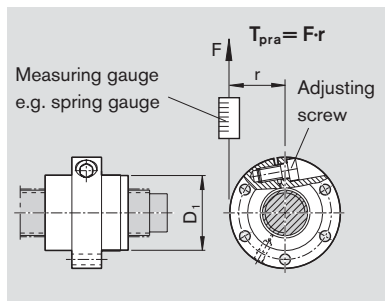


Preload of adjustable-preload single nuts

Measurement of the dynamic drag torque for SEM-E-C and SEM-E-S. Using the adjusting screw, reduce the clearance of the nut mounted on the screw until the corresponding dynamic drag torque T_{pra} specified in the table \Rightarrow page 123, has been attained (ball screw lightly oiled). Check this torque along the entire length of the thread; if the torque deviates from the value specified in the table at any point along the thread, adjust accordingly. Once the torque has been properly adjusted, the centering diameter D_1 must correspond to the values specified in the table \Rightarrow pages 44 and 48. Cover the head of the screw with a protective cap.



T_{pra} = currently measured dynamic drag torque

Mounting instructions are supplied as standard along with every unit. Please ask for extra copies if needed.

Installation in the machine

It is not normally necessary to remove the preservative coating before installation.

- If the ball screw is contaminated it must first be cleaned (see "Cleaning") and re-oiled
- Push the nut unit into the mounting bore, taking care to avoid any impact force or misalignment.
- Tighten the mounting screws using a torque wrench if necessary. Maximum tightening torque for the steel/steel material pairing ($R_m \geq 370 \text{ N/mm}^2$), see table.

Screw diameter (mm)	Tightening torque (Nm)		
	Strength class per DIN ISO 898:		
	8.8	10.9	12.9
M3	1.3	1.8	2.1
M4	2.7	3.8	4.6
M5	5.5	8.0	9.5
M6	9.5	13.0	16.0
M8	23.0	32.0	39.0
M10	46.0	64.0	77.0
M12	80.0	110.0	135.0
M14	125.0	180.0	215.0
M16	195.0	275.0	330.0
M18	280.0	400.0	470.0
M20	390.0	560.0	650.0

- For the steel/aluminum and aluminum/aluminum material pairings ($R_m \geq 280 \text{ N/mm}^2$) the maximum tightening torques specified in the follow table apply. When driving screws into aluminum, the length of thread engagement should be at least 1.5 times the screw diameter.

Screw diameter (mm)	Tightening torque (Nm)		
	Strength class per DIN ISO 898:		
	8.8	10.9	12.9
M3	1.2	1.2	1.2
M4	2.4	2.4	2.4
M5	4.8	4.8	4.8
M6	8.5	8.5	8.5
M8	20.0	20.0	20.0
M10	41.0	41.0	41.0
M12	70.0	70.0	70.0
M14	110.0	110.0	110.0
M16	175.0	175.0	175.0
M18	250.0	250.0	250.0
M20	345.0	345.0	345.0

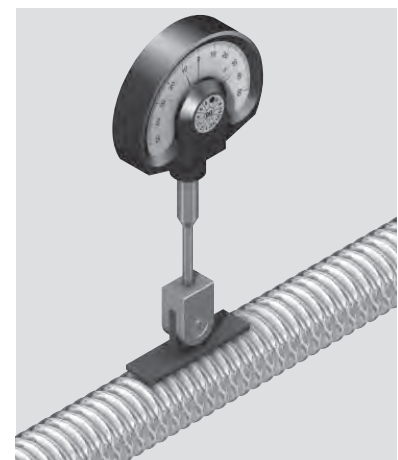
Tightening torques for fastening screws according to VDI 2230 for $\mu_G = \mu_K = 0.125$

Alignment of the precision ball screw assembly in the machine

A gauge with a self-aligning contact pad is available from Rexroth for easy alignment of the ball screw assembly.

Two pads of different lengths are available, which can be used depending on the screw lead:

- Part number R3305 131 19 Length 33 mm for leads < 20
- Part number R3305 131 21 Length 50 mm for leads > 20



Lubrication

Lubrication

When lubricating, please refer to the product and material safety data sheets for Dynalub which can be found online at www.boschrexroth.de/brl

Standard lubrication practices for ball bearings also apply to ball screws. Lubricant loss is, however, greater than that from conventional ball bearings, for instance, due to the axial motion between the screw and the nut.

Lifelong lubrication

If the Ball Screw is supplied completely pre-assembled with Front Lube Unit, it will require no relubrication for up to 300 million revolutions or five years in service. Afterwards, the Ball Screw can be relubricated as specified in the tables below.

Oil lubrication

The influence of the temperature on the performance of the ball screw is very significant, as the thermal expansion of the ball screw interferes with the positioning accuracy of the assembly. One of the advantages of oil lubrication over grease lubrication is therefore the minimized heat build-up of the ball screw, particularly

at high speeds.

