The Drive & Control Company

Rexroth
Bosch Group

# Planetary Screw Assemblies PLSA

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Bosch Group

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Catalog "Planetary Screw Assemblies PLSA" R310DE 3308 (2014.01)

Dear Ladies and Gentlemen,
The edition 2014-01 replaces the 2013-03 edition.
The print version of the 2014-01 edition is from around the end of March 2014 available.

Changes / additions:

- New sizes

Translations are under preparation.

Mit freundlichen Grüßen/ best regards
Bosch Rexroth AG
20.02.2014 / DC-IA / MKT31

Firmensitz / Headquarters: Stuttgart, Registrierung / Registration: Amtsgericht Stuttgart HRB 23192
Vorstand / Executive Board: Vorstand: Dr. Karl Tragl (Vorsitzender), Vorsitzender / President; Dr. Georg Hanen; Reiner Leipold-Büttner; Dr. Stefan Spindler
Vorsitzender des Aufsichtsrats / Chairman of the Supervisory Board: Vorsitzender des Aufsichtsrats: Dr. Siegfried Dais

# Planetary Screw Assemblies PLSA

Product Overview

# Nuts, Screws, Screw Ends, Bearings

| **Nuts** | | **Page** |
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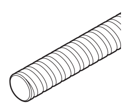
| **Flanged Single Nut**<br><br>**FEM-E-S**<br>With backlash or preload |  | **12** |
| **Flanged Single Nut split**<br><br>**FDM-E-S**<br>With preload |  | **14** |
| **Screws** | | |
| **Precision-rolled screw**<br>**PSR**<br>Tolerance grades<br>T5, T7, T9 |  | **16** |
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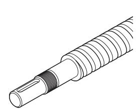
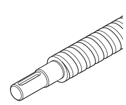
| |   | **17** |
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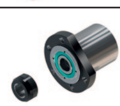
| **LAS** |  | **32** |
| **FEC-F** |  | **34** |

| **Diameter $d_0$** (mm) | **Lead P** (mm) | | |
|---|---|---|---|
| | 5 | 10 | 20 |
| 20 | X | - | - |
| 30 | X | X | - |
| 39 | X | X | - |
| 48 | X | X | - |
| 60 | - | X | X |
| 75 | - | X | X |

Product Overview

# Planetary Screw Assembly – Definition

**The Planetary Screw Assembly PLSA is an assembly comprising a screw with planets as the rolling elements.**
**It serves to convert rotary motion into linear motion and vice versa.**
**The function principle of a planetary screw assembly is easy to describe, but the range of designs and the requirements for practical applications are many and varied.**
**Planetary Screw Assemblies are designed to transmit high forces and extend the Screw Drives product portfolio at the upper end.**
**Planetary Screw Assemblies are screw drives in which threaded rollers (the planets) are housed in a screw nut, their ends being lodged in discs with holes arranged around a pitch circle so that they rotate parallel to the axis of a special screw, causing the nut to move linearly along the screw.**

Rexroth Planetary Screw Assemblies offer designers many opportunities to solve transport and positioning tasks in configurations with a driven screw. At Rexroth you will be sure to find exactly the kind of tailor-made products you need for special applications.

Structural Design:
Both the screw and the nut have an identical multi-start profile with a flank angle of 90°.
The planets have journals at both ends with are lodged in holes bored in the guide discs. The toothed ends of the planets engage with the internal gear rings of the nut. The planets have single-start threads and crowned flanks that roll without slipping along the nut threads.

At each end of the nut there is an internally geared ring which engages with the external gearing on the planets. Guide discs inside the gear rings support the planets' journals and ensure that they are correctly spaced. The discs also prevent coarse dirt from working its way into the nut.

Versions:
- Cylindrical Single Nut with backlash or preload (ZEM-E-S)
- Flanged Single Nut with backlash or preload (FEM-E-S)
- Flanged Single Nut, split, with preload (FDM-E-S)

## Precision Screws PSR

Bosch Rexroth has a long tradition of manufacturing precision screws. Offered in many sizes and in unmatched quality, these have for years been essential components in our Ball Screw Assemblies product range.

We have transferred this tried and trusted manufacturing technology to the screws of our Planetary Screw Assemblies. For users, this results in many advantages, including the following:
- Identical quality to Rexroth Ball Screw Assemblies
- Fast delivery
- Attractive prices thanks to cost-effective manufacturing

## Advantages

- Smooth functioning due to the synchronized movement of the planets
- Very low noise
- High linear travel speeds
- Large number of contact points
- High load ratings
- High mechanical efficiency
- Long life
- Compact design
- High power density
- Effective wiper seals
- Low lubricant consumption
- Preloaded units available
- High positioning accuracy and repeatability

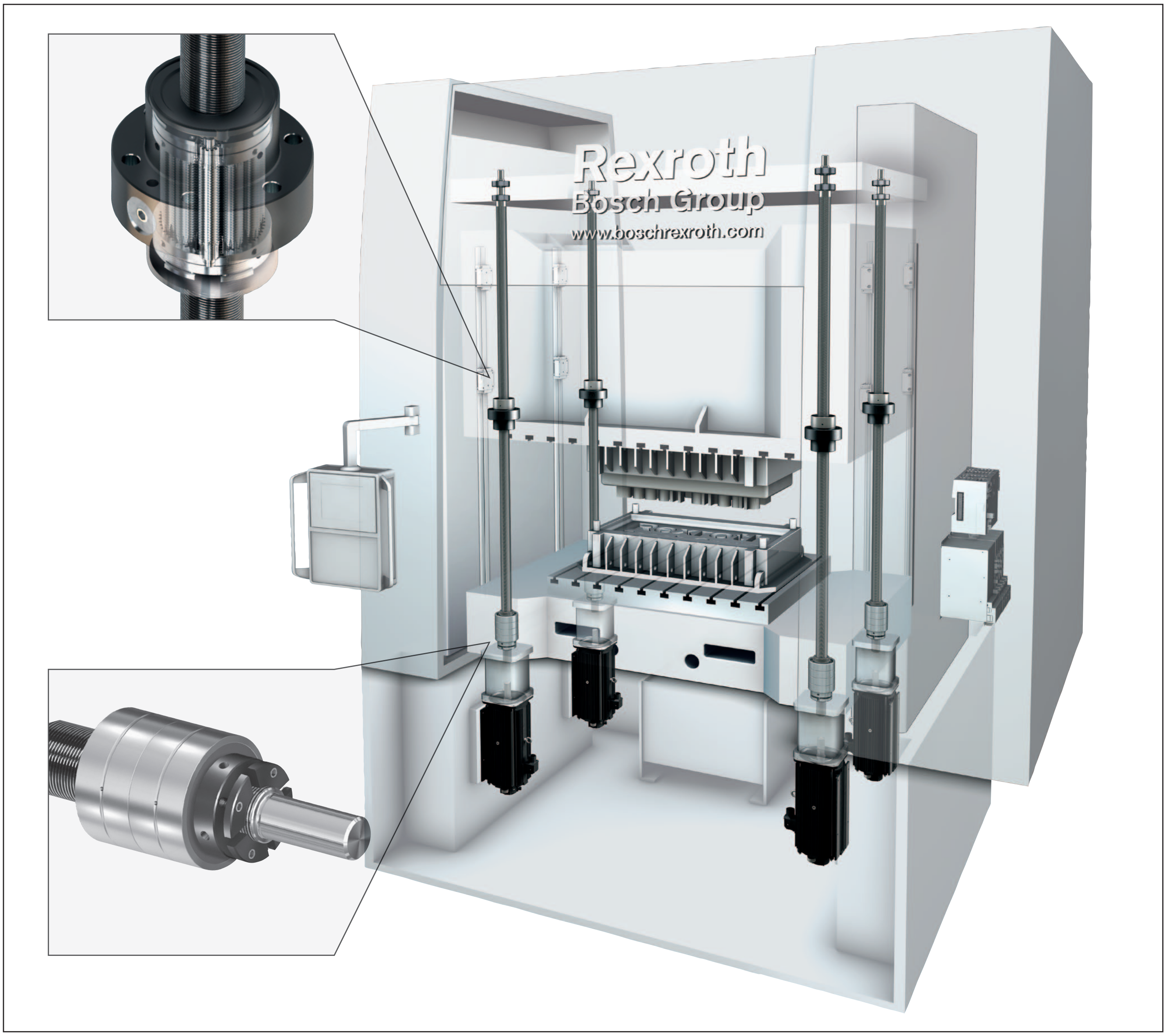
Product Overview

# Application Examples

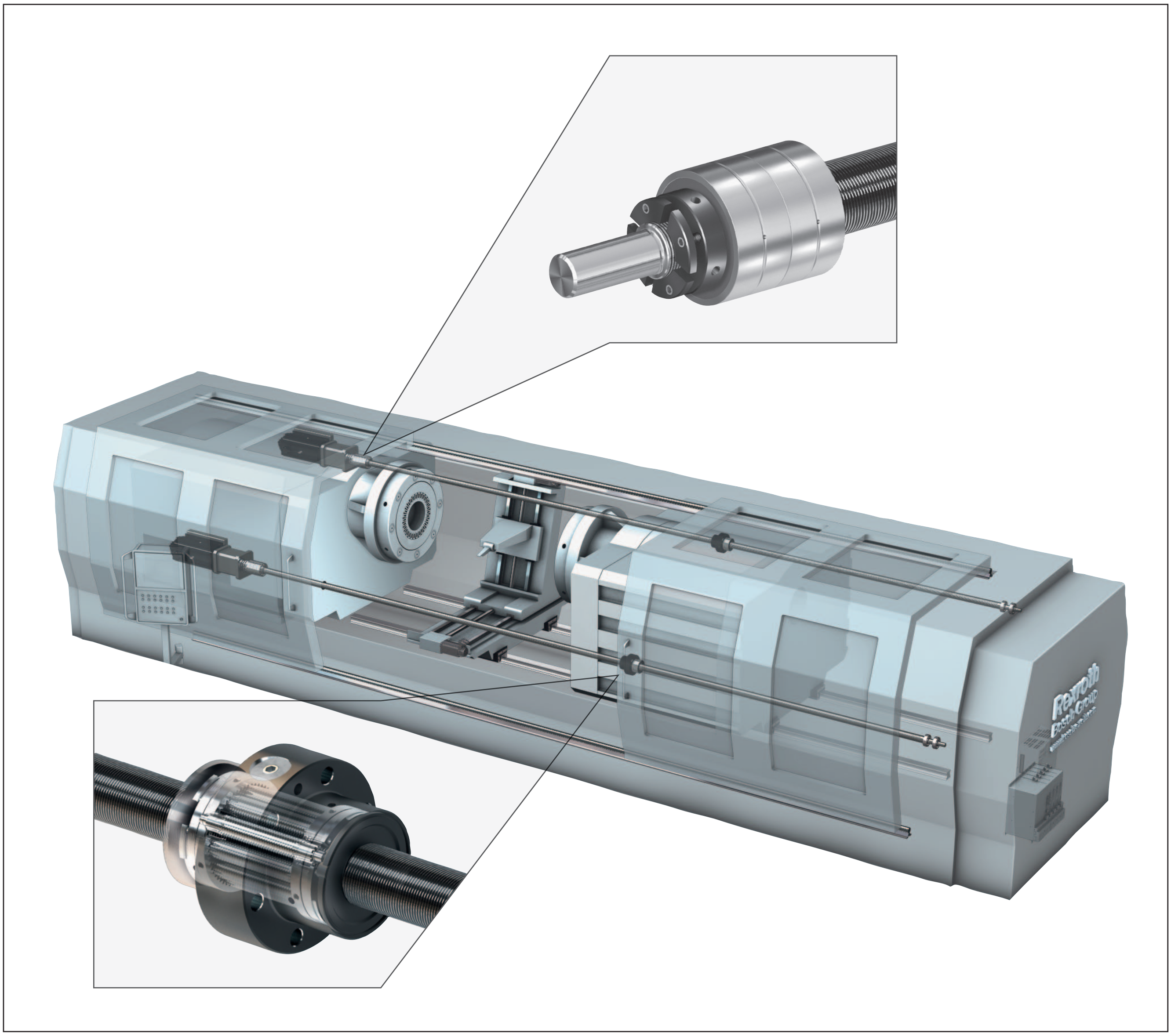
**Rexroth Planetary Screw Assemblies are used with great success in many different application areas:**

- Plastic injection molding machines
- Machine tools
- Measuring and material testing machines
- Robots
- Automotive industry
- Aerospace industry
- Automation and handling
- Food and packaging industries
- Printing and paper industry
- Medical technology
- Cutting operations
- Forming operations
- Metals industry

## Electric press



Friction welding machine



Product Overview

# Inquiries and Orders

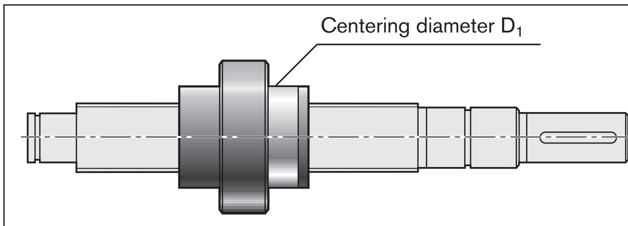
## Nut type

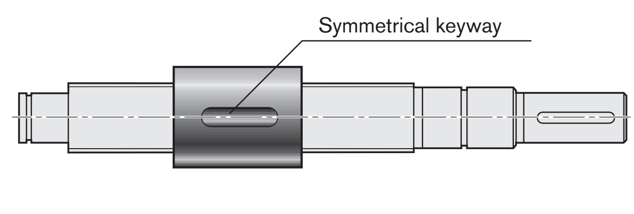
The various series versions and forms are shown below.

| Nuts | |
|---|---|
| **Cylindrical Single Nut**<br>**ZEM-E-S**<br>With backlash or preload |  |
| **Flanged Single Nut**<br>**FEM-E-S**<br>With backlash or preload |  |
| **Flanged Single Nut split**<br>**FDM-E-S**<br>With preload |  |

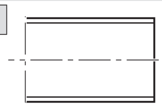
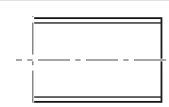
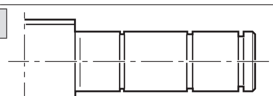
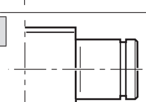
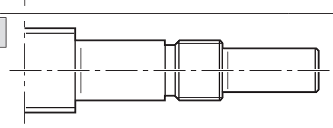
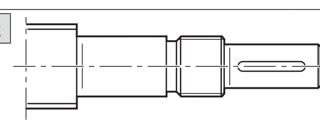
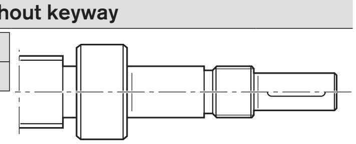
## Mounting direction of nut types

Definition: The centering diameter on a nut with flange points to the right end of the screw. For cylindrical nuts, the mounting direction can be chosen at will (symmetrical).

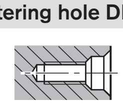
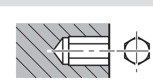



## Screw ends, forms for a left or right screw end

| Basic version | With keyway | Cut to size only „T“ |
|---|---|---|
| 002  | | 002  |
| 312  | | |
| 412  | | **End mechanically connected with/without keyway** |
| 812  | 822  | 832 / 842  |

**Machining of end face**

| Z Centering hole DIN 332-D | S Hex socket |
|---|---|
|  |  |

## Complete PLSA (screw and nut)

| Planetary Screw Assembly | FEM-E-S | 20 x 5R | 1 | 0 | T7 | R | 812Z120 | 412Z120 | 1250 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|---|

**Nut type**
ZEM-E-S Cylindrical Single nut
FEM-E-S Flanged Single Nut
FDM-E-S Flanged Single Nut, split

**Size**
Nominal diameter (mm)
Lead (mm)
Direction of lead **R** … right

**Seal** **0** … none; **1** … lip-type seal; **4** … gap-type seal (standard)

**Preload** **0** … backlash; **1** … preload

**Precision** **T5, T7, T9**

**Screw** **R** ... precision screw

**Left screw end**
Form
Option – **Z** … centering per DIN 332-D; **S** … hex socket; **K** … none
Version

**Right screw end** see left screw end

**Overall length $L_{tot}$ (mm)**

**Documentation**
**1** … standard (acceptance test report) – is always supplied
**2** … torque test report
**3** … lead test report
**6** … lead and torque test report

**Lubrication**
**1** … preserved and nut with basic greasing
**2** … preserved

Nuts

# Cylindrical Single Nut ZEM-E-S

- With standard seals
- With backlash max. 0.03 mm or preload
- For precision screws PSR in tolerance grade T5, T7, T9 (with backlash only)

**Note**: Delivered only as a complete unit.

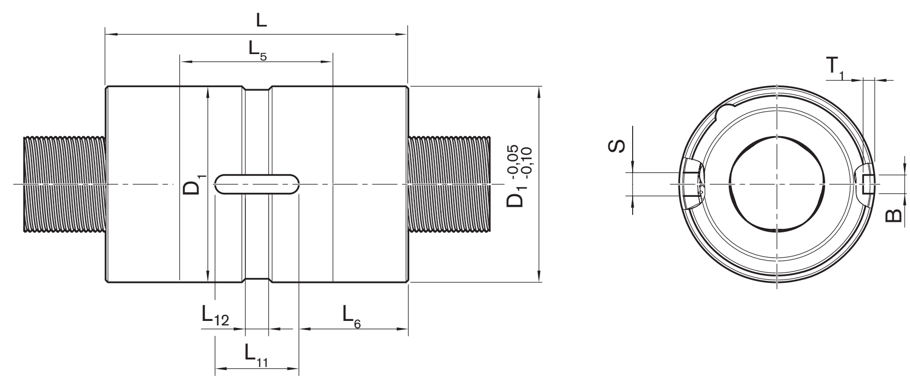
Ordering code PLSA:

| ZEM-E-S | 20 x 5R | 4 | 0 | T7 | R | 822Z120 | 412Z120 | 1250 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|

| $d_0$ x P | No. | $C^{1)}$ (kN) | $C_0^{1)}$ (kN) | $v_{max}^{2)}$ (m/min) |
|---|---|---|---|---|
| **20 x 5R** | R157C A10 03 | 55 | 80 | 37.5 |
| **30 x 5R** | R157C 310 13 | 87 | 178 | 25.0 |
| **30 x 10R** | R157C 330 03 | 101 | 174 | 50.0 |
| **39 x 5R** | R157C 410 03 | 123 | 269 | 19.2 |
| **39 x 10R** | R157C 430 03 | 145 | 271 | 38.4 |
| **48 x 5R** | R157C 610 03 | 188 | 481 | 15.6 |
| **48 x 10R** | R157C 630 03 | 220 | 475 | 31.2 |
| **60 x 10R** | R157C 730 03 | 322 | 780 | 25.0 |
| **60 x 20R** | R157C 770 03 | 375 | 786 | 50.0 |
| **75 x 10R** | R157C 830 03 | 480 | 1 487 | 20.0 |
| **75 x 20R** | R157C 870 03 | 544 | 1 496 | 40.0 |

1) The load ratings are valid for tolerance grade T5 only.
For other tolerance grades, please consider the correction factor $f_{ac}$ on page 43.
2) See page 43 Characteristic speed and page 62 Critical speed.

