size	Key size A/F (mm)	Torque (Nm)
150	08 SDC3134	EX or GR	M5 x 25	4	8.5	M6 x 25	5	11	M6 x 25	5	11	M20 x 80	17	420
160	08 SDC3136	EX or GR	M5 x 25	4	8.5	M6 x 25	5	11	M6 x 25	5	11	M20 x 80	17	420
180	02 SDC3140	EX or GR	M10 x 25 (2)	8 (2)	35 (2)	M6 x 10 (3)	3 (3)	7.8 (3)	N/A	N/A	N/A	M20 x 100	17	420
200	08 SDC3144	EX or GR	M5 x 30	4	8.5	M6 x 25	5	11	M8 x 30	6	26	M24 x 100	19	712
220	08 SDC3148	EX or GR	M5 x 30	4	8.5	M8 x 30	6	26	M8 x 30	6	26	M24 x 100	19	712
240	08 SDC3152	EX	M6 x 30	5	15	M8 x 30	6	26	M8 x 30	6	26	M30 x 120	22	1568
		GR	M6 x 30	5	15	M8 x 30	6	26	M8 x 30	6	26	M30 x 120	22	1568

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ROLLER BEARING

Shaft Diameter (mm)	References		Bearing Ratings				Principal Dimensions				Axial Movement (1) (mm)	Mass (kg)
	Expansion Type	Fixed Type	Cr (kN)	Cor (kN)	Ca (kN)	Max. Speed (rpm)	D	C	CI	B		
150	08 B 150M EX	08 B 150M GR	724	1005	52.4	1320	292	123.8	123.8	68.5	10	29
160	08 B 160M EX	08 B 160M GR	724	1005	52.4	1320	292	123.8	123.8	68.5	10	27
180 (4)	02 B 180M EX	02 B 180M GR	840	1191	71.2	1120	330.2 (5)	140	140	83.3	11	45
200	08 B 200M EX	08 B 200M GR	998	1457	80.0	960	368	156	156	90.5	10	49
220	08 B 220M EX	08 B 220M GR	1082	1662	89.8	850	395	163	163	90.5	14	58
240	08 B 240M EX	08 B 240M GR	1149	1756	98.8	750	432	170	178	96.8	18	92

PEDESTAL, END COVERS AND SEALS

Pedestal	References								
	End Cover (2)			Pedestal complete with End Covers			Seal (2)		
	To suit FP seal	To suit SRS seals	To suit ATL seal	To suit FP seal	To suit SRS seals	To suit ATL seal	FP	SRS	ATL
08SDC3134	EC150M	EC150MSRS	EC31	08SDC3134 EC	08SDC3134 ECSRS	08SDC3134 ECTL	FP150M	SR 150M	ATL 150M08
08SDC3136	EC160M	EC160MSRS	EC3110	08SDC3136 EC	08SDC3136 ECSRS	08SDC3136 ECTL	FP160M	SR 160M	ATL 160M08
02SDC3140	02 C 180M (6)	02 C 180M (6)	02 C 33 (6)	(N/A)	(N/A)	(N/A)	(7)	SR 180M (2)	ATL 180M
08SDC3144	EC200M	EC200MSRS	EC34	08SDC3144 EC	08SDC3144 ECSRS	08SDC3144 ECTL	FP200M	SR 200M	ATL 200M
08SDC3148	EC220M	EC220MSRS	EC35	08SDC3148 EC	08SDC3148 ECSRS	08SDC3148 ECTL	FP220M	SR 220M	ATL 220M08
08SDC3152	EC240M	EC240MSRS	EC36	08SDC3152 EC	08SDC3152 ECSRS	08SDC3152 ECTL	FP240M	SR 240M	ATL 240M08

PRINCIPAL HOUSING DIMENSIONS

H	R (mm)		S	Bolt Size	N	O	P	T	L	Mass (kg)			Shaft Diameter d (mm)
	Min.	Max.								Pedestal Only	End Covers (full set)	Complete Unit (with bearing)	
170	424	436	100	M24	510	170	40	395	220	49	25	103	150
180	444	456	110	M24	530	180	40	405	220	52	24	103	160
210	503	517	130	M30	600	210	40	482	242 (8)	99	66 (6)	210	180 (4)
220	533	547	140	M30	640	230	50	498	256	89	42	180	200
240	593	607	150	M30	700	240	55	540	261	117	47	222	220
260	642	658	160	M36	770	270	60	585	280	143	58	293	240

1) Total available movement available in expansion bearing. Maximum offset from centreline half this amount.
 2) 2 off required per unit
 3) 4 off required per unit
 4) Dimensions refer to standard Cooper 02 Series bearing in cartridge and pedestal

5) Cylindrical diameter
 6) Refers to cartridge type housing
 7) Standard seals for 02 180mm are felt seals. These are supplied with the cartridge.
 8) 222mm with felt or SRS seals

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