As a rule, commercially available mineral base oils used for ball bearings are suitable. The necessary viscosity depends on the speed, temperature and load conditions of the respective application (see DIN 51517, 51519 and GfT Work-sheet 3). Oils ranging from ISO VG 68 to approx. ISO VG 460 are used in practice. The high viscosity grades (e.g. ISO VG 460) should be preferred in general and particularly for slow running screws. A maximum relubrication interval of up to 10 operating hours can be attained with small quantities from the adjacent table. Please ask for details for driven nuts.

Relubrication quantity and intervals for oil

d ₀	Lubricating quantity		Lubricating interval ¹⁾															
	Initial lubrication	Relubrication	Time (h)	Revolutions (mill.)	Travel (km) with lead P =													
	V _e (ml)	V _n (ml/10 h)			1	2	2.5	5	10	12	16	20	25	32	40			
6	0.300	0.030	10	1.3	1.3	2.6												
8	0.300	0.030	10	1.3	1.3	2.6	3.3											
12	0.300	0.030	10	1.3		2.6			6.5	13.0								
16	0.300	0.030	10	1.3					6.5	13.0		20.8						
20	0.600	0.060	10	1.0					5.0				20.0					40.0
25	0.600	0.060	10	1.0					5.0	10.0						25.0		
32	0.600	0.060	10	1.0					5.0	10.0				20.0			32.0	
40	2.000 ²⁾	0.400 ²⁾	10	1.0					5.0	10.0	12.0	16.0	20.0					40.0
50	4.000 ²⁾	0.800 ²⁾	10	1.0					5.0	10.0	12.0	16.0	20.0	25.0				40.0
63	4.000 ²⁾	0.800 ²⁾	10	1.0						10.0				20.0				40.0
80	8.000	1.600	10	1.0						10.0				20.0				40.0

d₀ = nominal diameter

1) The value first reached defines the lubricating interval. 2) For 2-start single nut FED-E-B: use double the quantity of lubricant

Limit conditions:

- Load = ≤ 0.2 C
- n_{min} = 100 min⁻¹
- Temp_{max. nut} = 80 °C
- Temp_{continuous nut} = 60 °C

- Orientation: – any
- Operating mode: – driven screw
– no short stroking or hypercritical operation
- Sealing: – standard

Grease lubrication

The advantage of grease lubrication is that the ball screw can run long distances on one supply of grease. As a result, a lubricating system is not required in many cases. The amount of grease used should fill the nuts to approximately half of their capacity. All commercially available high-quality ball bearing lubricating greases may be used. Read the lubricant manufacturer's specifications carefully! Never use greases with solid lubricant components (e.g. graphite or MoS₂).

For relubrication, grease cartridges containing Dynalub 510 and 520 are available from Rexroth. Greases in accordance with DIN 51825-K2K and, for higher loads, KP2K of NLGI grade 2 in accordance with DIN 51818 are recommended for the longest possible lubrication intervals. Tests have shown that greases of NLGI grade 00 achieve only about 50% of the running performance of Class 2 at higher loads. The relubrication interval depends on many factors such as the degree of contamination, operating temperature, load, etc. The following values can thus serve only as a guideline.

Relubrication intervals for NLGI-2 greases

d ₀	Lubricating quantity Relubrication V _e (ml)	Lubricating interval										
		Revolutions (mill.)	Travel (km) with lead P =									
		1	2	2.5	5	10	16	20	25	32	40	
≤ 40	see table for	50	50	100	125	250	500	800	1000	1250	1600	2000
> 40	NLGI-2 greases	10				50	100	160	200			400

d₀ = nominal diameter

Relubrication quantities for Standard series

For NLGI grade 2 and NLGI grade 00 greases:

The nut has to be lubricated with lubricant via the lube port before the ball screw is started.

Twice the relubrication quantity of grease is to be used when lubricating for the first time.