C = dynamic load rating
$C_0$ = static load rating
$d_0$ x P = size
$d_0$ = nominal diameter
No. = part number
P = screw lead (R = right-hand)
S = lube port
$v_{max}$ = maximum linear speed



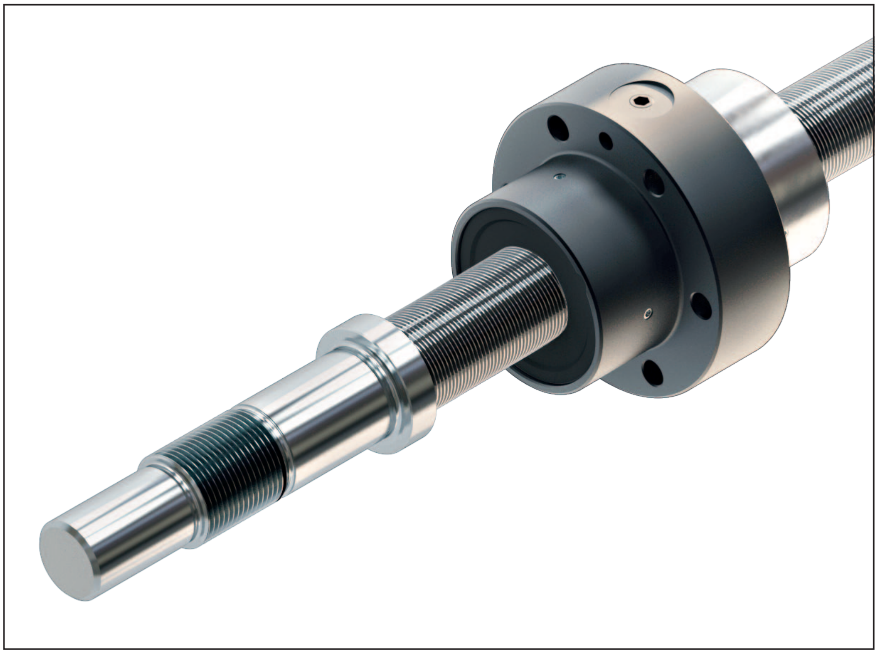

| $d_0$ x P | (mm) | | | | | | | | | Mass |
|---|---|---|---|---|---|---|---|---|---|---|
| | $B^{P9}$ | $D_{1\ g6}$ | L | $L_5$ | $L_6$ | $L_{11}$ $^{+0.2}$ | $L_{12}$ | $T_1$ $^{+0.1}$ | S | m (kg) |
| 20 x 5R | 4 | 42 | 65 | 34 | 23.5 | 18 | 5.0 | 2.5 | 2 | 0.62 |
| 30 x 5R | 6 | 64 | 85 | 53 | 26.5 | 32 | 5.0 | 3.5 | 5 | 1.25 |
| 30 x 10R | 6 | 64 | 85 | 53 | 26.5 | 32 | 5.0 | 3.5 | 5 | 1.25 |
| 39 x 5R | 8 | 80 | 100 | 64 | 30.0 | 40 | 5.0 | 4.0 | 5 | 2.00 |
| 39 x 10R | 8 | 80 | 100 | 64 | 30.0 | 40 | 7.0 | 4.0 | 5 | 2.00 |
| 48 x 5R | 8 | 100 | 127 | 87 | 41.0 | 45 | 7.0 | 4.0 | 5 | 4.20 |
| 48 x 10R | 8 | 100 | 127 | 87 | 41.0 | 45 | 7.0 | 4.0 | 5 | 4.20 |
| 60 x 10R | 10 | 122 | 152 | 99 | 53.5 | 45 | 10.5 | 5.0 | 5 | 6.82 |
| 60 x 20R | 10 | 122 | 152 | 99 | 53.5 | 45 | 10.5 | 5.0 | 5 | 6.80 |
| 75 x 10R | 10 | 150 | 191 | 129 | 64.0 | 63 | 10.5 | 5.0 | 5 | 14.00 |
| 75 x 20R | 10 | 150 | 191 | 129 | 64.0 | 63 | 10.5 | 5.0 | 5 | 13.70 |

Nuts

# Flanged Single Nut FEM-E-S

- With standard seals
- With backlash max. 0.03 mm or preload
- For precision screws PSR in tolerance grade T5, T7, T9 (with backlash only)

**Note**: Delivered only as a complete unit.



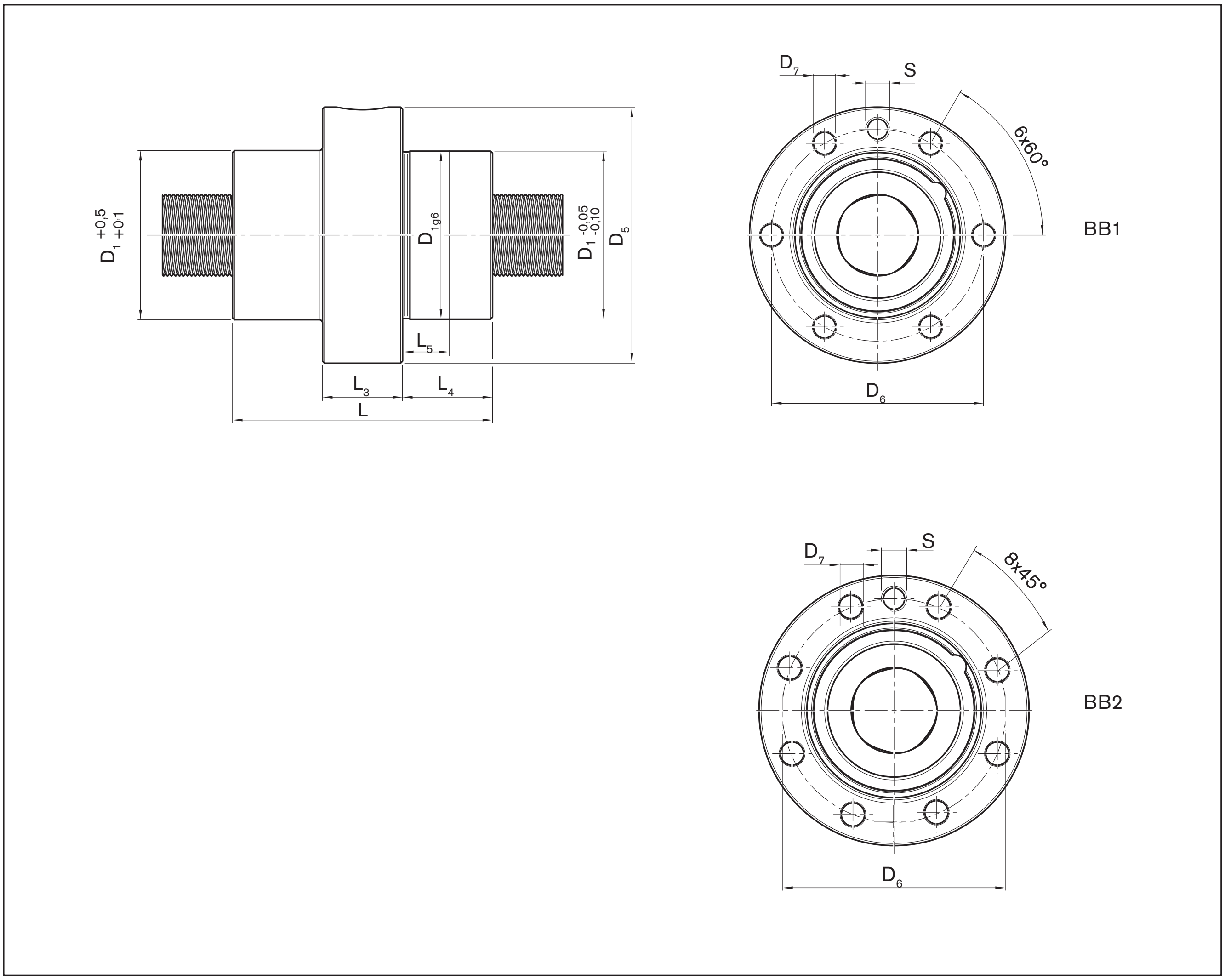
Ordering code PLSA:

| FEM-E-S | 20 x 5R | 4 | 0 | T5 | R | 812Z120 | 412Z120 | 1100 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|

| $d_0$ x P | No. | C[1)] (kN) | $C_0$[1)] (kN) | $v_{max}$[2)] (m/min) |
|---|---|---|---|---|
| **20 x 5R** | R157C A10 01 | 55 | 80 | 37.5 |
| **30 x 5R** | R157C 310 11 | 87 | 178 | 25.0 |
| **30 x 10R** | R157C 330 01 | 101 | 174 | 50.0 |
| **39 x 5R** | R157C 410 01 | 123 | 269 | 19.2 |
| **39 x 10R** | R157C 430 01 | 145 | 271 | 38.4 |
| **48 x 5R** | R157C 610 01 | 188 | 481 | 15.6 |
| **48 x 10R** | R157C 630 01 | 220 | 475 | 31.2 |
| **60 x 10R** | R157C 730 01 | 322 | 780 | 25.0 |
| **60 x 20R** | R157C 770 01 | 375 | 786 | 50.0 |
| **75 x 10R** | R157C 830 01 | 480 | 1 487 | 20.0 |
| **75 x 20R** | R157C 870 01 | 544 | 1 496 | 40.0 |

1) The load ratings are valid for tolerance grade T5 only.
For other tolerance grades, please consider the correction factor $f_{ac}$ on page 43.
2) See page 43 Characteristic speed and page 62 Critical speed.

C = dynamic load rating
$C_0$ = static load rating
$d_0$ x P = size
$d_0$ = nominal diameter
No. = part number
P = screw lead (R = right-hand)
S = lube port
$v_{max}$ = maximum linear speed




| $d_0$ x P | (mm) | | | | | | | | | | Mass |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | $D_1$ | $D_5$ | Hole pattern | L | $D_6$ | $D_7$ | $L_3$ | $L_4$ | $L_5$ | S | m (kg) |
| **20 x 5R** | 42 | 64 | BB1 | 65 | 53 | 5.5 | 20.0 | 22.5 | 11.0 | M6 | 0.65 |
| **30 x 5R** | 64 | 98 | BB1 | 85 | 81 | 9.0 | 27.0 | 29.0 | 13.0 | M6 | 2.10 |
| **30 x 10R** | 64 | 98 | BB1 | 85 | 81 | 9.0 | 27.0 | 29.0 | 13.0 | M6 | 2.10 |
| **39 x 5R** | 80 | 124 | BB1 | 100 | 102 | 11.0 | 33.0 | 33.5 | 15.5 | M8 x 1 | 3.70 |
| **39 x 10R** | 80 | 124 | BB1 | 100 | 102 | 11.0 | 33.0 | 33.5 | 15.5 | M8 x 1 | 3.70 |
| **48 x 5R** | 105 | 150 | BB1 | 127 | 127 | 13.5 | 37.0 | 45.0 | 25.0 | M8 x 1 | 7.60 |
| **48 x 10R** | 105 | 150 | BB1 | 127 | 127 | 13.5 | 37.0 | 45.0 | 25.0 | M8 x 1 | 7.60 |
| **60 x 10R** | 122 | 180 | BB1 | 152 | 150 | 17.5 | 45.0 | 53.5 | 27.0 | M8 x 1 | 11.30 |
| **60 x 20R** | 122 | 180 | BB1 | 152 | 150 | 17.5 | 45.0 | 53.5 | 27.0 | M8 x 1 | 11.30 |
| **75 x 10R** | 150 | 210 | BB2 | 191 | 180 | 17.5 | 45.0 | 73.0 | 42.0 | M8 x 1 | 19.40 |
| **75 x 20R** | 150 | 210 | BB2 | 191 | 180 | 17.5 | 45.0 | 73.0 | 42.0 | M8 x 1 | 20.20 |

Nuts

# Flanged Single Nut, split FDM-E-S

- With standard seals
- With preload
- For precision screws PSR in tolerance grade T5, T7

**Note**: Delivered only as a complete unit.

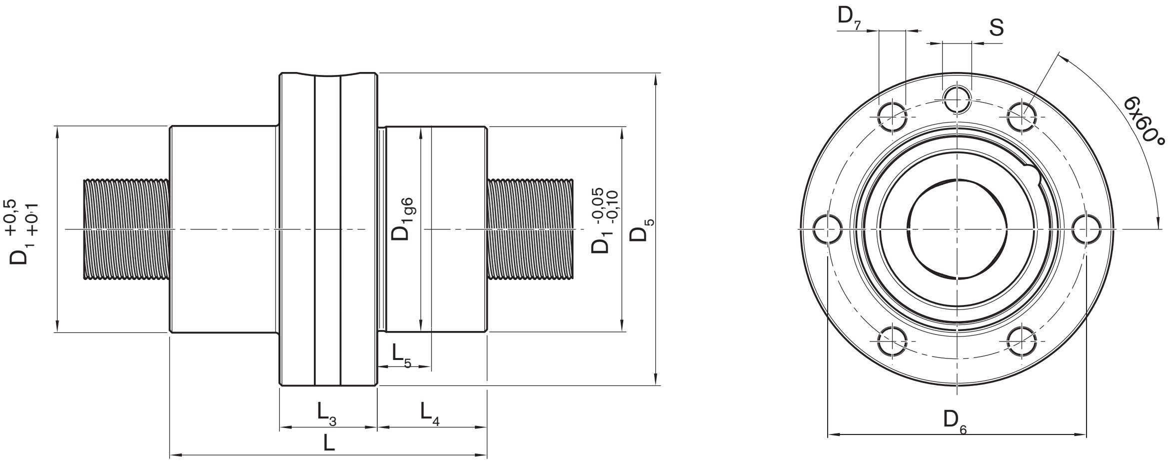
Ordering code PLSA:

| FDM-E-S | 20 x 5R | 4 | 0 | T5 | R | 812Z120 | 412Z120 | 1100 | 1 | 1 |
|---|---|---|---|---|---|---|---|---|---|---|

| $d_0$ x P | No. | C[1)] (kN) | $C_0$[1)] (kN) | $v_{max}$[2)] (m/min) |
|---|---|---|---|---|
| **20 x 5R** | R157C A10 02 | 32 | 40 | 37.5 |
| **30 x 5R** | R157C 310 12 | 50 | 89 | 25.0 |
| **30 x 10R** | R157C 330 02 | 58 | 87 | 50.0 |
| **39 x 5R** | R157C 410 02 | 71 | 134 | 19.2 |
| **39 x 10R** | R157C 430 02 | 84 | 135 | 38.4 |
| **48 x 5R** | R157C 610 02 | 109 | 240 | 15.6 |
| **48 x 10R** | R157C 630 02 | 127 | 237 | 31.2 |
| **60 x 10R** | R157C 730 02 | 187 | 390 | 25.0 |
| **60 x 20R** | R157C 770 02 | 218 | 393 | 50.0 |

1) The load ratings are valid for tolerance grade T5 only.
For other tolerance grades, please consider the correction factor $f_{ac}$ on page 43.
2) See page 43 Characteristic speed and page 62 Critical speed.

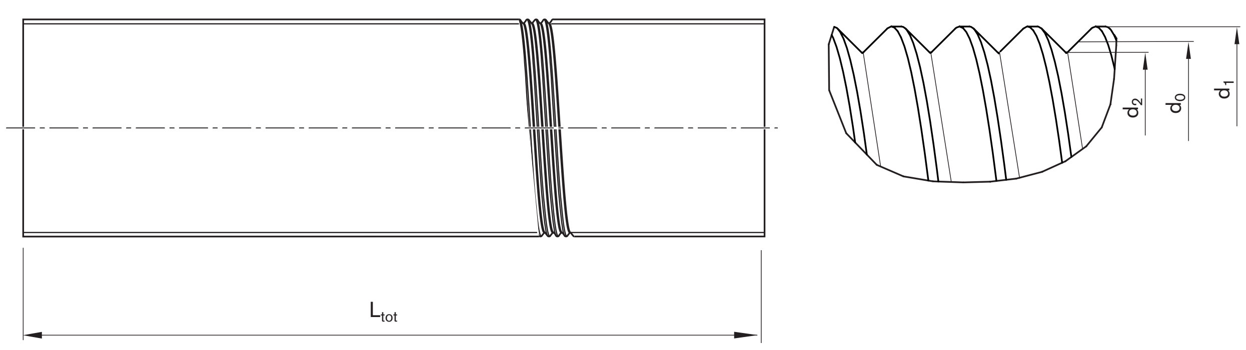
C = dynamic load rating
$C_0$ = static load rating
$d_0$ x P = size
$d_0$ = nominal diameter
No. = part number
P = screw lead (R = right-hand)
S = lube port
$v_{max}$ = maximum linear speed




| $d_0$ x P | (mm) | | | | | | | | | Mass |
|---|---|---|---|---|---|---|---|---|---|---|
| | $D_1$ | $D_5$ | L | $D_6$ | $D_7$ | $L_3$ | $L_4$ | $L_5$ | S | m (kg) |
| 20 x 5R | 42 | 64 | 65 | 53 | 5.5 | 20.0 | 22.5 | 11.0 | M6 | 0.65 |
| 30 x 5R | 64 | 98 | 85 | 81 | 9.0 | 27.0 | 29.0 | 13.0 | M6 | 2.10 |
| 30 x 10R | 64 | 98 | 85 | 81 | 9.0 | 27.0 | 29.0 | 13.0 | M6 | 2.10 |
| 39 x 5R | 80 | 124 | 100 | 102 | 11.0 | 33.0 | 33.5 | 15.5 | M6 | 3.65 |
| 39 x 10R | 80 | 124 | 100 | 102 | 11.0 | 33.0 | 33.5 | 15.5 | M6 | 3.65 |
| 48 x 5R | 105 | 150 | 127 | 127 | 13.5 | 37.0 | 45.0 | 25.0 | M8 x 1 | 7.60 |
| 48 x 10R | 105 | 150 | 127 | 127 | 13.5 | 37.0 | 45.0 | 25.0 | M8 x 1 | 7.60 |
| 60 x 10R | 122 | 180 | 152 | 150 | 17.5 | 45.0 | 53.5 | 27.0 | M8 x 1 | 11.10 |
| 60 x 20R | 122 | 180 | 152 | 150 | 17.5 | 45.0 | 53.5 | 27.0 | M8 x 1 | 11.10 |

Screws

# Precision Screw PSR




| $d_0$ x P | (mm) | | | | | Weight |
|---|---|---|---|---|---|---|
| | | | Length | | $J_s$ | |
| | $d_1$ | $d_2$ | Standard | On request | (kgcm²/m) | (kg/m) |
| 20 x 5R | 20.3 | 19.5 | 1 500 | 2 500 | 1.22 | 2.45 |
| 30 x 5R | 30.3 | 29.5 | 3 000 | 5 000 | 6.21 | 5.54 |
| 30 x 10R | 30.5 | 29.1 | | | 6.15 | 5.51 |
| 39 x 5R | 39.3 | 38.5 | | | 17.64 | 9.36 |
| 39 x 10R | 39.5 | 38.1 | | | 17.64 | 9.33 |
| 48 x 5R | 48.3 | 47.5 | | | 40.88 | 14.21 |
| 48 x 10R | 48.5 | 47.1 | | | 40.62 | 14.16 |
| 60 x 10R | 60.5 | 59.1 | | | 99.38 | 22.15 |
| 60 x 20R | 61.1 | 58.1 | | | 98.38 | 22.03 |
| 75 x 10R | 75.5 | 74.1 | | | 243.37 | 34.67 |
| 75 x 20R | 76.1 | 73.1 | | | 241.32 | 34.51 |

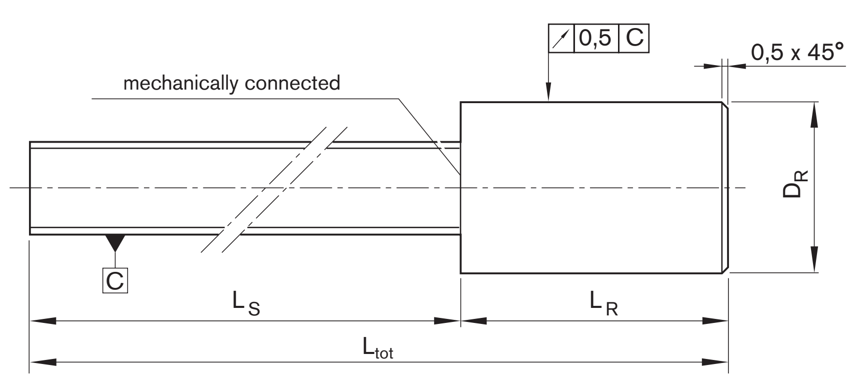
## Precision screws PSR, with mechanically connected screw ends

These screws consist of
- a precision screw part and
- an unmachined spigot (as the screw journal).

The spigot is mechanically connected on one side and is available in different sizes.

We have a solution to prevent problems arising from big end bearing diameters (e.g. visible thread grooves or axial contact faces which are too small for the fixed bearing).
Please ask.

Separate delivery of a screw without end machining and without nut is not planned.

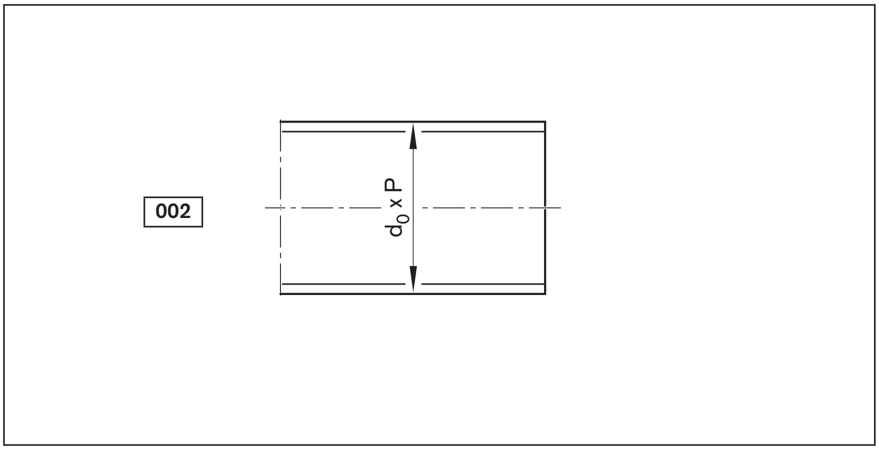


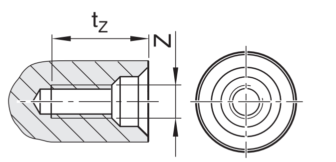
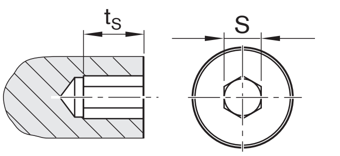

| $d_0$ x P (mm) | Tolerance grade | (mm) | | | |
|---|---|---|---|---|---|
| | | $D_R$ −1 | $L_R$ +2 | $L_{tot}$ | $L_S$ |
| 20 x 5R | T5 | 36,40 | 200 | 1700 | 1500 |
| 30 x 5R/10R | | 46,10 | 250 | 2050 | 1800 |
| 39 x 5R/10R | | 76,25 | 275 | 2175 | 1900 |
| 48 x 5R/10R | | 80,40 | 400 | 2300 | 1900 |
| 60 x 10R/20R | | 98,30 | 400 | 3300 | 2900 |
| 75 x 10R/20R | | 110,40 | 465 | 3365 | 2900 |
| | | | | | |

$d_0$ x P = size
$d_0$ = nominal diameter
$J_s$ = moment of inertia
P = screw lead (R = right-hand)

Screw Ends

# Form 002




| Option (machining of end face) | |
|---|---|
| Z |  |
| S |  |
| K | None |

Ordering code PLSA:

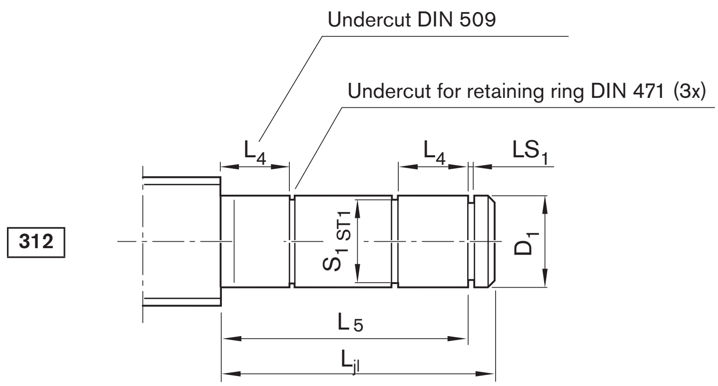
| FEM-E-S | 20 x 5R | 1 | 0 | T7 | R | 002K200 | 822K120 | 1250 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|

| Form | Version | (mm) | | | | |
|---|---|---|---|---|---|---|
| | | $d_0$ x P | Z | $t_Z$ | S | $t_S$ |
| **002** | **200** | **20 x 5** | M6 | 16 | 5 | 5 |
| | **300** | **30 x 5/10** | M10 | 22 | 10 | 10 |
| | **390** | **39 x 5/10** | M12 | 28 | 12 | 12 |
| | **480** | **48 x 5/10** | M16 | 36 | 14 | 14 |
| | **600** | **60 x 10/20** | M20 | 42 | 19 | 19 |
| | **750** | **75 x 10/20** | M20 | 42 | 19 | 19 |

$d_0$ x P = size
$d_0$ = nominal diameter
P = lead (R = right-hand)
S = hex socket
Z = centering hole DIN 332-D

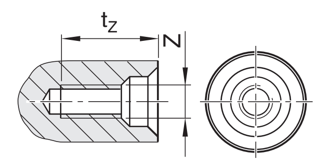
Screw Ends

# Form 312

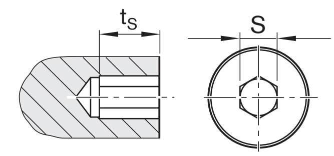



**Option** (machining of end face)

**Z**

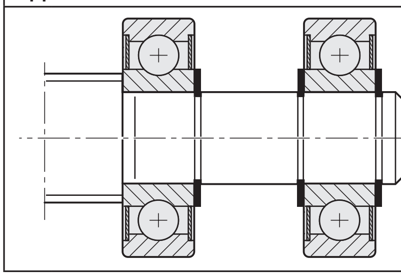



**S**




**K** None

**Application**



Ordering code PLSA:

| FEM-E-S | 20 x 5R | 1 | 0 | T7 | R | 312Z120 | 822Z120 | 1250 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|

| Form | Version[1)] | (mm) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | $D_1$ | $L_{jl}$ | $L_4$ | $L_5$ | $S_1$ | ST1 | $LS_1$ | Z | $t_Z$ | S | $t_S$ |
| | | $d_0$ x P | j6 | | | | | | H13 | | | | |
| 312 | 120 | 20 x 5R | 12 | 43 | 10 | 40 | 11.5 | h11 | 1.10 | M4 | 10.0 | 4 | 4 |
| | 150 | 20 x 5R | 15 | 47 | 11 | 44 | 14.3 | h11 | 1.10 | M5 | 12.5 | 4 | 4 |
| | 200 | 30 x 5R/10R | 20 | 60 | 14 | 56 | 19.0 | h11 | 1.30 | M6 | 16.0 | 5 | 5 |
| | 250 | 30 x 5R/10R | 25 | 64 | 15 | 60 | 23.9 | h12 | 1.30 | M10 | 22.0 | 8 | 8 |
| | 300 | 39 x 5R/10R | 30 | 68 | 16 | 64 | 28.6 | h12 | 1.60 | M10 | 22.0 | 10 | 10 |
| | 350 | 48 x 5R/10R | 35 | 73 | 17 | 68 | 33.0 | h12 | 1.60 | M12 | 28.0 | 12 | 12 |
| | 500 | 60 x 10R/20R | 50 | 87 | 20 | 80 | 47.0 | h12 | 2.15 | M16 | 36.0 | 19 | 19 |
| | 600 | 75 x 10R/20R | 60 | 95 | 22 | 88 | 57.0 | h12 | 2.15 | M20 | 42.0 | 19 | 19 |

1) The allocation of screw ends to the bearing units is defined by the version.
Note: Form 312 with two floating bearings increases the critical speed, see page 54.

$d_0$ x P = size
$d_0$ = nominal diameter
no. = part number
P = screw lead (R = right-hand)
S = hex socket
Z = centering hole DIN 332-D

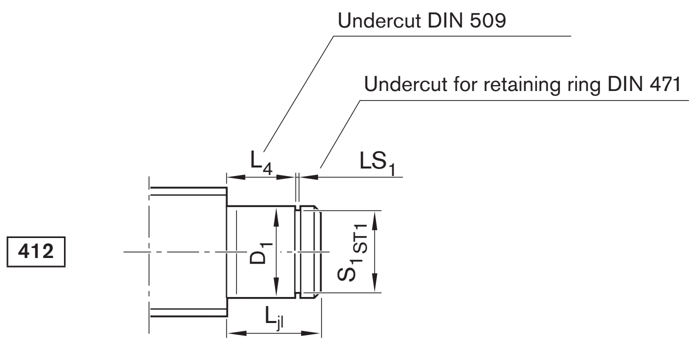
## End bearings for screw ends form 312

The bearing unit LAD consists of:
- 1 bearing (2x required)
- 2 retaining rings

| Form | Version | $d_0$ x P | LAD no. |
|---|---|---|---|
| **312** | **120** | **20 x 5R** | R1590 612 00 |
| | **150** | **20 x 5R** | R1590 615 00 |
| | **200** | **30 x 5R/10R** | R1590 620 00 |
| | **250** | **30 x 5R/10R** | R1590 625 00 |
| | **300** | **39 x 5R/10R** | R1590 630 00 |
| | **350** | **48 x 5R/10R** | R1590 635 00 |
| | **500** | **60 x 10R/20R** | R1590 650 00 |
| | **600** | **75 x 10R/20R** | R1590 660 00 |

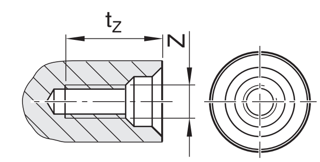
Screw Ends

# Form 412

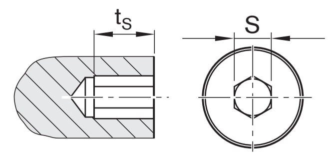



**Option** (machining of end face)

**Z**

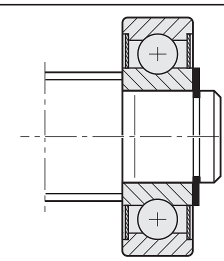



**S**




**K** None

**Application**



Ordering code PLSA:

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| FEM-E-S | 20 x 5R | 1 | 0 | T7 | R | 412Z120 | 822Z120 | 1250 | 1 | 0 |

| Form | Version[1)] | (mm) | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $d_0$ x P | $D_1$ j6 | $L_{jl}$ | $L_4$ | $S_1$ | ST1 | $LS_1$ H13 | Z | $t_Z$ | S | $t_S$ |
| 412 | 120 | 20 x 5R | 12 | 13 | 10 | 11.5 | h11 | 1.10 | M4 | 10 | 4 | 4 |
| | 150 | 20 x 5R | 15 | 14 | 11 | 14.3 | h11 | 1.10 | M5 | 12.5 | 4 | 4 |
| | 200 | 30 x 5R/10R | 20 | 18 | 14 | 19.0 | h11 | 1.30 | M6 | 16 | 5 | 5 |
| | 250 | 30 x 5R/10R | 25 | 19 | 15 | 23.9 | h12 | 1.30 | M10 | 22 | 8 | 8 |
| | 300 | 39 x 5R/10R | 30 | 20 | 16 | 28.6 | h12 | 1.60 | M10 | 22 | 10 | 10 |
| | 350 | 48 x 5R/10R | 35 | 22 | 17 | 33.0 | h12 | 1.60 | M12 | 28 | 12 | 12 |
| | 500 | 60 x 10R/20R | 50 | 27 | 20 | 47.0 | h12 | 2.15 | M16 | 36 | 19 | 19 |
| | 600 | 75 x 10R/20R | 60 | 29 | 22 | 57.0 | h12 | 2.15 | M20 | 42 | 19 | 19 |

1) The allocation of screw ends to the bearing units is defined by the version.

$d_0$ x P = size
$d_0$ = nominal diameter
no. = part number
P = screw lead (R = right-hand)
S = hex socket
Z = centering hole DIN 332-D

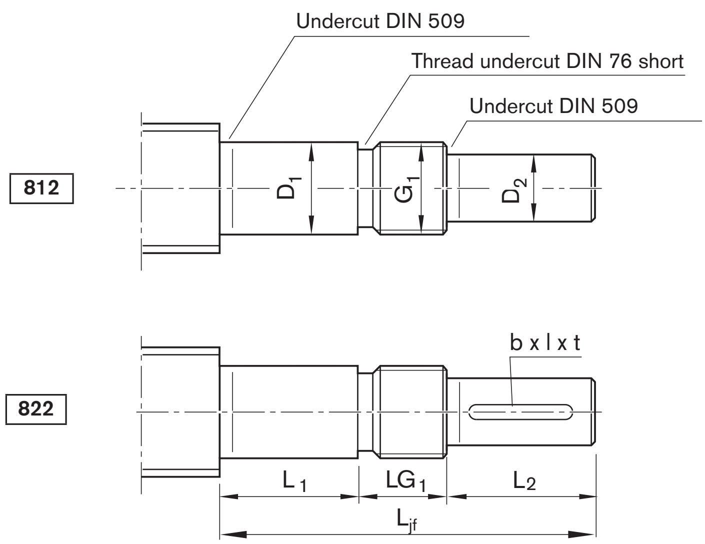
## End bearings for screw ends form 412

The bearing unit LAD consists of:
- 1 bearing
- 2 retaining rings

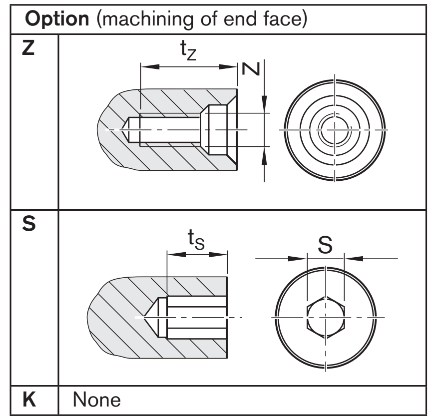
| Form | Version | $d_0$ x P | LAD no. |
|---|---|---|---|
| 412 | 120 | 20 x 5R | R1590 612 00 |
| | 150 | 20 x 5R | R1590 615 00 |
| | 200 | 30 x 5R/10R | R1590 620 00 |
| | 250 | 30 x 5R/10R | R1590 625 00 |
| | 300 | 39 x 5R/10R | R1590 630 00 |
| | 350 | 48 x 5R/10R | R1590 635 00 |
| | 500 | 60 x 10R/20R | R1590 650 00 |
| | 600 | 75 x 10R/20R | R1590 660 00 |

Screw Ends

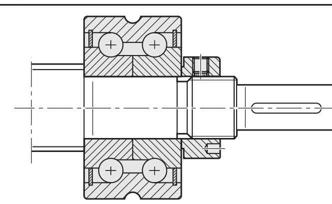
# Form 812




Form 822 nächste Doppelseite




**Application**



Ordering code PLSA:

| FEM-E-S | 20 x 5R | 1 | 0 | T7 | R | 812Z150 | 412Z120 | 1250 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|

| Form | Version[1)] | $d_0$ x P | $L_{jf}$ (mm) | $D_1$ h6 | $L_1$ | $D_2$ h7 | $L_2$ | $G_1$ | $LG_1$ | Keyway per DIN 6885 b P9 | l | t | Z Z | $t_Z$ | S S | $t_S$ | Mp (Nm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 812 | 150 | 20 x 5R | 70 | 15 | 23 | 12 | 25 | M15x1 | 22 | – | – | – | M4 | 10 | 4 | 4 | 12.1 |
| | 153 | 20 x 5R | 97 | 15 | 50 | 12 | 25 | M15x1 | 22 | – | – | – | M4 | 10 | 4 | 4 | 12.1 |
| | 205 | 30 x 5R | 116 | 20 | 54 | 18 | 40 | M20x1 | 22 | – | – | – | M6 | 16 | 5 | 5 | 22.6 |
| | | 30 x 10R | 116 | 20 | 54 | 18 | 40 | M20x1 | 22 | – | – | – | M6 | 16 | 5 | 5 | 38.8 |
| | 206 | 30 x 5R | 120 | 20 | 58 | 18 | 40 | M20x1 | 22 | – | – | – | M6 | 16 | 5 | 5 | 22.6 |
| | | 30 x 10R | 120 | 20 | 58 | 18 | 40 | M20x1 | 22 | – | – | – | M6 | 16 | 5 | 5 | 38.8 |
| | 305 | 39 x 5R | 128 | 30 | 54 | 25 | 50 | M30x1.5 | 24 | – | – | – | M10 | 22 | 8 | 8 | 46.1 |
| | | 39 x 10R | 128 | 30 | 54 | 25 | 50 | M30x1.5 | 24 | – | – | – | M10 | 22 | 8 | 8 | 86.4 |
| | 306 | 39 x 5R | 148 | 30 | 74 | 25 | 50 | M30x1.5 | 24 | – | – | – | M10 | 22 | 8 | 8 | 46.1 |
| | | 39 x 10R | 148 | 30 | 74 | 25 | 50 | M30x1.5 | 24 | – | – | – | M10 | 22 | 8 | 8 | 86.4 |
| | 351 | 48 x 5R | 140 | 35 | 66 | 30 | 50 | M35x1.5 | 24 | – | – | – | M10 | 22 | 10 | 10 | 62.7 |
| | | 48 x 10R | 140 | 35 | 66 | 30 | 50 | M35x1.5 | 24 | – | – | – | M10 | 22 | 10 | 10 | 120.4 |
| | 352 | 48 x 5R | 156 | 35 | 82 | 30 | 50 | M35x1.5 | 24 | – | – | – | M10 | 22 | 10 | 10 | 62.7 |
| | | 48 x 10R | 156 | 35 | 82 | 30 | 50 | M35x1.5 | 24 | – | – | – | M10 | 22 | 10 | 10 | 120.4 |
| | 450 | 60 x 10R | 184 | 45 | 98 | 40 | 60 | M45x1.5 | 26 | – | – | – | M16 | 36 | 12 | 12 | 192.6 |
| | | 60 x 20R | 184 | 45 | 98 | 40 | 60 | M45x1.5 | 26 | – | – | – | M16 | 36 | 12 | 12 | 359.7 |
| | 603 | 75 x 10R | 233 | 60 | 122 | 55 | 80 | M60x2 | 31 | – | – | – | M20 | 42 | 19 | 19 | 321.5 |
| | | 75 x 20R | 233 | 60 | 122 | 55 | 80 | M60x2 | 31 | – | – | – | M20 | 42 | 19 | 19 | 618.1 |

1) The allocation of screw ends to the bearing units is defined by the version.

$d_0$ x P = size
$d_0$ = nominal diameter
$M_p$ = maximum permissible drive torque (precondition: no radial load at drive journal)
No. = part number
P = screw lead (R = right-hand)
S = hex socket
Z = centering hole DIN 332-D

## End bearings for screw ends form 812

The bearing unit LAF, LAN, LAS consists of:
- 1 bearing
- 1 slotted nut

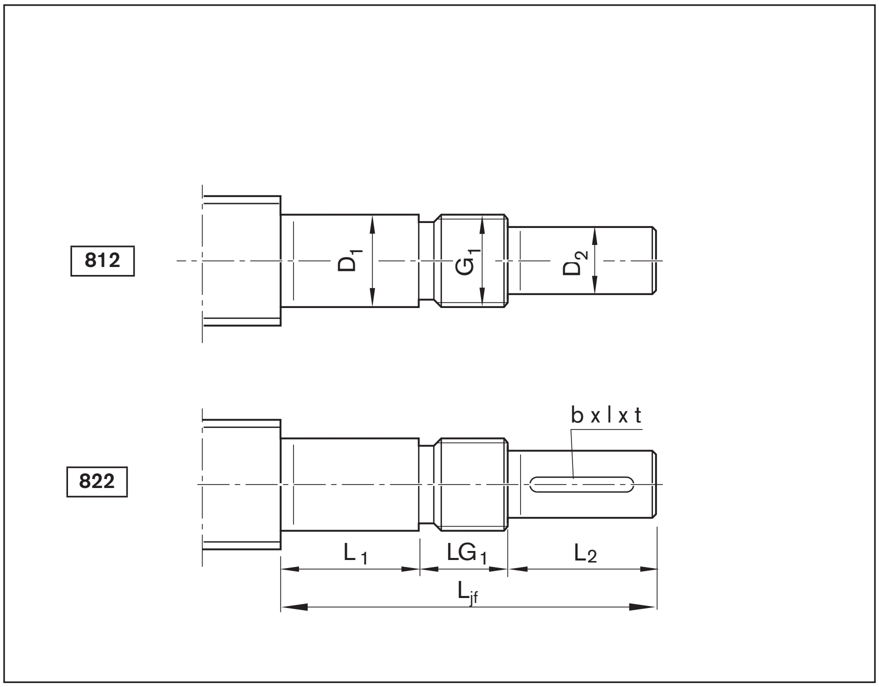
LAF

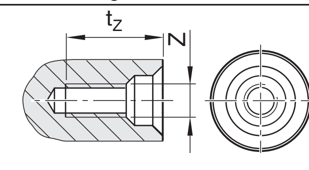
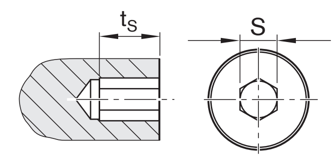
LAN

LAS

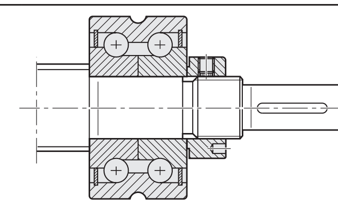
| Form | Version | | No. | | |
|---|---|---|---|---|---|
| | | $d_0$ x P | LAF | LAN | LAS |
| **812** | **150** | **20 x 5R** | R159A 015 01 | R159A 115 01 | – |
| | **153** | **20 x 5R** | – | – | R159A 415 01 |
| | **205** | **30 x 5R** | R159A 320 01 | R159A 220 01 | – |
| | | **30 x 10R** | R159A 320 01 | R159A 220 01 | – |
| | **206** | **30 x 5R** | – | – | R159A 420 02 |
| | | **30 x 10R** | – | – | R159A 420 02 |
| | **305** | **39 x 5R** | R1590 330 30 | R1590 230 30 | – |
| | | **39 x 10R** | R1590 330 30 | R1590 230 30 | – |
| | **306** | **39 x 5R** | – | – | R159A 430 01 |
| | | **39 x 10R** | – | – | R159A 430 01 |
| | **351** | **48 x 5R** | R159A 335 01 | R159A 235 01 | – |
| | | **48 x 10R** | R159A 335 01 | R159A 235 01 | – |
| | **352** | **48 x 5R** | – | – | R159A 435 01 |
| | | **48 x 10R** | – | – | R159A 435 01 |
| | **450** | **60 x 10R** | – | – | R159A 445 01 |
| | | **60 x 20R** | – | – | R159A 445 01 |
| | **603** | **75 x 10R** | – | – | R159A 460 01 |
| | | **75 x 20R** | – | – | R159A 460 01 |

# Form 822




| **Option** (machining of end face) | |
|---|---|
| **Z** |   |
| **S** |   |
| **K** | None |

**Application**



Ordering code PLSA:

| FEM-E-S | 20 x 5R | 1 | 0 | T7 | R | 822Z150 | 412Z120 | 1250 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|

| Form | Version[1] | | (mm) | | | | | | | Keyway per DIN 6885 | | | Z | | S | | Mp (Nm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $d_0$ x P | $L_{jf}$ | $D_1$ h6 | $L_1$ | $D_2$ h7 | $L_2$ | $G_1$ | $LG_1$ | b P9 | l | t | Z | $t_Z$ | S | $t_S$ | |
| **822** | **150** | **20 x 5R** | 70 | 15 | 23 | 12 | 25 | M15x1 | 22 | 4 | 20 | 2.5 | M4 | 10 | 4 | 4 | 12.1 |
| | **153** | **20 x 5R** | 97 | 15 | 50 | 12 | 25 | M15x1 | 22 | 4 | 20 | 2.5 | M4 | 10 | 4 | 4 | 12.1 |
| | **205** | **30 x 5R** | 116 | 20 | 54 | 18 | 40 | M20x1 | 22 | 6 | 28 | 3.5 | M6 | 16 | 5 | 5 | 22.6 |
| | | **30 x 10R** | 116 | 20 | 54 | 18 | 40 | M20x1 | 22 | 6 | 28 | 3.5 | M6 | 16 | 5 | 5 | 38.8 |
| | **206** | **30 x 5R** | 120 | 20 | 58 | 18 | 40 | M20x1 | 22 | 6 | 28 | 3.5 | M6 | 16 | 5 | 5 | 22.6 |
| | | **30 x 10R** | 120 | 20 | 58 | 18 | 40 | M20x1 | 22 | 6 | 28 | 3.5 | M6 | 16 | 5 | 5 | 38.8 |
| | **305** | **39 x 5R** | 128 | 30 | 54 | 25 | 50 | M30x1.5 | 24 | 8 | 36 | 4.0 | M10 | 22 | 8 | 8 | 46.1 |
| | | **39 x 10R** | 128 | 30 | 54 | 25 | 50 | M30x1.5 | 24 | 8 | 36 | 4.0 | M10 | 22 | 8 | 8 | 86.4 |
| | **306** | **39 x 5R** | 148 | 30 | 74 | 25 | 50 | M30x1.5 | 24 | 8 | 36 | 4.0 | M10 | 22 | 8 | 8 | 46.1 |
| | | **39 x 10R** | 148 | 30 | 74 | 25 | 50 | M30x1.5 | 24 | 8 | 36 | 4.0 | M10 | 22 | 8 | 8 | 86.4 |
| | **351** | **48 x 5R** | 140 | 35 | 66 | 30 | 50 | M35x1.5 | 24 | 8 | 36 | 4.0 | M10 | 22 | 10 | 10 | 62.7 |
| | | **48 x 10R** | 140 | 35 | 66 | 30 | 50 | M35x1.5 | 24 | 8 | 36 | 4.0 | M10 | 22 | 10 | 10 | 120.4 |
| | **352** | **48 x 5R** | 156 | 35 | 82 | 30 | 50 | M35x1.5 | 24 | 8 | 36 | 4.0 | M10 | 22 | 10 | 10 | 62.7 |
| | | **48 x 10R** | 156 | 35 | 82 | 30 | 50 | M35x1.5 | 24 | 8 | 36 | 4.0 | M10 | 22 | 10 | 10 | 120.4 |
| | **450** | **60 x 10R** | 184 | 45 | 98 | 40 | 60 | M45x1.5 | 26 | 12 | 50 | 5.0 | M16 | 36 | 12 | 12 | 192.6 |
| | | **60 x 20R** | 184 | 45 | 98 | 40 | 60 | M45x1.5 | 26 | 12 | 50 | 5.0 | M16 | 36 | 12 | 12 | 359.7 |
| | **603** | **75 x 10R** | 233 | 60 | 122 | 55 | 80 | M60x2 | 31 | 16 | 63 | 6.0 | M20 | 42 | 19 | 19 | 321.5 |
| | | **75 x 20R** | 233 | 60 | 122 | 55 | 80 | M60x2 | 31 | 16 | 63 | 6.0 | M20 | 42 | 19 | 19 | 618.1 |

1) The allocation of screw ends to the bearing units is defined by the version.