Size	Relubrication quantity of grease (g)	
	Single nut FEM-E-C / FEM-E-S / SEM-E-C SEM-E-S / ZEM-E-A / ZEM-E-S FED-E-B Precision screw SN-R	Double nut FDM-E-C / FDM-E-S Precision screw SN-R
$d_0 \times P \times D_W - i$		
8 x 2.5R x 1.588 - 3	0.10	–
12 x 2R x 1.2 - 4	0.15	–
12 x 5R x 2 - 3	0.30	–
12 x 10R x 2 - 2	0.30	–
16 x 5R x 3 - 4	0.60	1.7
16 x 10R x 3 - 3	0.80	–
16 x 16R x 3 - 2	0.90	–
16 x 16R x 3 - 3	1.10	–
20 x 5R/L x 3 - 4	0.90	2.7
20 x 5R x 3 - 5	1.00	–
20 x 10R x 3 - 4	1.40	–
20 x 20R/L x 3.5 - 2	1.70	–
20 x 20R x 3.5 - 3	2.20	–
25 x 5R/L x 3 - 4	1.40	3.2
25 x 10R x 3 - 4	1.70	3.8
25 x 25R/L x 3.5 - 2	2.40	–
25 x 25R x 3.5 - 3	3.10	–
32 x 5L x 3.5 - 4	2.30	–
32 x 5R x 3.5 - 4	2.00	4.5
32 x 10R x 3.969 - 5	2.80	6.0
32 x 20R x 3.969 - 2	2.50	–
32 x 20R x 3.969 - 3	3.20	–
32 x 32R x 3.969 - 2	3.70	–
32 x 32R x 3.969 - 3	4.90	–
40 x 5L x 3.5 - 5	3.10	–
40 x 5R x 3.5 - 5	2.70	6.9
40 x 10L x 6 - 4	6.00	–
40 x 10R x 6 - 4	6.00	15.1
40 x 10R x 6 - 6	7.30	17.7
40 x 12R x 6 - 4	6.10	–
40 x 16R x 6 - 4	8.30	19.3
40 x 20R x 6 - 3	7.80	18.5
40 x 20R x 6 - 4 x 2	8.60	–
40 x 40R x 6 - 2	9.40	–
40 x 40R x 6 - 3	12.90	–
40 x 40R x 6 - 3 x 2	13.80	–
50 x 5R x 3.5 - 5	3.90	7.1
50 x 10R x 6 - 4	8.00	19.7
50 x 10R x 6 - 6	9.70	23.0
50 x 12R x 6 - 6	10.40	–
50 x 16R x 6 - 6	14.60	–
50 x 20R x 6.5 - 3	11.40	–
50 x 20R x 6.5 - 5	15.60	31.3
50 x 20R x 6.5 - 4 x 2	9.10	–
50 x 25R x 6.5 - 3 x 2	9.60	–
50 x 40R x 6.5 - 2	13.90	–
50 x 40R x 6.5 - 3	18.60	–
50 x 40R x 6.5 - 3 x 2	17.60	–
63 x 10R x 6 - 4	9.00	23.0
63 x 10R x 6 - 6	11.00	27.0
63 x 20R x 6.5 - 3	13.90	–
63 x 20R x 6.5 - 5	19.20	39.4
63 x 20R x 6.5 - 4 x 2	13.20	–
63 x 40R x 6.5 - 2	17.00	–
63 x 40R x 6.5 - 3	22.90	–
63 x 40R x 6.5 - 3 x 2	24.80	–
80 x 10R x 6.5 - 6	16.30	39.0
80 x 20R x 12.7 - 6	59.00	119.5

NLGI grade 00
Dynalub 520 or alternatively
Castrol Longtime PD00

NLGI grade 2
Dynalub 510 or alternatively
Castrol Longtime PD2

Lubrication

Lubrication

Relubrication quantities for Miniature, ECOplus and eLINE series.

For NLGI grade 2 and NLGI grade 00 greases:

The nut has to be lubricated with lubricant via the lube port before the ball screw is started.

Twice the relubrication quantity of grease is to be used when lubricating for the first time.

Size $d_0 \times P \times D_w - i$	Relubrication quantity of grease (g) Single nut, precision-rolled screw SN-R				
	FEM-E-B -Miniature	FBZ-E-S	FSZ-E-S	FEP-E-S	ZEV-E-S
6 x 1R x 0.8- 4	0.06	–	–	–	– NLGI grade 00
6 x 2R x 0.8- 4	0.12	–	–	–	– Dynalub 520
8 x 1R x 0.8- 4	0.12	–	–	–	– or alternatively
8 x 2R x 1.2- 4	0.24	–	–	–	– Castrol Long-
8 x 2.5R x 1.588- 3	0.10	–	–	–	– time PD00
12 x 2R x 1.2- 4	0.15	–	–	–	–
12 x 5R x 2- 3	0.30	–	–	–	– 0.30
12 x 10R x 2- 2	0.30	–	–	–	– 0.30
16 x 5L x 3- 3	–	–	–	–	– 0.85 NLGI grade 2
16 x 5R x 3- 3	–	–	–	–	– 0.85 Dynalub 510
16 x 10R x 3- 3	–	–	–	–	– 1.00 or alternatively
20 x 5R x 3- 4	–	0.7	0.7	–	– 1.20 Castrol Long-
20 x 5R x 3- 5	–	–	–	–	– time PD2
20 x 40R x 3.5- 1 x 4	–	–	–	1.6	–
25 x 5R x 3- 4	–	1.1	1.1	–	–
25 x 10R x 3- 4	–	1.3	1.3	–	–
25 x 25R x 3.5- 1.2 x 4	–	–	–	1.5	–
32 x 5R x 3.5- 4	–	1.6	1.6	–	–
32 x 10R x 3.969- 5	–	2.3	2.3	–	–
32 x 20R x 3.969- 2	–	–	2.0	–	–
32 x 32R x 3.969- 1.2 x 4	–	–	–	2.6	–
32 x 64R x 3.969- 1 x 4	–	–	–	3.1	–
40 x 5R x 3.5- 5	–	–	2.2	–	–
40 x 10R x 6- 4	–	–	5.2	–	–
40 x 20R x 6- 3	–	–	6.7	–	–