$d_0$ x P = size
$d_0$ = nominal diameter
$M_p$ = maximum permissible drive torque (precondition: no radial load at drive journal)
No. = part number
P = screw lead (R = right-hand)
S = hex socket
Z = centering hole DIN 332-D

## End bearings for screw ends form 822

The bearing unit LAF, LAN, LAS consists of:
- 1 bearing
- 1 slotted nut

LAF

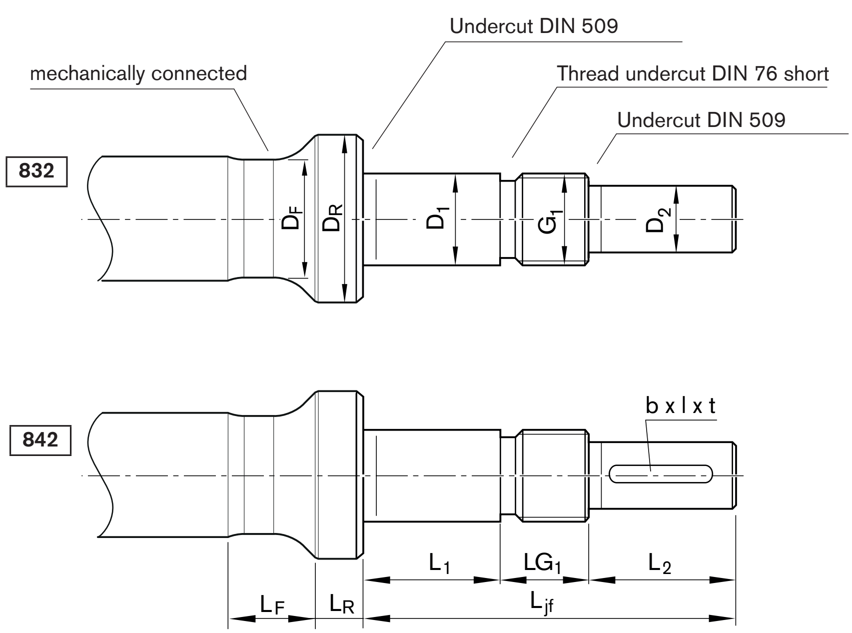
LAN

LAS

| Form | Version | | No. | | |
|---|---|---|---|---|---|
| | | $d_0$ x P | LAF | LAN | LAS |
| 822 | 150 | 20 x 5R | R159A 015 01 | R159A 115 01 | – |
| | 153 | 20 x 5R | – | – | R159A 415 01 |
| | 205 | 30 x 5R | R159A 320 01 | R159A 220 01 | – |
| | | 30 x 10R | R159A 320 01 | R159A 220 01 | – |
| | 206 | 30 x 5R | – | – | R159A 420 02 |
| | | 30 x 10R | – | – | R159A 420 02 |
| | 305 | 39 x 5R | R1590 330 30 | R1590 230 30 | – |
| | | 39 x 10R | R1590 330 30 | R1590 230 30 | – |
| | 306 | 39 x 5R | – | – | R159A 430 01 |
| | | 39 x 10R | – | – | R159A 430 01 |
| | 351 | 48 x 5R | R159A 335 01 | R159A 235 01 | – |
| | | 48 x 10R | R159A 335 01 | R159A 235 01 | – |
| | 352 | 48 x 5R | – | – | R159A 435 01 |
| | | 48 x 10R | – | – | R159A 435 01 |
| | 450 | 60 x 10R | – | – | R159A 445 01 |
| | | 60 x 20R | – | – | R159A 445 01 |
| | 603 | 75 x 10R | – | – | R159A 460 01 |
| | | 75 x 20R | – | – | R159A 460 01 |

Screw Ends

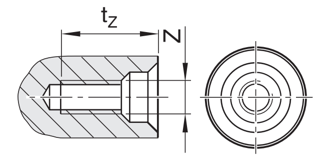
# Form 832



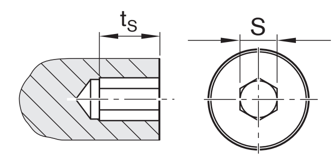

Form 842 nächste Doppelseite

**Option** (machining of end face)

**Z**

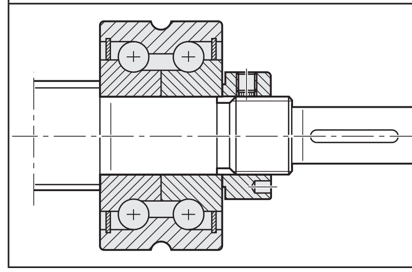



**S**




**K** None

**Application**



Ordering code PLSA:

| FEM-E-S | 20 x 5R | 1 | 0 | T7 | R | 832Z201 | 312Z120 | 1250 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|

| Form | Version[1] | (mm) $d_0$ x P | $L_{jf}$ | $D_1$ h6 | $L_1$ | $D_2$ h7 | $L_2$ | $G_1$ | $LG_1$ | Keyway per DIN 6885 b P9 | l | t | Z Z | $t_Z$ | S S | $t_S$ | Mp (Nm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **832** | **201** | **20 x 5R** | 116 | 20 | 54 | 18 | 40 | M20x1 | 22 | – | – | – | M6 | 16 | 5 | 5 | 22.9 |
| | **251** | **20 x 5R** | 157 | 25 | 87 | 20 | 45 | M25x1.5 | 25 | – | – | – | M6 | 16 | 5 | 5 | 28.6 |
| | **301** | **30 x 5R** | 148 | 30 | 74 | 25 | 50 | M30x1.5 | 24 | – | – | – | M10 | 22 | 8 | 8 | 45.8 |
| | **302** | **30 x 10R** | 148 | 30 | 74 | 25 | 50 | M30x1.5 | 24 | – | – | – | M10 | 22 | 8 | 8 | 85.9 |
| | **350** | **30 x 5R** | 189 | 35 | 108 | 30 | 55 | M35x1.5 | 26 | – | – | – | M10 | 22 | 10 | 10 | 54.3 |
| | **351** | **30 x 10R** | 189 | 35 | 108 | 30 | 55 | M35x1.5 | 26 | – | – | – | M10 | 22 | 10 | 10 | 108.6 |
| | **401** | **39 x 5R** | 176 | 40 | 90 | 36 | 60 | M40x1.5 | 26 | – | – | – | M12 | 28 | 12 | 12 | 80.2 |
| | **402** | **39 x 10R** | 176 | 40 | 90 | 36 | 60 | M40x1.5 | 26 | – | – | – | M12 | 28 | 12 | 12 | 156.0 |
| | **505** | **39 x 5R** | 233 | 50 | 137 | 40 | 65 | M50x1.5 | 31 | – | – | – | M16 | 36 | 12 | 12 | 91.1 |
| | **506** | **39 x 10R** | 233 | 50 | 137 | 40 | 65 | M50x1.4 | 31 | – | – | – | M16 | 36 | 12 | 12 | 175.4 |
| | **503** | **48 x 5R** | 205 | 50 | 106 | 40 | 70 | M50x1.5 | 29 | – | – | – | M16 | 36 | 12 | 12 | 121.3 |
| | **504** | **48 x 10R** | 205 | 50 | 106 | 40 | 70 | M50x1.5 | 29 | – | – | – | M16 | 36 | 12 | 12 | 237.3 |
| | **650** | **48 x 5R** | 310 | 65 | 178 | 60 | 100 | M65x2 | 32 | – | – | – | M20 | 42 | 19 | 19 | 137.4 |
| | **651** | **48 x 10R** | 310 | 65 | 178 | 60 | 100 | M65x2 | 32 | – | – | – | M20 | 42 | 19 | 19 | 279.9 |
| | **700** | **60 x 10R** | 271 | 70 | 138 | 65 | 100 | M70x2 | 33 | – | – | – | M20 | 42 | 19 | 19 | 423.8 |
| | **701** | **60 x 20R** | 271 | 70 | 138 | 65 | 100 | M70x2 | 33 | – | – | – | M20 | 42 | 19 | 19 | 793.8 |
| | **652** | **60 x 10R** | 310 | 65 | 178 | 60 | 100 | M65x2 | 32 | – | – | – | M20 | 42 | 19 | 19 | 408.1 |
| | **653** | **60 x 20R** | 310 | 65 | 178 | 60 | 100 | M65x2 | 32 | – | – | – | M20 | 42 | 19 | 19 | 771.4 |
| | **900** | **75 x 10R** | 327 | 90 | 169 | 85 | 120 | M90x2 | 38 | – | – | – | M20 | 42 | 19 | 19 | 656.2 |
| | **901** | **75 x 20R** | 327 | 90 | 169 | 85 | 120 | M90x2 | 38 | – | – | – | M20 | 42 | 19 | 19 | 1250.0 |
| | **902** | **75 x 10R** | 389 | 90 | 233 | 85 | 120 | M90x2 | 36 | – | – | – | M20 | 42 | 19 | 19 | 656.2 |
| | **903** | **75 x 20R** | 389 | 90 | 233 | 85 | 120 | M90x2 | 36 | – | – | – | M20 | 42 | 19 | 19 | 1250.0 |

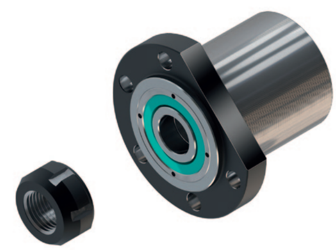
1) The allocation of screw ends to the bearing units is defined by the version.

## End bearings for screw ends form 832

The bearing unit LAS, FEC-F consists of:
– 1 bearing
– 1 slotted nut

LAS

FEC-F

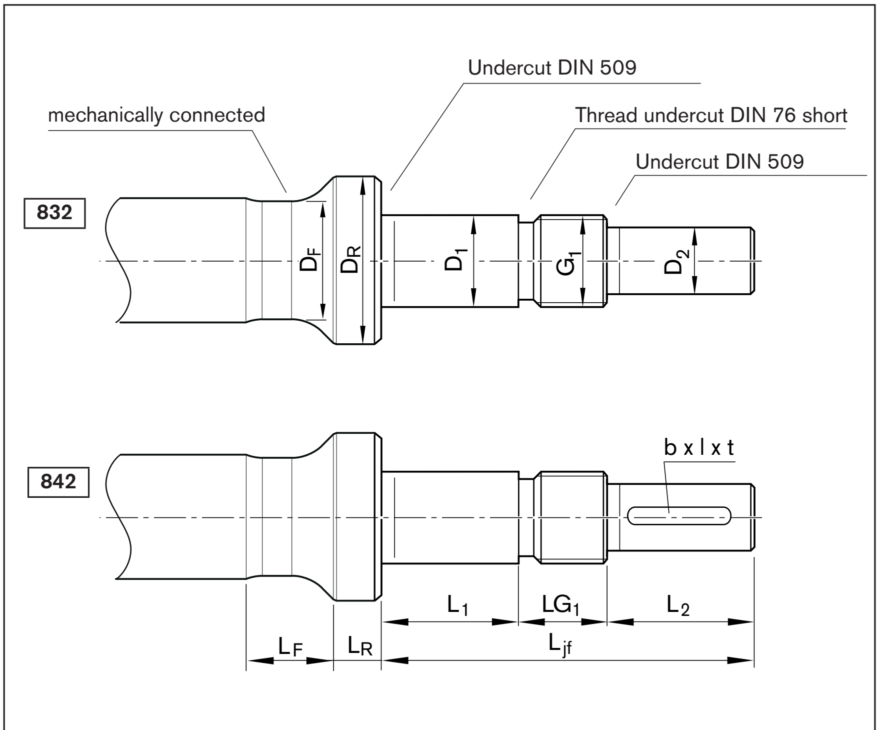


| Form | Version | (mm) | | | | | No. | |
|---|---|---|---|---|---|---|---|---|
| | | $d_0$ x P | $D_R$ | $L_R$ | $D_F$ | $L_F$ | LAS | FEC-F |
| **832** | **201** | **20 x 5R** | 27 | 7 | 19.2 | 14.0 | R159A 420 01 | – |
| | **251** | **20 x 5R** | 34 | 7 | 19.2 | 26.0 | – | R159B 425 01 |
| | **301** | **30 x 5R** | 40 | 10 | 29.2 | 17.0 | R159A 430 01 | – |
| | **302** | **30 x 10R** | 40 | 10 | 28.7 | 17.0 | R159A 430 01 | – |
| | **350** | **30 x 5R** | 45 | 10 | 29.2 | 28.0 | – | R159B 435 01 |
| | **351** | **30 x 10R** | 45 | 10 | 28.7 | 28.0 | – | R159B 435 01 |
| | **401** | **39 x 5R** | 54 | 12 | 38.1 | 24.5 | R159A 440 01 | – |
| | **402** | **39 x 10R** | 54 | 12 | 37.7 | 24.5 | R159A 440 01 | – |
| | **505** | **39 x 5R** | 62 | 12 | 38.1 | 32.0 | - | R159B 450 01 |
| | **506** | **39 x 10R** | 62 | 12 | 37.7 | 32.0 | - | R159B 450 01 |
| | **503** | **48 x 5R** | 62 | 12 | 47.2 | 22.0 | R159A 450 01 | – |
| | **504** | **48 x 10R** | 62 | 12 | 46.7 | 22.0 | R159A 450 01 | – |
| | **650** | **48 x 5R** | 78 | 18 | 47.2 | 46.0 | – | R159B 465 01 |
| | **651** | **48 x 10R** | 78 | 18 | 46.7 | 46.0 | – | R159B 465 01 |
| | **700** | **60 x 10R** | 90 | 20 | 58.7 | 50.0 | R159A 470 01 | - |
| | **701** | **60 x 20R** | 90 | 20 | 57.7 | 50.0 | R159A 470 01 | - |
| | **652** | **60 x 10R** | 78 | 18 | 58.7 | 39.0 | - | R159B 465 01 |
| | **653** | **60 x 20R** | 78 | 18 | 57.7 | 39.0 | - | R159B 465 01 |
| | **900** | **75 x 10R** | 108 | 25 | 73.7 | 59.0 | R159A 49001 | - |
| | **901** | **75 x 20R** | 108 | 25 | 72.7 | 59.0 | R159A 49001 | - |
| | **902** | **75 x 10R** | 108 | 25 | 73.7 | 59.0 | - | R159B 490 01 |
| | **903** | **75 x 20R** | 108 | 25 | 72.7 | 59.0 | - | R159B 490 01 |

$d_0$ x P = size
$d_0$ = nominal diameter
$M_p$ = maximum permissible drive torque (precondition: no radial load at drive journal)
No. = part number
P = screw lead (R = right-hand)
S = hex socket
Z = centering hole DIN 332-D

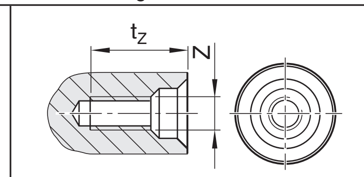
Screw Ends

# Form 842

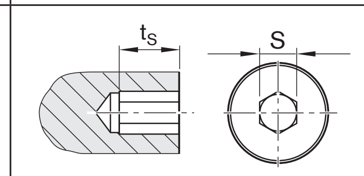



**Option** (machining of end face)

**Z**

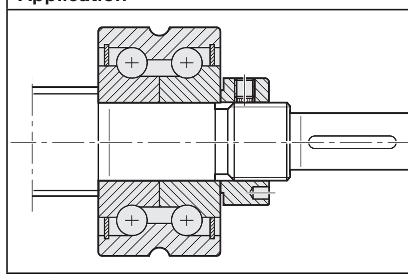



**S**




**K** None

**Application**



Ordering code PLSA:

| FEM-E-S | 20 x 5R | 1 | 0 | T7 | R | 842Z201 | 312Z120 | 1250 | 1 | 0 |
|---|---|---|---|---|---|---|---|---|---|---|

| Form | Version1) | (mm) | | | | | | | | Keyway per DIN 6885 | | | Z | | S | | Mp (Nm) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | $d_0$ x P | $L_{jf}$ | $D_1$ h6 | $L_1$ | $D_2$ h7 | $L_2$ | $G_1$ | $LG_1$ | b P9 | l | t | Z | $t_Z$ | S | $t_S$ | |
| 842 | **201** | **20 x 5R** | 116 | 20 | 54 | 18 | 40 | M20x1 | 22 | 6 | 36 | 3.5 | M6 | 16 | 5 | 5 | 22.9 |
| | **251** | **20 x 5R** | 157 | 25 | 87 | 20 | 45 | M25x1.5 | 25 | 6 | 40 | 3.5 | M6 | 16 | 5 | 5 | 28.6 |
| | **301** | **30 x 5R** | 148 | 30 | 74 | 25 | 50 | M30x1.5 | 24 | 8 | 40 | 4.0 | M10 | 22 | 8 | 8 | 45.8 |
| | **302** | **30 x 10R** | 148 | 30 | 74 | 25 | 50 | M30x1.5 | 24 | 8 | 40 | 4.0 | M10 | 22 | 8 | 8 | 85.9 |
| | **350** | **30 x 5R** | 189 | 35 | 108 | 30 | 55 | M35x1.5 | 26 | 8 | 45 | 4.0 | M10 | 22 | 10 | 10 | 54.3 |
| | **351** | **30 x 10R** | 189 | 35 | 108 | 30 | 55 | M35x1.5 | 26 | 8 | 45 | 4.0 | M10 | 22 | 10 | 10 | 108.6 |
| | **401** | **39 x 5R** | 176 | 40 | 90 | 36 | 60 | M40x1.5 | 26 | 10 | 50 | 5.0 | M12 | 28 | 12 | 12 | 80.2 |
| | **402** | **39 x 10R** | 176 | 40 | 90 | 36 | 60 | M40x1.5 | 26 | 10 | 50 | 5.0 | M12 | 28 | 12 | 12 | 156.0 |
| | **505** | **39 x 5R** | 233 | 50 | 137 | 40 | 65 | M50x1.5 | 31 | 12 | 50 | 5.0 | M16 | 36 | 12 | 12 | 91.1 |
| | **506** | **39 x 10R** | 233 | 50 | 137 | 40 | 65 | M50x1.4 | 31 | 12 | 50 | 5.0 | M16 | 36 | 12 | 12 | 175.4 |
| | **503** | **48 x 5R** | 205 | 50 | 106 | 40 | 70 | M50x1.5 | 29 | 12 | 50 | 5.0 | M16 | 36 | 12 | 12 | 121.3 |
| | **504** | **48 x 10R** | 205 | 50 | 106 | 40 | 70 | M50x1.5 | 29 | 12 | 50 | 5.0 | M16 | 36 | 12 | 12 | 237.3 |
| | **650** | **48 x 5R** | 310 | 65 | 178 | 60 | 100 | M65x2 | 32 | 18 | 90 | 7.0 | M20 | 42 | 19 | 19 | 137.4 |
| | **651** | **48 x 10R** | 310 | 65 | 178 | 60 | 100 | M65x2 | 32 | 18 | 90 | 7.0 | M20 | 42 | 19 | 19 | 279.9 |
| | **700** | **60 x 10R** | 271 | 70 | 138 | 65 | 100 | M70x2 | 33 | 18 | 90 | 7.0 | M20 | 42 | 19 | 19 | 423.8 |
| | **701** | **60 x 20R** | 271 | 70 | 138 | 65 | 100 | M70x2 | 33 | 18 | 90 | 7.0 | M20 | 42 | 19 | 19 | 793.8 |
| | **652** | **60 x 10R** | 310 | 65 | 178 | 60 | 100 | M65x2 | 32 | 18 | 90 | 7.0 | M20 | 42 | 19 | 19 | 408.1 |
| | **653** | **60 x 20R** | 310 | 65 | 178 | 60 | 100 | M65x2 | 32 | 18 | 90 | 7.0 | M20 | 42 | 19 | 19 | 771.4 |
| | **900** | **75 x 10R** | 327 | 90 | 169 | 85 | 120 | M90x2 | 38 | 22 | 100 | 9.0 | M20 | 42 | 19 | 19 | 656.2 |
| | **901** | **75 x 20R** | 327 | 90 | 169 | 85 | 120 | M90x2 | 38 | 22 | 100 | 9.0 | M20 | 42 | 19 | 19 | 1250.0 |
| | **902** | **75 x 10R** | 389 | 90 | 233 | 85 | 120 | M90x2 | 36 | 22 | 100 | 9.0 | M20 | 42 | 19 | 19 | 656.2 |
| | **903** | **75 x 20R** | 389 | 90 | 233 | 85 | 120 | M90x2 | 36 | 22 | 100 | 9.0 | M20 | 42 | 19 | 19 | 1250.0 |

1) The allocation of screw ends to the bearing units is defined by the version.

## End bearings for screw ends form 842

The bearing unit LAS, FEC-F consists of:
- 1 bearing
- 1 slotted nut

LAS

FEC-F

| Form | Version | (mm) | | | | | No. | |
|---|---|---|---|---|---|---|---|---|
| | | $d_0$ x P | $D_R$ | $L_R$ | $D_F$ | $L_F$ | LAS | FEC-F |
| 832 | 201 | 20 x 5R | 27 | 7 | 19.2 | 14.0 | R159A 420 01 | – |
| | 251 | 20 x 5R | 34 | 7 | 19.2 | 26.0 | – | R159B 425 01 |
| | 301 | 30 x 5R | 40 | 10 | 29.2 | 17.0 | R159A 430 01 | – |
| | 302 | 30 x 10R | 40 | 10 | 28.7 | 17.0 | R159A 430 01 | – |
| | 350 | 30 x 5R | 45 | 10 | 29.2 | 28.0 | – | R159B 435 01 |
| | 351 | 30 x 10R | 45 | 10 | 28.7 | 28.0 | – | R159B 435 01 |
| | 401 | 39 x 5R | 54 | 12 | 38.1 | 24.5 | R159A 440 01 | – |
| | 402 | 39 x 10R | 54 | 12 | 37.7 | 24.5 | R159A 440 01 | – |
| | 505 | 39 x 5R | 62 | 12 | 38.1 | 32.0 | - | R159B 450 01 |
| | 506 | 39 x 10R | 62 | 12 | 37.7 | 32.0 | - | R159B 450 01 |
| | 503 | 48 x 5R | 62 | 12 | 47.2 | 22.0 | R159A 450 01 | – |
| | 504 | 48 x 10R | 62 | 12 | 46.7 | 22.0 | R159A 450 01 | – |
| | 650 | 48 x 5R | 78 | 18 | 47.2 | 46.0 | – | R159B 465 01 |
| | 651 | 48 x 10R | 78 | 18 | 46.7 | 46.0 | – | R159B 465 01 |
| | 700 | 60 x 10R | 90 | 20 | 58.7 | 50.0 | R159A 470 01 | - |
| | 701 | 60 x 20R | 90 | 20 | 57.7 | 50.0 | R159A 470 01 | - |
| | 652 | 60 x 10R | 78 | 18 | 58.7 | 39.0 | - | R159B 465 01 |
| | 653 | 60 x 20R | 78 | 18 | 57.7 | 39.0 | - | R159B 465 01 |
| | 900 | 75 x 10R | 108 | 25 | 73.7 | 59.0 | R159A 49001 | - |
| | 901 | 75 x 20R | 108 | 25 | 72.7 | 59.0 | R159A 49001 | - |
| | 902 | 75 x 10R | 108 | 25 | 73.7 | 59.0 | - | R159B 490 01 |
| | 903 | 75 x 20R | 108 | 25 | 72.7 | 59.0 | - | R159B 490 01 |

$d_0$ x P = size
$d_0$ = nominal diameter
$M_p$ = maximum permissible drive torque (precondition: no radial load at drive journal)
No. = part number
P = screw lead (R = right-hand)
S = hex socket
Z = centering hole DIN 332-D

Bearings

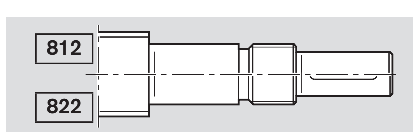
# Bearing unit LAF

**Fixed bearing with angular-contact thrust ball bearing LGF**
**Double-thrust, screw-down, Series LGF-B-…**
**Double-thrust, screw-down, Series LGF-C-…**

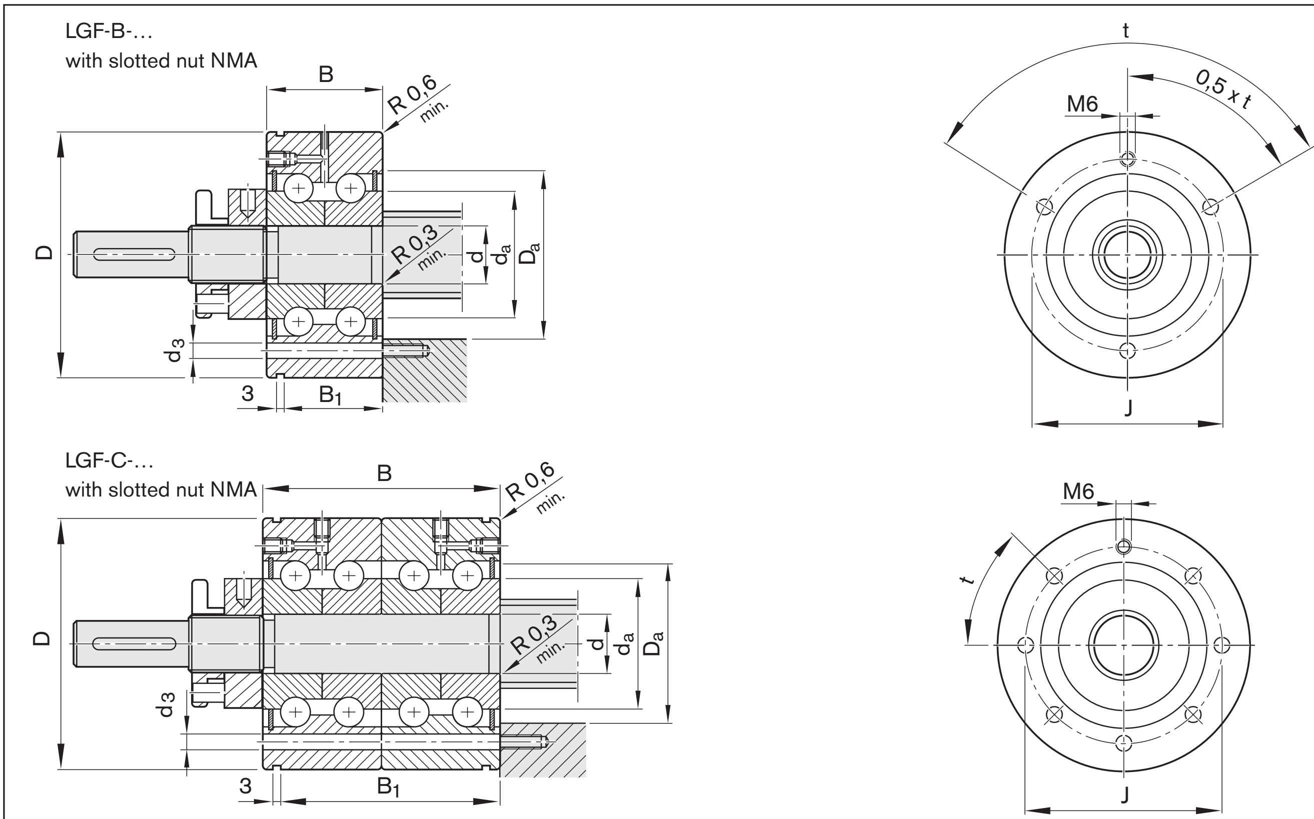
The bearing unit consists of:
- angular-contact thrust ball bearing LGF (not available as a separate part)
- slotted nut NMA...

| $d_0$ x P | LAF no. | LGF Designation | NMA Designation | NMA no. | Weight complete (kg) | C (N) | $C_0$ (N) | $M_{RL}$ (Nm) | $R_{fb}$ (N/µm) | $R_{kl}$ (Nm/mrad) | $n_G$ ($min^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **20 x 5R** | R159A 015 01 | LGF-B-1560 | NMA 15x1 | R3446 020 04 | 0.49 | 17900 | 28000 | 0.20 | 400 | 65 | 3500 |
| **30 x 5R/10R** | R159A 320 01 | LGF-C-2068 | NMA 20x1 | R3446 015 04 | 1.35 | 42000 | 94000 | 0.45 | 1150 | 320 | 3000 |
| **39 x 5R/10R** | R1590 330 30 | LGF-C-3080 | NMA 30x1.5 | R3446 016 04 | 1.76 | 47500 | 127000 | 0.75 | 1500 | 620 | 2200 |
| **48 x 5R/10R** | R159A 335 01 | LGF-C-3590 | NMA 35x1.5 | R3446 012 04 | 2.49 | 66000 | 177000 | 0.90 | 1600 | 900 | 2000 |

**Suitable for screw ends: Form**




C = dynamic load rating
$C_0$ = static load rating
$d_0$ x P = size
$d_0$ = nominal diameter
$M_{RL}$ = Bearing friction torque with seal
$n_G$ = Limit speed (grease)
no. = part number
P = screw lead (R = right-hand)
$R_{fb}$ = Rigidity (axial)
$R_{kl}$ = Rigidity against tilting




| $d_0$ x P | (mm) | | | | | | | | | Mounting holes | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | d | D | B | $B_1$ | J | $D_a$ | | $d_a$ | | Number | $d_3$ | t |
| | | | | | | min. | max. | min. | max. | | (mm) | (°) |
| **20 x 5R** | $15_{-0.010}$ | $60_{-0.013}$ | $25_{-0.25}$ | 17 | 46 | 32 | 35 | 20 | 31 | 3 | 6.8 | 120 |
| **30 x 5R/10R** | $20_{-0.005}$ | $68_{-0.010}$ | $56_{-0.50}$ | 47 | 53 | 40 | 43 | 25 | 39 | 7 | 6.8 | 45 |
| **39 x 5R/10R** | $30_{-0.005}$ | $80_{-0.010}$ | $56_{-0.50}$ | 47 | 63 | 50 | 53 | 40 | 49 | 11 | 6.8 | 30 |
| **48 x 5R/10R** | $35_{-0.005}$ | $90_{-0.010}$ | $68_{-0.50}$ | 59 | 75 | 59 | 62 | 45 | 58 | 7 | 8.8 | 45 |

Bearings

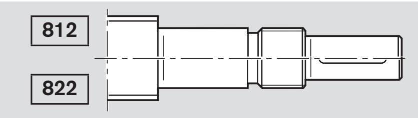
# Bearing unit LAN

**Fixed bearing with angular-contact thrust ball bearing LGN**
**Double-thrust,**
**Series LGN-B-…**
**Double-thrust, in pairs,**
**Series LGN-C-…**

The bearing unit consists of:
- angular-contact thrust ball bearing LGN (not available as a separate part)
- slotted nut NMA...

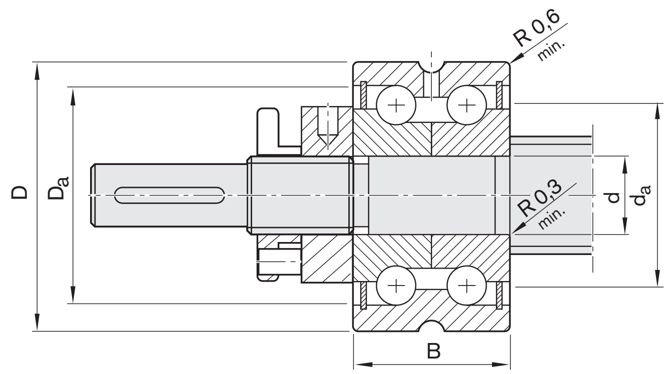
| $d_0$ x P | LAN no. | LGN Designation | NMA Designation | NMA no. | Weight complete (kg) | C (N) | $C_0$ (N) | $M_{RL}$ (Nm) | $R_{fb}$ (N/μm) | $R_{kl}$ (Nm/mrad) | $n_G$ ($min^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **20 x 5R** | R159A 115 01 | LGN-B-1545 | NMA 15x1 | R3446 020 04 | 0.27 | 17900 | 28000 | 0.20 | 400 | 65 | 3500 |
| **30 x 5R/10R** | R159A 220 01 | LGN-C-2052 | NMA 20x1 | R3446 015 04 | 0.75 | 42000 | 94000 | 0.45 | 1150 | 320 | 3000 |
| **39 x 5R/10R** | R1590 230 30 | LGN -C-3062 | NMA 30x1.5 | R3446 016 04 | 0.98 | 47500 | 127000 | 0.75 | 1500 | 620 | 2200 |
| **48 x 5R/10R** | R159A 235 01 | LGN-C-3572 | NMA 35x1.5 | R3446 012 04 | 1.25 | 66000 | 177000 | 0.90 | 1600 | 900 | 2000 |

**Suitable for screw ends: Form**

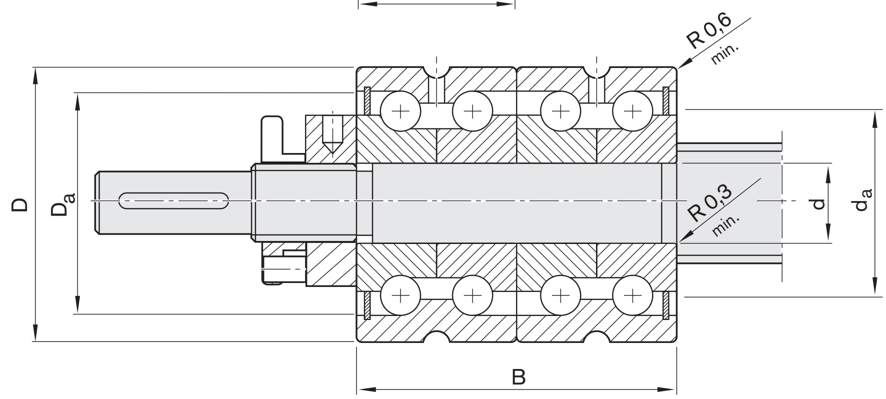



C = dynamic load rating
$C_0$ = static load rating
$d_0$ x P = size
$d_0$ = nominal diameter
$M_{RL}$ = Bearing friction torque with seal
$n_G$ = Limit speed (grease)
no. = part number
P = screw lead (R = right-hand)
$R_{fb}$ = Rigidity (axial)
$R_{kl}$ = Rigidity against tilting

LGN-B-…
with slotted nut NMA




LGN-C-…
with slotted nut NMA




| $d_0$ x P | (mm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | d | D | B | $D_a$ | | $d_a$ | |
| | | | | min. | max. | min. | max. |
| **20 x 5R** | $15_{-0.010}$ | $45_{-0.01}$ | $25_{-0.25}$ | 32 | 35 | 20 | 31 |
| **30 x 5R/10R** | $20_{-0.005}$ | $52_{-0.01}$ | $56_{-0.50}$ | 40 | 43 | 25 | 39 |
| **39 x 5R/10R** | $30_{-0.005}$ | $62_{-0.01}$ | $56_{-0.50}$ | 50 | 53 | 40 | 49 |
| **48 x 5R/10R** | $35_{-0.005}$ | $72_{-0.01}$ | $68_{-0.50}$ | 59 | 62 | 45 | 58 |

Bearings

# Bearing unit LAD

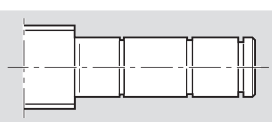
## Floating bearing with deep-groove ball bearing

The bearing unit consists of:
– deep-groove ball bearing per DIN 625... .2RS
– retaining ring DIN 471 (2 pcs)

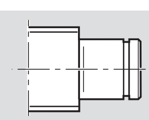
| $d_0$ x P | LAD | Single parts | | | | Weight | C | $C_0$ |
|---|---|---|---|---|---|---|---|---|
| | | Deep-groove ball bearing DIN 625 | | Retaining ring DIN 471 | | complete | | |
| | no. | Designation | no. | Designation | no. | (kg) | (N) | (N) |
| **20 x 5R** | R1590 612 00 | 6201.2RS | R3414 042 00 | 12x1 | R3410 712 00 | 0,035 | 6950 | 2650 |
| | R1590 615 00 | 6202.2RS | R3414 074 00 | 15x1 | R3410 748 00 | 0,043 | 7800 | 3250 |
| **30 x 5R/10R** | R1590 620 00 | 6204.2RS | R3414 038 00 | 20x1,2 | R3410 735 00 | 0,106 | 12700 | 5700 |
| | R1590 625 00 | 6205.2RS | R3414 063 00 | 25x1,2 | R3410 750 00 | 0,125 | 14300 | 6950 |
| **39 x 5R/10R** | R1590 630 00 | 6206.2RS | R3414 051 00 | 30x1,5 | R3410 724 00 | 0,195 | 19300 | 9800 |
| **48 x 5R/10R** | R1590 635 00 | 6207.2RS | R3414 075 00 | 35x1,5 | R3410 725 00 | 0,288 | 25500 | 13200 |
| **60 x 10R/20R** | R1590 650 00 | 6210.2RS | R3414 077 00 | 50x2 | R3410 727 00 | 0,453 | 36500 | 20800 |
| **75 x 10R/20R** | R1590 660 00 | 6212.2RS | R3414 078 00 | 60x2 | R3410 764 00 | 0,783 | 52000 | 31000 |

**Suitable for screw ends: Form**

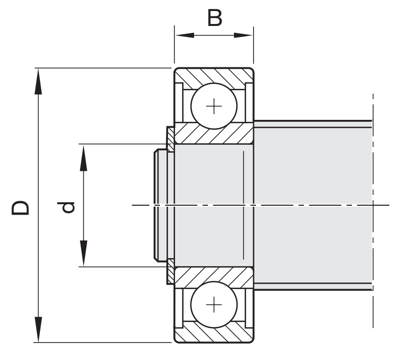
312



412



C = dynamic load rating
$C_0$ = static load rating
$d_0$ x P = size
$d_0$ = nominal diameter
no. = part number
P = screw lead (R = right-hand)




| $d_0$ x P | (mm) | | |
|---|---|---|---|
| | d | D | B |
| 20 x 5R | 12 | 32 | 10 |
| | 15 | 35 | 11 |
| 30 x 5R/10R | 20 | 47 | 14 |
| | 25 | 52 | 15 |
| 39 x 5R/10R | 30 | 62 | 16 |
| 48 x 5R/10R | 35 | 72 | 17 |
| 60 x 10R/20R | 50 | 90 | 20 |
| 75 x 10R/20R | 60 | 110 | 22 |

Bearings

# Bearing unit LAS

## Fixed bearing with angular-contact thrust ball bearing LGS

**Double-thrust**

**Series LAS-E**

The bearing unit consists of:

- angular-contact thrust ball bearing LGS per DIN 628 (not available as a separate part)
- slotted nut NMA...

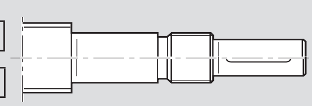
| $d_0$ x P | LAS no. | LGS Designation | NMA Designation | NMA no. | Weight complete (kg) | C (kN) | $C_0$ (kN) | $n_G$ 1) (min$^{-1}$) |
|---|---|---|---|---|---|---|---|---|
| **20 x 5R** | R159A 415 01 | LGS-E-1542 | NMA 15x1 | R3446 020 04 | 0.39 | 37.1 | 51.5 | 9000 |
| | R159A 420 01 | LGS-E-2047 | NMA 20x1 | R3446 015 04 | 0.57 | 39.9 | 63.8 | 8550 |
| **30 x 5R/10R** | R159A 420 02 | LGS-E-2052 | NMA 20x1 | R3446 015 04 | 0.73 | 54.2 | 80.0 | 8100 |
| | R159A 430 01 | LGS-E-3072 | NMA 30x1.5 | R3446 016 04 | 1.68 | 98.3 | 163.1 | 5850 |
| **39 x 5R/10R** | R159A 430 01 | LGS-E-3072 | NMA 30x1.5 | R3446 016 04 | 1.68 | 98.3 | 163.1 | 5850 |
| | R159A 440 01 | LGS-E-4090 | NMA 40x1.5 | R3446 016 08 | 2.74 | 140.8 | 257.7 | 4500 |
| **48 x 5R/10R** | R159A 435 01 | LGS-E-3580 | NMA 35x1.5 | R3446 012 04 | 2.19 | 111.2 | 188.5 | 4950 |
| | R159A 450 01 | LGS-E-50110 | NMA 50x1.5 | R3446 019 04 | 4.95 | 211.2 | 392.3 | 3600 |
| **60 x 10R/20R** | R159A 445 01 | LGS-E-45100 | NMA 45x1.5 | R9130 342 15 | 1.70 | 172.4 | 319.2 | 4050 |
| | R159A 470 01 | LGS-E-70150 | NMA 70x2 | R9130 342 17 | 10.99 | 339.2 | 692.3 | 2520 |
| **75 x 10R/20R** | R159A 460 01 | LGS-E-60130 | NMA 60x2 | R9130 342 16 | 7.49 | 272.5 | 534.6 | 3015 |
| | R159A 490 01 | LGS-E-90190 | NMA 90x2 | R9163 113 51 | 21.45 | 470.3 | 1123.1 | 2025 |

1) Values as a guide for low bearing load, good heat dissipation and suitable lubricating greases with low consistency.

**Suitable for screw ends: Form**

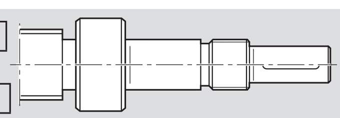
812

822

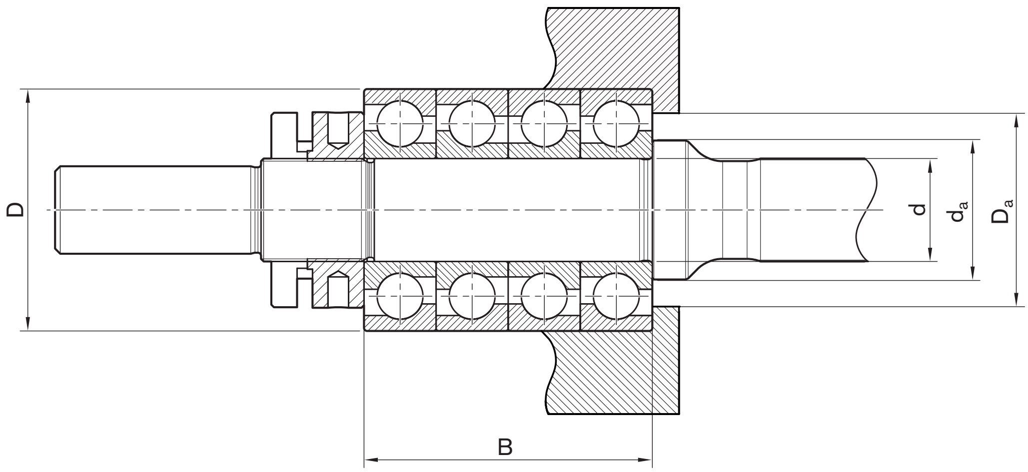


832

842



C = dynamic load rating
$C_0$ = static load rating
$d_0$ x P = size
$d_0$ = nominal diameter
no. = part number
$n_G$ = rotary speed limit (grease)
P = screw lead (R = right-hand)



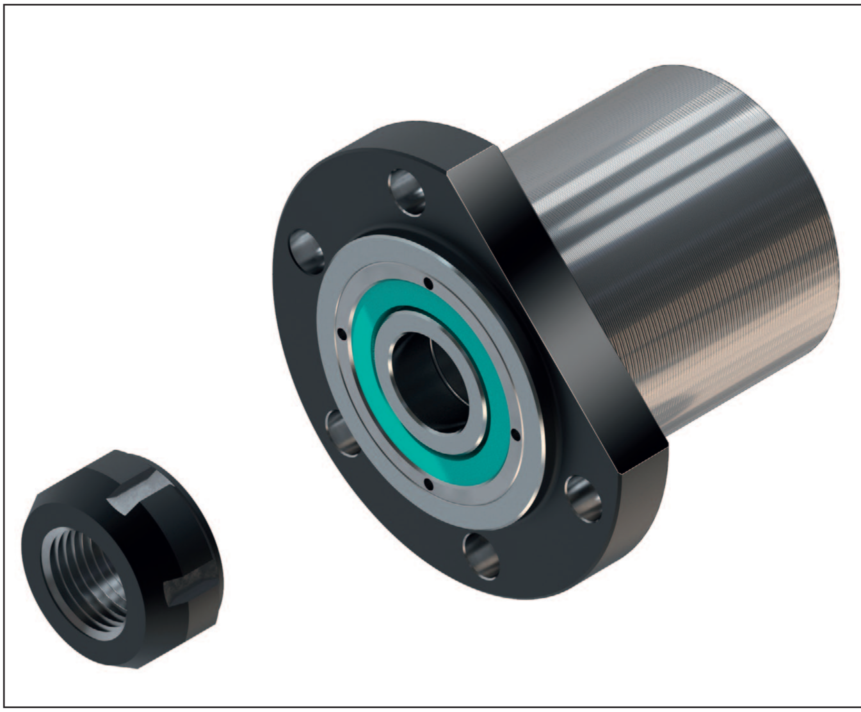

| $d_0$ x P | (mm) | | | | | | |
|---|---|---|---|---|---|---|---|
| | d | D | B | $D_a$ | | $d_a$ | |
| | | | | min. | max. | min. | max. |
| **20 x 5R** | $15_{-0.008}$ | $42_{-0.011}$ | 52 | 33.0 | 36 | - | - |
| | $20_{-0.010}$ | $47_{-0.011}$ | 56 | 36.0 | 41 | 25.6 | 35.0 |
| **30 x 5R/10R** | $20_{-0.010}$ | $52_{-0.013}$ | 60 | 40.0 | 45 | - | - |
| | $30_{-0.010}$ | $72_{-0.013}$ | 76 | 56.5 | 65 | 37.0 | 55.5 |
| **39 x 5R/10R** | $30_{-0.010}$ | $72_{-0.013}$ | 76 | 56.5 | 65 | - | - |
| | $40_{-0.012}$ | $90_{-0.015}$ | 92 | 72.0 | 81 | 49.0 | 71.0 |
| **48 x 5R/10R** | $35_{-0.012}$ | $80_{-0.013}$ | 84 | 63.0 | 71 | - | - |
| | $50_{-0.012}$ | $110_{-0.015}$ | 108 | 89.0 | 100 | 61.0 | 88.0 |
| **60 x 10R/20R** | $45_{-0.012}$ | $100_{-0.015}$ | 100 | 81.0 | 91 | - | - |
| | $70_{-0.015}$ | $150_{-0.018}$ | 140 | 121.0 | 138 | 82.0 | 119.0 |
| **75 x 10R/20R** | $60_{-0.015}$ | $130_{-0.018}$ | 124 | 106.0 | 118 | - | - |
| | $90_{-0.020}$ | $190_{-0.030}$ | 172 | 153.0 | 176 | 104.0 | 150.0 |

Bearings

# Bearing unit FEC-F

### Fixed bearing with angular-contact thrust ball bearing LGS

The bearing unit consists of:
– Precision steel flanged housing
– angular-contact thrust ball bearing LGS
– slotted nut NMB
The slotted nut is delivered unmounted

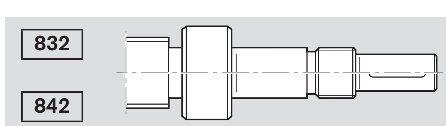


| $d_0$ x P | FEC-F no. | LGS Designation | NMB Designation | $M_A$ (Nm) | Weight complete (kg) | C (kN) | $C_0$ (kN) | $M_{RL}$ 1) (Nm) | $R_{fb}$ (N/µm) | $R_{kL}$ (Nm/mrad) | $n_G$ 2) ($min^{-1}$) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| **20 x 5R** | R159B 425 01 | LGS-E-2562 | NMB 25x1,5 | 25 | 3,5 | 74,2 | 119,2 | 1,10 | 450 | 160 | 6900 |
| **30 x 5R/10R** | R159B 435 01 | LGS-E-3580 | NMB 35x1,5 | 42 | 6,0 | 109,4 | 188,4 | 1,10 | 600 | 715 | 4950 |
| **39 x 5R/10R** | R159B 450 01 | LGS-E-50110 | NMB 50x1,5 | 70 | 11,8 | 208,8 | 392,3 | 1,50 | 750 | 1000 | 3600 |
| **48 x 5R/10R** | R159B 465 01 | LGS-E-65140 | NMB 65x2 | 100 | 27,0 | 305,3 | 615,4 | 2,00 | 1250 | 3200 | 2835 |
| **60 x 10R/20R** | R159B 465 01 | LGS-E-65140 | NMB 65x2 | 100 | 27,0 | 305,3 | 615,4 | 2,00 | 1250 | 3200 | 2835 |
| **75 x 10R/20R** | R159B 490 01 | LGS-E-90190 | NMB 90x2 | 160 | 53,4 | 473,1 | 1123,0 | 2,30 | 1500 | 7500 | 2025 |

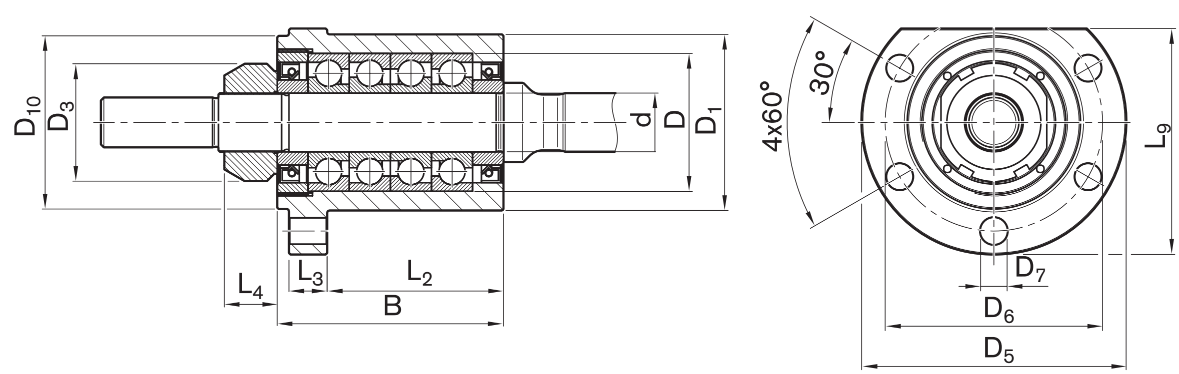
Values apply for bearing configuration 2 + 2.
Bearing configurations 3 + 1 or 1 + 3 are possible. Please ask.

1) Measured at 50 min-1
2) Values as a guide for low bearing load, good heat dissipation and suitable lubricating greases with low consistency.

**Suitable for screw ends: Form**




C = dynamic load rating
$C_0$ = static load rating
$d_0$ x P = size
$d_0$ = nominal diameter
no. = part number
P = screw lead (R = right-hand)
$M_{RL}$ = bearing friction torque with sealing disk
$R_{fb}$ = stiffness (axial)
$R_{kL}$ = tilting rigidity
$n_G$ = rotary speed limit (grease)



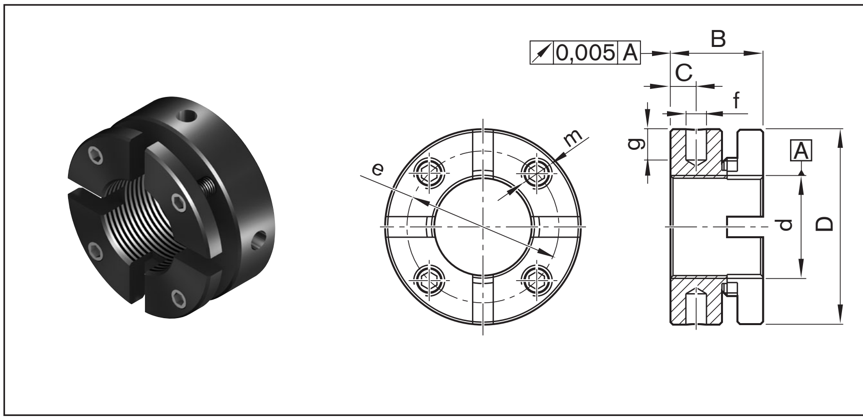

| $d_0$ x P | (mm) | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | d | D | B | L2 | L3 | L4 | L9 | D1 h7 | D3 | D5 | D6 | D7 | D10 |
| **20 x 5R** | $25_{-0.010}$ | $62_{-0.013}$ | 89 | 68.0 | 16 | 20 | 104.0 | 80 | 44 | 120 | 100 | 11.0 | 80 |
| **30 x 5R/10R** | $35_{-0.012}$ | $80_{-0.013}$ | 110 | 82.0 | 20 | 22 | 124.0 | 100 | 54 | 140 | 120 | 13.0 | 99 |
| **39 x 5R/10R** | $50_{-0.012}$ | $110_{-0.015}$ | 140 | 98.5 | 25 | 25 | 152.5 | 130 | 75 | 171 | 152 | 13.0 | 130 |
| **48 x 5R/10R** | $65_{-0.015}$ | $140_{-0.018}$ | 180 | 133.5 | 30 | 28 | 199.5 | 170 | 95 | 225 | 198 | 17.5 | 170 |
| **60 x 10R/20R** | $65_{-0.015}$ | $140_{-0.018}$ | 180 | 133.5 | 30 | 28 | 199.5 | 170 | 95 | 225 | 198 | 17.5 | 170 |
| **75 x 10R/20R** | $90_{-0.020}$ | $190_{-0.018}$ | 235 | 174.0 | 35 | 32 | 257.5 | 219 | 125 | 285 | 252 | 22.0 | 219 |

Slotted Nuts and Housing Nuts

# Slotted Nuts NMA for Fixed Bearings

## Slotted nut NMA

– for maximum vibratory loads



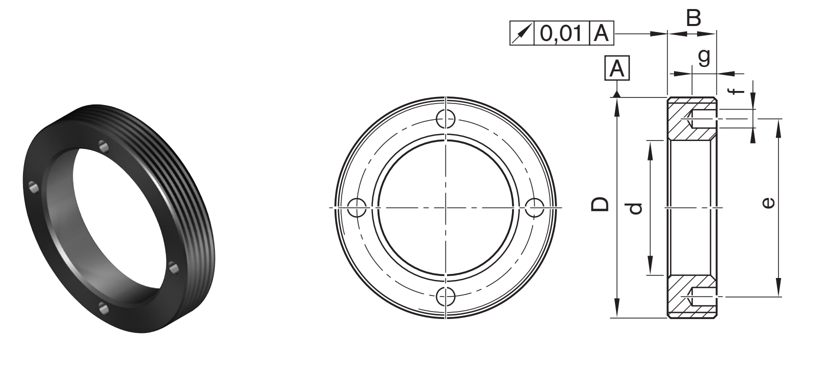

**$M_A$** = tightening torque for slotted nut
**$F_{aB}$** = axial breaking load of slotted nut
**$M_{AG}$** = tightening torque for set screw
**Nr.** = part number

| Designation | No. | (mm) d | D | B | c | m | e | f | g | $M_A$ (Nm) | $F_{aB}$ (kN) | $M_{AG}$ (Nm) | Weight (g) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **NMA 15x1** | R3446 020 04 | M15x1 | 30 | 18 | 5 | M5 | 24 | 4 | 5 | 10 | 100 | 3 | 60 |
| **NMA 17x1** | R3446 014 04 | M17x1 | 32 | 18 | 5 | M5 | 26 | 4 | 5 | 15 | 120 | 3 | 70 |
| **NMA 20x1** | R3446 015 04 | M20x1 | 38 | 18 | 5 | M6 | 31 | 4 | 6 | 18 | 145 | 5 | 130 |
| **NMA 25x1,5** | R3446 011 04 | M25x1.5 | 45 | 20 | 6 | M6 | 38 | 5 | 6 | 25 | 205 | 5 | 160 |
| **NMA 30x1,5** | R3446 016 04 | M30x1.5 | 52 | 20 | 6 | M6 | 45 | 5 | 7 | 32 | 250 | 5 | 200 |
| **NMA 35x1,5** | R3446 012 04 | M35x1.5 | 58 | 20 | 6 | M6 | 51 | 5 | 7 | 40 | 280 | 5 | 230 |
| **NMA 40x1,5** | R3446 018 04 | M40x1.5 | 65 | 22 | 6 | M6 | 58 | 6 | 8 | 55 | 350 | 5 | 300 |
| **NMA 45x1,5** | R9130 342 15 | M45x1.5 | 70 | 22 | 6 | M6 | 63 | 6 | 8 | 65 | 360 | 5 | 340 |
| **NMA 50x1,5** | R3446 019 04 | M50x1.5 | 75 | 25 | 8 | M6 | 68 | 6 | 8 | 85 | 450 | 5 | 430 |
| **NMA 60x2** | R9130 342 16 | M60x2.0 | 90 | 26 | 8 | M8 | 80 | 6 | 8 | 100 | 550 | 15 | 650 |
| **NMA 70x2** | R9130 342 17 | M70x2.0 | 100 | 28 | 9 | M8 | 90 | 8 | 10 | 130 | 650 | 15 | 790 |
| **NMA 90x2** | R9163 113 51 | M90x2.0 | 130 | 32 | 13 | M10 | 118 | 8 | 10 | 200 | 900 | 20 | 1530 |

## Housing nut GWR

- for angular-contact thrust ball bearing LGN
- for cylindrical single nut ZEM-E-S

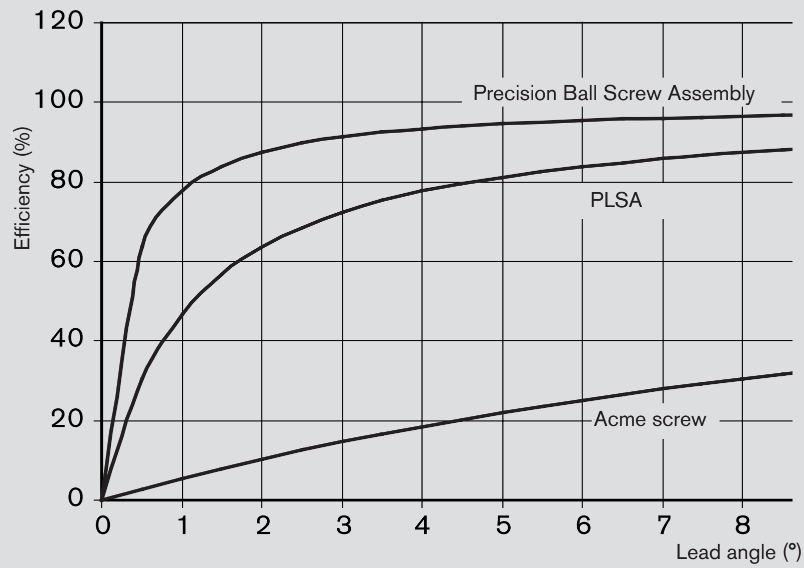
Note:
Use a threadlocker (e.g. Loctite 638) to secure against loosening.




| Designation | No. | (mm) | | | | | | Weight |
|---|---|---|---|---|---|---|---|---|
| | | D | d | B | e | f | g | (g) |
| **GWR 18x1** | R1507 040 33 | M18x1 | 8.5 | 8 | 12.5 | 2.5 | 3 | 10.0 |
| **GWR 23x1** | R1507 240 35 | M23x1 | 13.0 | 8 | 18.0 | 2.5 | 3 | 15.0 |
| **GWR 26x1.5** | R1507 240 22 | M26x1.5 | 16.5 | 8 | 20.5 | 2.5 | 3 | 16.5 |
| **GWR 30x1.5** | R1507 340 34 | M30x1.5 | 17.0 | 8 | 23.0 | 3.0 | 4 | 29.0 |
| **GWR 36x1.5** | R1507 040 23 | M36x1.5 | 22.0 | 8 | 29.0 | 3.0 | 4 | 35.0 |
| **GWR 40x1.5** | R1507 140 03 | M40x1.5 | 25.0 | 8 | 33.0 | 3.0 | 4 | 39.5 |
| **GWR 45x1.5** | R1507 240 04 | M45x1.5 | 28.0 | 8 | 38.0 | 3.0 | 4 | 55.0 |
| **GWR 50x1.5** | R1507 240 25 | M50x1.5 | 31.0 | 10 | 40.0 | 4.0 | 5 | 86.0 |
| **GWR 55x1.5** | R1507 340 05 | M55x1.5 | 36.0 | 10 | 46.0 | 4.0 | 5 | 96.0 |
| **GWR 58x1.5** | R1507 440 32 | M58x1.5 | 43.0 | 10 | 50.0 | 4.0 | 5 | 84.0 |
| **GWR 60x1** | R1507 440 28 | M60x1 | 43.0 | 10 | 51.0 | 4.0 | 5 | 97.0 |
| **GWR 62x1.5** | R1507 440 29 | M62x1.5 | 43.0 | 12 | 53.0 | 5.0 | 6 | 127.0 |
| **GWR 65x1.5** | R1507 440 26 | M65x1.5 | 47.0 | 12 | 55.0 | 4.0 | 5 | 136.0 |
| **GWR 70x1.5** | R1507 440 06 | M70x1.5 | 42.0 | 12 | 58.0 | 4.0 | 5 | 216.0 |
| **GWR 78x2** | R1507 540 07 | M78x2 | 52.0 | 15 | 67.0 | 6.0 | 7 | 286.0 |
| **GWR 92x2** | R1507 640 09 | M92x2 | 65.0 | 16 | 82.0 | 6.0 | 7 | 385.0 |
| **GWR 112x2** | R1507 740 11 | M112x2 | 82.0 | 18 | 100.0 | 8.0 | 8 | 596.0 |

# Technical Notes

The degree of efficiency determines the torque required to convert the rotary motion into linear motion.




Due to their high mechanical efficiency, PLSAs are in principle not self-locking.

⚠ **Safety information**
For installation, customers should check whether separate protection against falling loads, e.g. a safety nut, is required. Please consult us.

**Advantages over the Acme screw drive**

- The mechanical efficiency of an Acme screw drive is a maximum 50%, whereas a PLSA can reach a mechanical efficiency of up to 90%.
- Higher life expectancy due to negligible wear during operation
- Less drive power required
- No stick-slip effect
- More precise positioning
- Higher travel speed
- Less heat-up

**Selection criteria for PLSAs (extract)**

The following factors should be considered when selecting the PLSA for a given application:
- degree of accuracy required (lead deviation)
- in-service load conditions
- service life
- critical speed
- buckling load
- rigidity/permissible clearance or desired preload
- characteristic speed (max. permissible linear speed)

⚠ **Note**
Radial and eccentric forces relative to the screw must be avoided, as they can affect the PLSA's performance and shorten its life. Where special conditions of use are involved, please ask.

The following points should be taken into consideration when selecting a PLSA that is to be both cost-efficient and optimally designed:
- The calculation of the service life should be based on average loads and average speeds, not on maximum values.
- In order for us to provide you with a customized solution, installation drawings or sketches of the nut environment should be enclosed with.

**Static load rating $C_0$**

The static load rating is an axial, concentrically acting force that induces a permanent deformation of 0.0001 x the rolling element diameter.

**Dynamic load rating C**

The dynamic load rating is an axial, concentrically acting force of constant magnitude and direction under which 90% of a sufficiently large number of identical PLSAs can achieve a nominal service life of one million revolutions.

**Correction factor for tolerance grades**

The static load rating $C_0$ and the dynamic load rating C must be multiplied by the correction factor $f_{ac}$ as appropriate for the specific tolerance grade of the screw.

| Tolerance grade T | 5 | 7 | 9 |
|---|---|---|---|
| $f_{ac}$ | 1 | 0,9 | 0,8 |

**Service life**

The nominal life is expressed by the number of revolutions (or number of operating hours at constant speed) that will be attained or exceeded by 90% of a representative sample of identical PLSA´s before the first signs of material fatigue become evident. The nominal life is designated as L or $L_h$, depending on whether it is specified in revolutions or hours.
The nominal life calculation is based on optimal installation and environmental conditions. The service life may be shortened, for example, if the lubrication is affected by exposure to process media.

**Critical speed and buckling load**

The critical speed and buckling load can be checked using the corresponding charts. For precise calculations see formula 12 15, in “Design Calculations”.

**Characteristic speed $d_0 \cdot n$**

Rexroth PLSAs can be operated at very high speeds due to their structural design. Characteristic speeds of up to 150,000 are possible depending on the nut type. The Characteristic speeds can be exceeded for a short-term, please consult us.

**$d_0 \cdot n \leq$ 150 000**
**$d_0$ = nominal diameter (mm)**
**n = speed ($min^{-1}$)**

The theoretically possible maximum linear speed $v_{max}$ (m/min) is specified on the page featuring the relevant nut. Actually attainable speeds are heavily dependent among other factors on preload and duty cycle. They are gen-erally restricted by the critical speed. (See “Design Calculations”).

**Material, hardness**

PLSAs are made of high-quality, heat-treatable steel, carbon chrome alloy steels or case-hardened steels. The screw and nut raceways have a minimum Rockwell hardness of HRC 58. The screw ends are not hardened.

# Technical Notes

**Sealing**

PLSAs are precision assemblies that require protection against contamination.
Flat protective covers, bellows type dust boots or other enclosures are particularly suitable for this purpose. As there are some applications in which these methods do not provide sufficient protection, we have developed an additional gapless lip-type seal which ensures an optimal sealing effect and maintains high efficiency due to the low friction level. Our PLSAs can therefore be supplied with lip-type seals as an option. At the customer's request, the seals can be omitted entirely.
To ensure that seals retain their functionality, dirt must be removed at regular intervals.

**Short stroke**
Short stroke applications = stroke ≤ nut length

**Lubrication:**
During a short stroke, the planets do not make a real turn. It is therefore impossible for an adequate lubricating film to form. This may result in premature wear.
To avoid this, it is sufficient to perform longer strokes at regular intervals with simultaneous relubrication as "lubricating strokes".

**Load rating:**
Short stroke applications will increase the number of times a rolling load passes over each point within the load zone. This reduces the load rating.
Please consult us.

**Permissible operating temperature**

PLSAs are suitable for continuous operation at temperatures up to 80 °C with temporary peaks of 100 °C (measurements taken on the outer shell of the nut).

Permissible operating temperatures:
$-10\ °C \leq T_{operating} \leq 80\ °C$

Permissible bearing temperature:
$-15\ °C \leq T_{bearing} \leq 80\ °C$

**Bearings**

When calculating the life expectancy of the overall system, the end bearings must be considered separately.

# Acceptance Conditions and Tolerance Grades

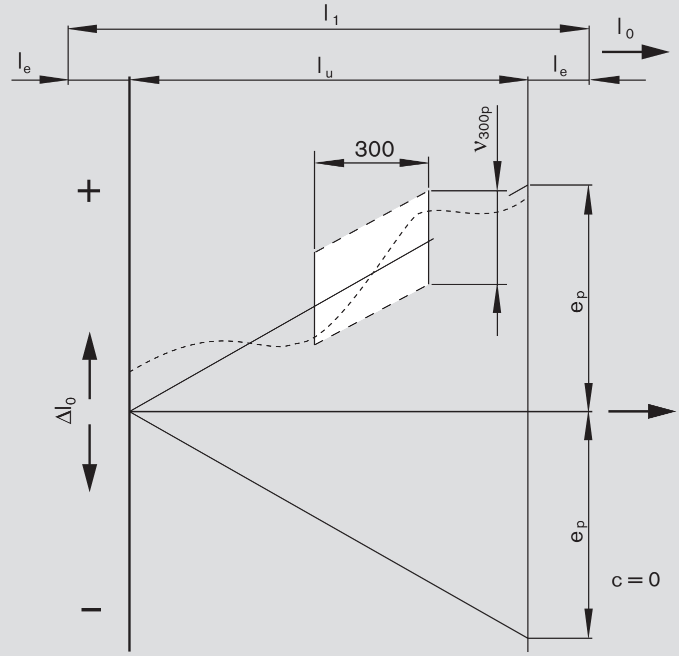
## Permissible travel deviation

in accordance with DIN ISO 3408-3

**Symbol definitions (excerpt):**

$l_0$ = nominal travel
$l_1$ = thread length
$\Delta l_0$ = travel deviation
$l_u$ = useful travel
$l_e$ = excess travel (the closer tolerances for travel and hardness do not apply here)
c = travel compensation (target travel deviation) (standard: c = 0)
$e_p$ = tolerance mean actual travel deviation
$\nu_{300p}$ = permissible travel deviation within 300 mm travel
$\nu_{2\pi p}$ = permissible travel deviation within one revolution

**T PLSA with precision screw PSR**




| Useful travel $l_u$ | | tolerance mean actual travel deviation $e_p$ (µm) Tolerance grade | | |
|---|---|---|---|---|
| > | ≤ | 5 | 7 | 9 |
| **0** | **100** | 18 | 44 | 110 |
| **100** | **200** | 20 | 48 | 120 |
| **200** | **315** | 23 | 52 | 130 |
| **315** | | $e_p = \frac{l_u}{300} \cdot \nu_{300p}$ | | |

**For precision screws PSR the following values apply in all cases:**

| $\nu_{300p}$ (µm) Tolerance grade | | |
|---|---|---|
| 5 | 7 | 9 |
| 23 | 52 | 130 |

**Non-usable length $l'_e$**
(Excess travel)

| $d_0$ (mm) | $l_e$ (mm) |
|---|---|
| **20, 30** | 40 |
| **48** | 50 |

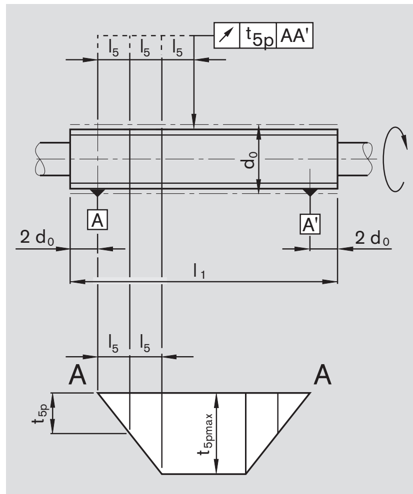
Minimum number of measurements within 300 mm (measuring interval) and excess travel to be taken into consideration.

| Lead P (mm) | Minimum number of measurements for tolerance grade 5 | 7 | 9 |
|---|---|---|---|
| 5 | 6 | 3 | 3 |
| 10 | 3 | 1 | 1 |
| 20 | 3 | 1 | 1 |

# Acceptance Conditions and Tolerance Grades

**Run-outs and location deviations** based on DIN ISO 3408-3

Radial run-out $t_5$ of the outer diameter of the screw over the length $l_5$ used to determine the straightness in relation to AA'.

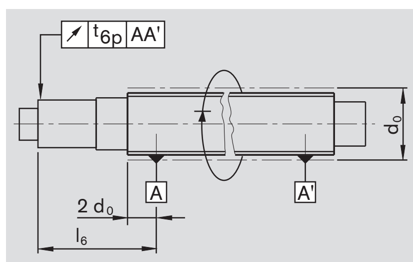



| $d_0$ | | $l_5$ | $t_{5pmax}$ in µm for $l_5$ tolerance grade | | |
|---|---|---|---|---|---|
| > | ≤ | | 5 | 7 | 9 |
| 6 | 12 | 80 | 32 | 40 | 60 |
| 12 | 25 | 160 | | | |
| 25 | 50 | 315 | | | |
| 50 | 100 | 630 | | | |

| $l_1/d_0$ | | $t_{5pmax}$ in µm for $l_1 \geq 4l_5$ tolerance grade | | |
|---|---|---|---|---|
| > | ≤ | 5 | 7 | 9 |
| | 40 | 64 | 80 | 120 |
| 40 | 60 | 96 | 120 | 180 |
| 60 | 80 | 160 | 200 | 300 |
| 80 | 100 | 256 | 320 | 480 |

Radial run-out $t_6$ of the bearing diameter in relation to AA' for $\mathbf{l_6} \leq \mathbf{l}$.
Table value $\mathbf{t_{6p}}$ applies when $\mathbf{l_6} \leq$ reference length **l**.

Where $l_6 > l$ then $t_{6a} \leq t_{6p} \cdot \frac{l_6}{l}$

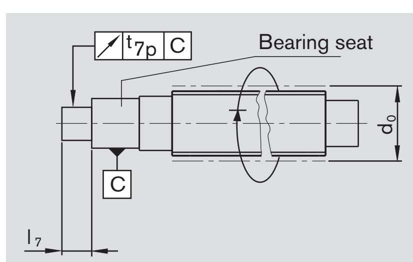



| $d_0$ | | Reference length l | $t_{6p}$ in µm for $l_6 \leq l$ tolerance grade | | |
|---|---|---|---|---|---|
| > | ≤ | | 5 | 7 | 9 |
| 6 | 20 | 80 | 20 | 40 | 50 |
| 20 | 50 | 125 | 25 | 50 | 63 |
| 50 | 125 | 200 | 32 | 63 | 80 |

Coaxial deviation $t_7$' of the journal diameter of the screw shaft in relation to the bearing diameter for $l_7 > l$.

Table value $\mathbf{t_{7p}}$ applies when $\mathbf{l_7} \leq$ reference length **l**.

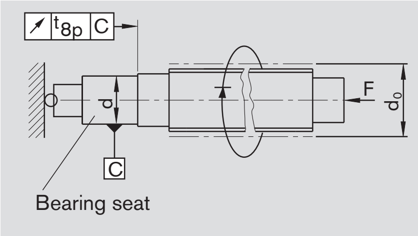
Where $l_7 > l$ then $t_{7a} \leq t_{7p} \cdot \frac{l_7}{l}$




| $d_0$ | | Reference length l | $t_{7p}$ in µm for $l_7 \leq l$ tolerance grade | | |
|---|---|---|---|---|---|
| > | ≤ | | 5 | 7 | 9 |
| 6 | 20 | 80 | 8 | 12 | 14 |
| 20 | 50 | 125 | 10 | 16 | 18 |
| 50 | 125 | 200 | 12 | 20 | 23 |

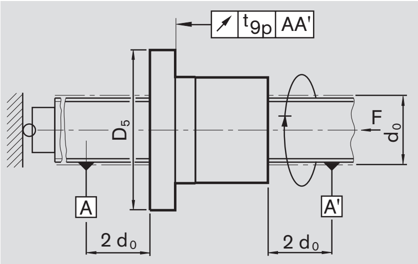
$d_0$ = nominal diameter

Axial run-out $\mathbf{t_8}$ of the shaft (bearing) face of the screw shaft in relation to the bearing diameter.



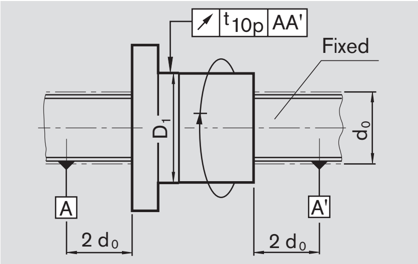

| $d_0$ | | $t_{8p}$ in µm for tolerance grade | | |
|---|---|---|---|---|
| > | ≤ | 5 | 7 | 9 |
| **6** | **63** | 5 | 6 | 8 |
| **63** | **125** | 6 | 8 | 10 |

Axial run-out $t_9$ of the nut location face in relation to **A** and **A'** (for preloaded nuts only).




| Flange diameter $D_5$ | | $t_{9p}$ in µm for tolerance grade | |
|---|---|---|---|
| > | ≤ | 5 | 7 |
| **16** | **32** | 16 | 20 |
| **32** | **63** | 20 | 25 |
| **63** | **125** | 25 | 32 |
| **125** | **250** | 32 | 40 |

Radial run-out $\mathbf{t_{10}}$ of the outer diameter $\mathbf{D_1}$ of the nut in relation to A and **A'** (for preloaded and rotating nuts only). Fix screw against rotation before carrying out the measurement.



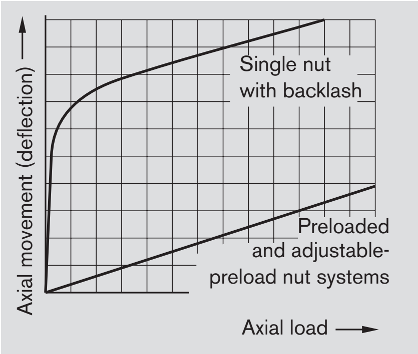

| Outer diameter $D_1$ | | $t_{10p}$ in µm for tolerance grade | |
|---|---|---|---|
| > | ≤ | 5 | 7 |
| **16** | **32** | 16 | 20 |
| **32** | **63** | 20 | 25 |
| **63** | **125** | 25 | 32 |
| **125** | **250** | 32 | 40 |

Technical Data

# Preload, Rigidity, Friction Torques

## Nut system preload

In addition to single nuts with reduced backlash, Rexroth supplies preloaded nut systems.




With preloaded nut systems, the deformation due to load cycling is significantly less than that of systems without preload. Preloaded nut systems should therefore be used in applications requiring a high degree of rigidity.
The preload of the PLSA will decrease over time as a function of the load the operating hours.
The screw is typically far less rigid than the nut unit (for details see “Overall axial rigidity...”).

## Rigidity

The rigidity of a PLSA is also influenced by all adjoining parts such as bearings, housing bores, nut housings etc.

**Overall axial rigidity $R_{bs}$ of the PLSA**

The overall axial rigidity $\mathbf{R_{bs}}$ is comprised of the component rigidity of the bearing $\mathbf{R_{fb}}$, the screw $\mathbf{R_S}$ and the nut unit $\mathbf{R_{nu}}$.

$$\frac{1}{R_{bs}} = \frac{1}{R_{fb}} + \frac{1}{R_S} + \frac{1}{R_{nu}} \qquad (16)$$

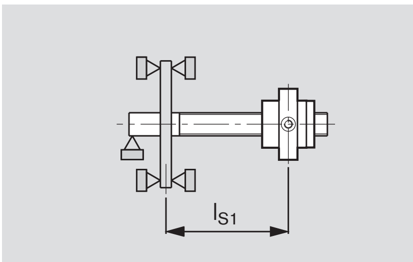
**Rigidity of the bearing $R_{fb}$**

The rigidity of the bearings corresponds to the values found in the bearing manufacturer’s catalog. See the corresponding tables in this catalog for rigidity values of the bearings offered by Rexroth.

**Rigidity of the screw $R_S$**

The rigidity of the screw $\mathbf{R_S}$ depends on the type of bearing used.
See the corresponding tables for rigidity values.
**Note:**
Please note that in most cases the rigidity $\mathbf{R_S}$ of the screw will be significantly lower than the rigidity $\mathbf{R_{nu}}$ of the nut unit.

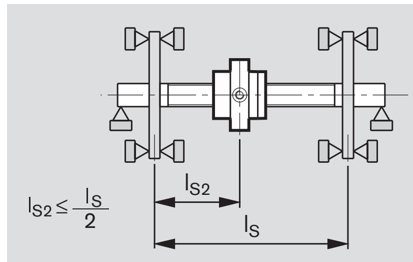
**1** PLSA shaft is fixed at one end.




$$R_{S2} = 165 \cdot \frac{(d_0)^2}{l_{S2}} \cdot \frac{l_S}{l_S - l_{S2}} \ (N/\mu m) \quad (18)$$

$$R_{S1} = 165 \cdot \frac{(d_0)^2}{l_{S1}} \ (N/\mu m) \quad (17)$$

**2** PLSA shaft is fixed at both ends.




The lowest screw rigidity $\mathbf{R_{S2min}}$ occurs at the center of the screw ($l_{S2} = l_S/2$) and thus equals:

$$R_{S2min} = 660 \cdot \frac{(d_0)^2}{l_S} \ (N/\mu m) \quad (19)$$

$\mathbf{R_S/R_{S1}/R_{S2}}$ = rigidity of the screw (N/µm)
$\mathbf{d_0}$ = nominal diameter (mm)
$\mathbf{l_S}$ = distance between bearing and bearing (mm)
$\mathbf{l_{S2}}$ = distance between bearing and nut (mm)

**Rigidity in the area of the nut unit $R_{nu}$**

See the corresponding tables for rigidity values.

### Preload and rigidity

| $d_0$ x P | Backlash of single nut FEM / ZEM standard (mm) | Preload of single nut | | | | | |
|---|---|---|---|---|---|---|---|
| | | | FDM | | FEM / ZEM | | |
| | | $R_{nu}$ (N/µm) max. | $T_{pr0}$ (Nm) min. | $T_{pr0}$ (Nm) max. | $T_{pr0}$ (Nm) min. | $T_{pr0}$ (Nm) max. | $R_S$ $\left(\frac{N \cdot m}{\mu m}\right)$ |
| **20 x 5** | 0,03 | 400 | 0,29 | 0,60 | 0,29 | 0,66 | 66 |
| **30 x 5** | | 620 | 0,57 | 1,13 | 0,57 | 1,24 | 148 |
| **30 x 10** | | 420 | 0,57 | 1,13 | 0,57 | 1,24 | 148 |
| **39 x 5** | | 750 | 0,88 | 1,75 | 0,88 | 1,92 | 250 |
| **39 x 10** | | 500 | 0,88 | 1,75 | 0,88 | 1,92 | 250 |
| **48 x 5** | | 1080 | 1,24 | 2,47 | 1,24 | 2,72 | 380 |
| **48 x 10** | | 760 | 1,24 | 2,47 | 1,24 | 2,72 | 380 |
| **60 x 10** | | 1030 | 1,79 | 3,58 | 1,79 | 3,94 | 594 |
| **60 x 20** | | 700 | 1,79 | 3,58 | 1,79 | 3,94 | 594 |
| **75 x 10** | | 1400 | - | - | 2,61 | 5,17 | 928 |
| **75 x 20** | | 1000 | - | - | 2,61 | 5,17 | 928 |

### Dynamic drag torque of the seals

Seal torque in the nuts

$\mathbf{d_0}$ **x P** = Size
$\mathbf{R_S}$ = rigidity of the screw
$\mathbf{R_{nu}}$ = rigidity of the nut unit
$\mathbf{T_{RD}}$ = dynamic drag torque of the 2 seals
$\mathbf{T_{pr0}}$ = dynamic drag torque without seals
$\mathbf{T_0}$ = overall dynamic drag torque
$\mathbf{T_0}$ = $T_{pr0} + T_{RD}$

| $d_0$ x P | Dynamic drag torque $T_{RD}$ approx. (Nm) | |
|---|---|---|
| | Lip-type seal | Gap-type seal |
| **20 x 5** | 0.10 | 0 |
| **30 x 5/10** | 0.15 | 0 |
| **39 x 5/10** | 0.25 | 0 |
| **48 x 5/10** | 0.35 | 0 |
| **60 x 10/20** | 0.50 | 0 |
| **75 x 10/20** | 0.70 | 0 |

The values given for dynamic drag torque are proven practical indicators for the nut preloading.

# Mounting

## Condition as delivered

Rexroth PLSAs are normally delivered with an initial supply of grease. Relubrication is possible, and cartridges and cans of this grease are available. If another lubricant is used, you will need to check that it is compatible with the initial supply.
For special cases, the PLSAs can also be supplied with only a preservative coating. This can be indicated by choosing the appropriate option number in the ordering code.

⚠ **Important**
The selected lubricant must be in the nut before the machine is started.

⚠ **Note**
In systems with gap-type seal (Option 4), the user must apply the stroke-dependent amount of grease in addition. (See section on Lubrication).

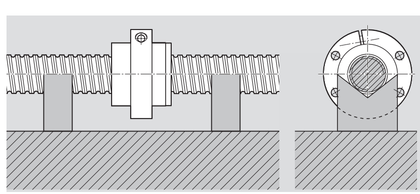
### Cleaning

Various cleaning agents can be used to degrease and wash the assembly:
- aqueous cleaning agents
- organic cleaning agents

⚠ **Important**
Immediately after cleaning, thoroughly dry all parts, then apply a preservative coating or anti-corrosion oil. In all cases, take care to observe the appropriate legal regulations (environmental protection, health and safety at work, etc.) as well as the specifications for the cleaning agent (e.g. handling).

## Storage

PLSAs are high-quality systems that must be treated with due care. In order to prevent damage and contamination, the elements should not be removed from the protective wrapping until immediately before installation. Once they have been removed from the packaging, they must be set down on V-shaped cradles.



## Installation in the machine

It is not normally necessary to remove the preservative coating before installation.
- If the PLSA 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 ($R_m \geq 370$ N/mm$^2$), see table.
- For the steel/aluminum and alumi-num/aluminum material pairings ($R_m \geq 280$ 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.

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

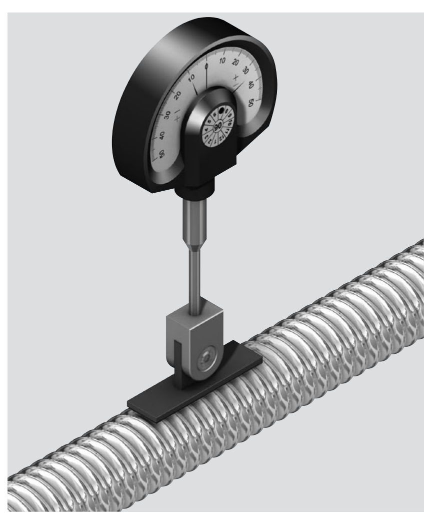
| Steel/aluminum and aluminum/aluminum material pairings<br>Screw diameter (mm) | Tightening torque (Nm)<br>Strength class per DIN ISO 898:<br>8.8 | 10.9 | 12.9 |
|---|---|---|---|
| **M3** | 1.2 | 1.2 | 1.2 |
| **M4** | 2.4 | 2.4 | 2.4 |
| **M5** | 4.8 | 4.8 | 4.8 |
| **M6** | 8.5 | 8.5 | 8.5 |
| **M8** | 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 |

| Steel/steel material pairing<br>Screw diameter (mm) | Tightening torque (Nm)<br>Strength class per DIN ISO 898:<br>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 |

## Alignment of the PLSA in the machine

Self-aligning contact pads for easy alignment of the PLSA are available from Rexroth. (pads fitting for standard gauge).
Two pads of different lengths are available, which can be used depending on the screw lead:

– Part number R3305 131 19: length 33 mm
– Part number R3305 131 21: length 50 mm

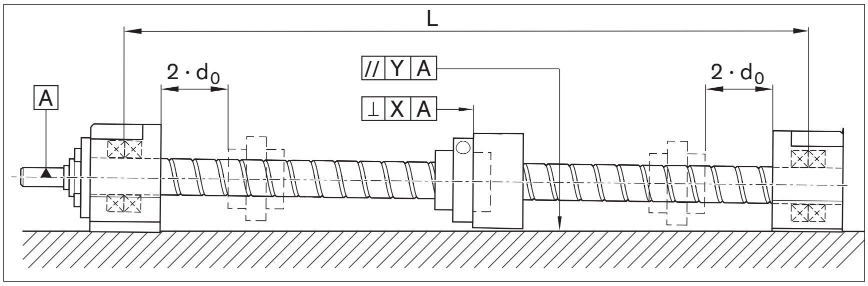


# Mounting

## Installation Tolerances

To ensure that a PLSA can actually achieve the calculated service life and performance, its system-related requirements and limitations must be taken into account at the design stage. Screw drives are not suitable for transferring radial forces and torques, such as may be caused by misalignments during installation. The following sections illustrate the most important principles for achieving designs that will be compatible with the screw drive system and its requirements.

When using PLSAs, the specified installation tolerances must be observed when designing and building the adjoining structures. The first basic principle is: The higher the PLSA's precision and preload, the more accurate the adjoining structures must be.
This applies in particular to applications in which the nut travels close up to the end bearings since, in this area, the risk of distortive stresses and therefore of additional loads is very high.




Parallelism offset and details of the rectangularity between the screw shaft axis and the location face of the nut housing.

L = distance between end bearings (mm)

$d_0$ = nominal diameter of screw (mm)

X = permissible deviation from rectangularity (mm)
The tolerance applies to a surface that must lie between two planes spaced at a distance X from each other, which are perpendicular to the reference axis A.

Y = Permissible parallelism offset between the guide and the screw axis (mm)

The table shows the main recommended tolerances for planetary screw assemblies as a function of the preload. These tolerances include the rectangularity of the nut housing (or adjoining structure) relative to the screw axis. The tolerances for parallelism between the guide and the screw axis must also be complied with. Any alignment errors can lead to premature breakdown of the planetary screw assembly!

| **Option Preload** | **X (mm)** | **Y (mm)** |
|---|---|---|
| Backlash | 0.02 | 0.02 |
| Preload | 0.01 | 0.01 |

End Bearings

# Design Notes, Mounting Instructions

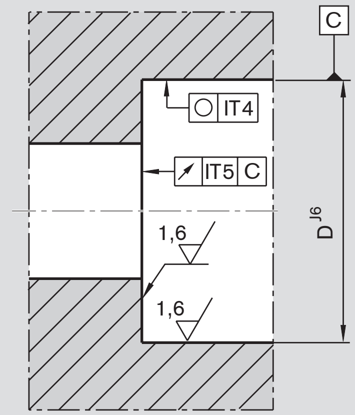
## Bearing design

For customer-machined screw ends, please consider the design notes given for screw ends and housings.

For Rexroth screw end designs, see "End Machining Details."

Rexroth delivers complete drive systems, including the end bearings. Calculations are performed with the formulas used in the antifriction bearing industry.

**Housing**

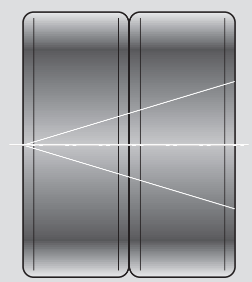



## Mounting

### Angular-contact thrust ball bearings and deep-groove ball bearings

When mounting the angular-contact thrust ball bearings LGF and LGN, ensure that the mounting forces are exerted only on the bearing rings. Never apply mounting forces via the anti-friction bearing elements or the seal rings! The two sections of the inner raceway may not be separated during assembly or disassembly for any reason! Tighten the mounting screws for screw-down or flange-mounted bearings in crosswise sequence. The mounting screws may be subjected only to tension amounting to a maximum of 70% of their yielding point. The screw-down (LGF) bearings have a groove on the cylindrical surface of the outer raceway for disassembly. The individual bearings of the bearing pair series LGF-C... and LGN-C... are marked on the cylindrical surfaces of the outer raceways (see Figure). The markings reveal the bearing sequence. The sealing rings should face outward after proper mounting.

**Outer raceway markings for paired bearings**



## Slotted nut NMA, NMZ

The bearings are preloaded by tight-ening the nuts.

In order to prevent settling phenomena, we recommend first tightening the slot-ted nut by twice the value of the tightening torque $M_A$ and then easing the load. Only then should the slotted nut be retightened to the specified tightening torque $M_A$. The two set screws are then alternately tightened using a hexagon socket wrench.

The components are disassembled in the reverse order, i.e. the set screws are to be removed before the slotted nut. The slotted nuts can be used several times when properly assembled and disassembled by competent personnel. The inner raceways of the bearings are dimensioned in such a way as to achieve a defined bearing preload sufficient for most applications when the slotted nut is tightened ($M_A$ in accordance with Dimension Table).

# Lubrication

⚠ **Do not use greases containing solid particles (e.g., graphite or $MoS_2$)!**

⚠ **If other lubricants are used, this may lead to a reduction in the relubrication intervals, the achievable travel in short-stroke applications, and the load ratings. Possible chemical interactions between the plastic materials, lubricants and preservative oils must also be taken into account.**

⚠ **If your application involves more demanding environmental requirements (such as clean room, vacuum, food industry environment, increased exposure to fluids or aggressive media, extreme temperatures), please consult us. These situations must be investigated on a case by case basis and may require the use of a special lubricant. Be sure to have all the information concerning your application at hand when contacting us.**

⚠ **For certain areas of use, e.g. food industry, clean room, vacuum applications, etc. or conditions such as extreme temperatures or exposure to processing media, the standard in-factory prelubrication and anticorrosive treatment may not be suitable or may not be compatible with the lubricant used for in-service lubrication. Please check suitability with us first!**

⚠ **Even under normal operating conditions, the system must be relubricated at the latest after 2 years due to aging of the grease. Please consider the reduction in load capacities as described in the technical notes.**

## Grease lubrication

Planetary Screw Assemblies (PLSAs) are designed for lubrication with NLGI class 2 greases. The advantage of grease lubrication is that the PLSA can run long distances on one supply of grease.

### Grease lubricant

We recommend using Dynalub 510 with the following properties:
- High performance lithium soap grease, consistency class NLGI 2 as per DIN 51818 (KP2K-20 per DIN 51825)
- Good water resistance
- Corrosion protection

Under conventional environmental conditions this ground-fiber, homogeneous grease is ideally suited for the lubrication of linear elements.
- At loads of up to 50% C
- For short-stroke applications $>$ 1 mm
- For the permissible speed range of Planetary Screw Assemblies

The product and safety data sheets can be found on our website at www.boschrexroth.de/brl.

Part numbers for Dynalub 510:
- R3416 037 00 (cartridge 400 g)
- R3416 035 00 (hobbock 25 kg)

## Initial lubrication of the PLSA
(basic lubrication)

Completely assembled PLSAs are prelubricated before shipment with Dynalub 510. In versions without prelubrication, the lubrication quantities according to Table 1 or Table 2 must be injected into the nut unit via the lube hole. Please follow the described procedure. For versions with gap-type seal, the stroke-dependent grease quantity according to Table 1 must be applied in addition.

## Relubrication of the PLSA

**Stroke > nut length L:**
When the relubrication interval according to Table 1 or 2 has been reached, add the relubrication quantity according to Table 1 for the gap-type seal, or Table 2 for the lip-type seal.

**Stroke < nut length L:**
Perform a lubricating stroke at regular intervals (if possible)! Reduce the relubrication intervals stated in Table 1 or 2 by at least factor 3. The relubrication quantity can be halved (1/2 relubrication quantity). Please follow the described procedure.

**Gap-type seal**

| $d_0$ x P | Relubrication interval (in million revolutions) | | Lubricant quantity ($cm^3$) | |
|---|---|---|---|---|
| | FEM / ZEM | FDM | Initial lubrication | Relubrication |
| **20 x 5** | 4 | 8 | 10 + $L_s$ / 115 | 5 + $L_s$ / 115 |
| **30 x 5/10** | 4 | 8 | 20 + $L_s$ / 75 | 10 + $L_s$ / 75 |
| **39 x 5/10** | 4 | 8 | 35 + $L_s$ / 60 | 17,5 + $L_s$ / 60 |
| **48 x 5/10** | 4 | 8 | 50 + $L_s$ / 50 | 25 + $L_s$ / 50 |
| **60 x 10/20** | 2 | 4 | 150 + $L_s$ / 40 | 75 + $L_s$ / 40 |
| **75 x 10/20** | 2 | - | 250 + $L_s$ / 30 | 125 + $L_s$ / 30 |

Table 1

$L_s$ = stroke length (mm)
The nut unit has been prelubricated before shipment. The stroke-dependent grease quantity must be added before putting the screw assembly into service.
Apply the grease via the nut unit in several partial quantities. The nut unit must be traversed across the entire stroke during this process.
Conditions::
- Load $F_m \leq 0{,}3$ x C
- Temperature ≤ 60° C
- Relubrication interval applies as long as the lubricant is not spun off by the screw or removed.

**Lip-type seal**

| $d_0$ x P | Relubrication interval (in million revolutions) | | Lubricant quantity ($cm^3$) | |
|---|---|---|---|---|
| | FEM / ZEM | FDM | Initial lubrication | Relubrication |
| **20 x 5** | 1 | 3 | 10 | 5.0 |
| **30 x 5/10** | 1 | 3 | 20 | 10.0 |
| **39 x 5/10** | 1 | 3 | 35 | 17.5 |
| **48 x 5/10** | 1 | 3 | 50 | 25.0 |
| **60 x 10/20** | 0.5 | 1.5 | 150 | 75.0 |
| **75 x 10/20** | 0.5 | - | 250 | 125.0 |

Table 2

Apply the grease via the nut unit in several partial quantities. The nut unit must be traversed by at least its own length during this process.
Conditions:
- Load $F_m \leq 0{,}3$ x C
- Temperature ≤ 60° C

# Lubrication

## Oil lubrication

**Oil lubricant**
We recommend using Shell Tonna S 220 with the following properties:
- Special demulsifying oil CLP or CGLP as per DIN 51517-3 for machine bed tracks and tool guides
- A blend of highly refined mineral oils and additives
- Can be used even when mixed with significant quantities of metalworking fluids

We recommend using piston distributors from SKF. These should be installed as close as possible to the lube ports of the nut units. Long lines and small line diameters should be avoided, and the lines should be laid on an upward slant.

**Initial lubrication of the PLSA**
(Basic lubrication)
Completely assembled PLSAs are prelubricated before shipment with Dynalub 510. In versions without prelubrication, the initial lubrication quantities according to Table 3 must be applied to the nut unit via the lube hole.
Please follow the described procedure. When using single-line distributor systems, care should be taken that all lines and the piston distributors (including the connection to the nut unit) are filled before performing basic lubrication or relubrication.

**Position specification**
Lube hole: The connection should be at the top wherever possible (horizontal mounting orientation).

**Relubrication of the PLSA**
Apply the relubrication quantity according to Table 3 to the lube port when the specified relubrication interval has been reached.
The pulse count can be calculated as the quotient (rounded to the next whole figure) of the relubrication quantity and the piston distributor size.
The lubricant cycle time can then be obtained by dividing the relubrication interval by the calculated pulse count.

**Gap-type seal / Lip-type seal**

| $d_0$ x P | Relubrication interval (in revolutions) | | Lubricant quantity ($cm^3$) | |
|---|---|---|---|---|
| | FEM / ZEM | FDM | Initial lubrication | Relubrication |
| **20 x 5** | 250 000 | 500 000 | 2.7 | 1.4 |
| **30 x 5/10** | 250 000 | 500 000 | 3.5 | 1.8 |
| **39 x 5/10** | 250 000 | 500 000 | 12.0 | 6.0 |
| **48 x 5/10** | 250 000 | 500 000 | 20.0 | 10.0 |
| **60 x 10/20** | 125 000 | 250 000 | 50.0 | 25.0 |
| **75 x 10/20** | 125 000 | 250 000 | 80.0 | 40.0 |

Table 3

Apply the oil quantity through the nut unit. The nut unit must be traversed during this process.
Conditions:
- Load $F_m \leq 0{,}3 \times C$
- Temperature ≤ 60° C
- Relubrication interval applies as long as the lubricant is not spun off by the screw or removed.
- For gap-type seals, horizontal mounting only.

# Design Calculations

**Upon request, we can perform all calculations to your specifications.**

See “Design Calculation Service Form”, page 58

## Average speed and average load

Where the speed and load fluctuate, the service life must be calculated using the averages $\mathbf{F_m}$ and $\mathbf{n_m}$.

– where the speed fluctuates, the average speed $\mathbf{n_m}$ is calculated as follows:

$$n_m = \frac{|n_1| \cdot q_{t1} + |n_2| \cdot q_{t2} + \ldots + |n_n| \cdot q_{tn}}{100\%} \quad (1)$$

| | | | |
|---|---|---|---|
| $n_1, n_2, \ldots n_n$ | = | speeds in phases 1 … n | $(\text{min}^{-1})$ |
| $n_m$ | = | average speed | $(\text{min}^{-1})$ |
| $q_{t1}, q_{t2}, \ldots q_{tn}$ | = | discrete time step in phases 1 … n | (%) |

The following applies for the effective equivalent bearing load:

| $d_0$ x P | $F_{pr}$ (N) |
|---|---|
| 20 x 5 | 1180 |
| 30 x 5 | 1840 |
| 30 x 10 | 1470 |
| 39 x 5 | 2290 |
| 39 x 10 | 1960 |
| 48 x 5 | 2700 |
| 48 x 10 | 2410 |
| 60 x 10 | 2910 |
| 60 x 20 | 2320 |
| 75 x 10 | 3800 |
| 75 x 20 | 3000 |

$$F > 2{,}8 \cdot F_{pr} \qquad F_{eff\,n} = |F_n|$$

$$F \leq 2{,}8 \cdot F_{pr} \qquad F_{eff\,n} = \left(\frac{|F_n|}{2{,}8 \cdot F_{pr}} + 1\right)^{\frac{3}{2}} \cdot F_{pr}$$

| | | | |
|---|---|---|---|
| $F_{eff\,n}$ | = | effective equivalent axial load during phase n | (N) |
| $F_n$ | = | axial load during phase n | (N) |
| $F_{pr}$ | = | internal axial load on the nut unit due to the preload | (N) |

– where the load fluctuates and the speed is constant, the average load $\mathbf{F_m}$ is calculated as follows:

$$F_m = \sqrt[3]{|F_{eff\,1}|^3 \cdot \frac{q_{t1}}{100\%} + |F_{eff\,2}|^3 \cdot \frac{q_{t2}}{100\%} + \ldots + |F_{eff\,n}|^3 \cdot \frac{q_{tn}}{100\%}} \quad (2)$$

| | | | |
|---|---|---|---|
| $F_{eff\,1}, F_{eff\,2}, \ldots F_{eff\,n}$ | = | effective equivalent axial load during phases 1 … n | (N) |
| $F_m$ | = | equivalent dynamic axial load | (N) |
| $q_{t1}, q_{t2}, \ldots q_{tn}$ | = | discrete time step for $F_{eff\,1}, \ldots F_{eff\,n}$ | (%) |

– where both the load and the speed fluctuate, the average load $\mathbf{F_m}$ is calculated as follows:

$$F_m = \sqrt[3]{|F_{eff\,1}|^3 \cdot \frac{|n_1|}{n_m} \cdot \frac{q_{t1}}{100\%} + |F_{eff\,2}|^3 \cdot \frac{|n_2|}{n_m} \cdot \frac{q_{t2}}{100\%} + \ldots + |F_{eff\,n}|^3 \cdot \frac{|n_n|}{n_m} \cdot \frac{q_{tn}}{100\%}} \quad (3)$$

| | | | |
|---|---|---|---|
| $F_{eff\,1}, F_{eff\,2}, \ldots F_{eff\,n}$ | = | effective equivalent axial load during phases 1 … n | (N) |
| $F_m$ | = | equivalent dynamic axial load | (N) |
| $n_1, n_2, \ldots n_n$ | = | speeds during phases 1 … n | $(\text{min}^{-1})$ |
| $n_m$ | = | average speed | $(\text{min}^{-1})$ |
| $q_{t1}, q_{t2}, \ldots q_{tn}$ | = | discrete time step for $F_{eff\,1}, \ldots F_{eff\,n}$ | (%) |

## Nominal life

**Service life in revolutions L**

$$L = \left[\frac{C}{F_m}\right]^3 \cdot 10^6 \quad (4) \Rightarrow C = F_m \cdot \sqrt[3]{\frac{L}{10^6}} \quad (5) \Rightarrow F_m = \frac{C}{\sqrt[3]{\frac{L}{10^6}}} \quad (6)$$

| | | | |
|---|---|---|---|
| $C$ | = | dynamic load rating | (N) |
| $F_m$ | = | equivalent dynamic axial load | (N) |
| $L$ | = | service life in revolutions | (–) |

**Service life in hours $L_h$**

$$L_h = \frac{L}{n_m \cdot 60} \quad (7)$$

| | | | |
|---|---|---|---|
| $L_h$ | = | service life | (h) |
| $L$ | = | service life in revolutions | (–) |
| $n_m$ | = | average speed | ($min^{-1}$) |

$$L_{h\ machine} = L_h \cdot \frac{DC_{machine}}{DC_{PLSA}} \quad (8)$$

| | | | |
|---|---|---|---|
| $DC_{machine}$ | = | duty cycle of the machine | (%) |
| $DC_{PLSA}$ | = | duty cycle of the PLSA | (%) |
| $L_{h\ machine}$ | = | nominal service life of the machine | (h) |
| $L_h$ | = | nominal service life of the PLSA | (h) |

## Drive torque and drive power

**Drive torque $M_{ta}$**
for conversion of rotary motion into linear motion:

$$M_{ta} = \frac{F_L \cdot P}{2000 \cdot \pi \cdot \eta} \quad (9)$$

$$M_{ta} \leq M_p$$

| | | | |
|---|---|---|---|
| $F_L$ | = | thrust force | (N) |
| $M_p$ | = | maximum permissible drive torque | (Nm) |
| $M_{ta}$ | = | drive torque | (Nm) |
| $P$ | = | lead | (mm) |
| $\eta$ | = | mech. efficiency (approx. 0.8) | (–) |

**Transmitted torque $M_{te}$**
for conversion of linear motion into rotary motion:

$$M_{te} = \frac{F_L \cdot P \cdot \eta'}{2000 \cdot \pi} \quad (10)$$

$$M_{te} \leq M_p$$

| | | | |
|---|---|---|---|
| $F_L$ | = | thrust force | (N) |
| $M_p$ | = | maximum permissible drive torque | (Nm) |
| $M_{te}$ | = | transmitted torque | (Nm) |
| $P$ | = | lead | (mm) |
| $\eta'$ | = | mech. efficiency ($\eta'$ approx. 0.7) | (–) |

The dynamic drag torque must be taken into account for preloaded nuts.

**Drive power $P_a$**

$$P_a = \frac{M_{ta} \cdot n}{9550} \quad (11)$$

| | | | |
|---|---|---|---|
| $M_{ta}$ | = | drive torque | (Nm) |
| $n$ | = | speed | ($min^{-1}$) |
| $P_a$ | = | drive power | (kW) |

# Design Calculations

## Calculation example Service life

Proposed PLSA: 30 x 5, tolerance grade T5

### Operating conditions

The service life of the machine should be 40,000 operating hours with the PLSA operating 60% of the time.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $F_1$ | = | 50 000 N | at | $n_1$ | = | 10 min$^{-1}$ | for | $q_1$ | = | 6% | of the duty cycle |
| $F_2$ | = | 25 000 N | at | $n_2$ | = | 30 min$^{-1}$ | for | $q_2$ | = | 22% | of the duty cycle |
| $F_3$ | = | 8 000 N | at | $n_3$ | = | 100 min$^{-1}$ | for | $q_3$ | = | 47% | of the duty cycle |
| $F_4$ | = | 2 000 N | at | $n_4$ | = | 1 000 min$^{-1}$ | for | $q_4$ | = | 25% | of the duty cycle |
| | | | | | | | | | | 100% | |

### Calculation procedure

Average speed $\mathbf{n_m}$

$$n_m = \frac{6}{100} \cdot |10| + \frac{22}{100} \cdot |30| + \frac{47}{100} \cdot |100| + \frac{25}{100} \cdot |1000| \quad (1)$$

$$n_m = 304 \text{ min}^{-1}$$

Average load $\mathbf{F_m}$ for variable load and variable speed

$$F_m = \sqrt[3]{\left|50000\right|^3 \cdot \frac{|10|}{304} \cdot \frac{6}{100} + \left|25000\right|^3 \cdot \frac{|30|}{304} \cdot \frac{22}{100} + \left|8000\right|^3 \cdot \frac{|100|}{304} \cdot \frac{47}{100} + \left|2000\right|^3 \cdot \frac{|1000|}{304} \cdot \frac{25}{100}} \quad (3)$$

$$F_m = 8757 \text{ N}$$

Required service life **L** (revolutions)
The service life **L** can be calculated by transposing the formulas (7) and (8):

$$L = L_h \cdot n_m \cdot 60$$

$$L_h = L_{h\ machine} \cdot \frac{DC_{PLSA}}{DC_{machine}}$$

$$L_h = 40000 \cdot \frac{60}{100} = 24000 \text{ h}$$

$$L = 24000 \cdot 304 \cdot 60$$

$$L = 437\ 760\ 000 \text{ revolutions}$$

Basic dynamic load rating **C**

$$C = 8757 \cdot \sqrt[3]{\frac{437\ 760\ 000}{10^6}} \quad (5) \qquad C \approx 66492 \text{ N}$$

**Result and selection**

The PLSA can now be selected from the Dimension Tables:

e.g. PLSA, size 30 x 5 R, with flanged single nut FEM-E-S, and screw in tolerance grade T5

Dynamic load rating C = 87 KN.

Note:

Take into account the dynamic load rating of the screw end bearing used! Consider the correction factor for the tolerance grade!

**Cross check**

Service life of the selected PLSA in revolutions

$$L = \left(\frac{87\,000}{8757}\right)^3 \cdot 10^6 \quad (4)$$

$L \approx 981 \cdot 10^6$ revolutions

Service life in hours $L_h$

$$L_h = \frac{981 \cdot 10^6}{304 \cdot 60} \quad (7)$$

$L_h \approx 57\,761$ hours

The life of the selected PLSA assembly is thus greater than the required service life of 24,000 hours (including operating hours).

Design Calculations

## Critical speed $n_{cr}$

The critical speed $n_{cr}$ depends on the diameter of the screw, the type of end fixity and the free length $l_{cr}$.

No allowance must be made for guidance by a nut without preload. The operating speed should not reach more than 80% of the critical speed.

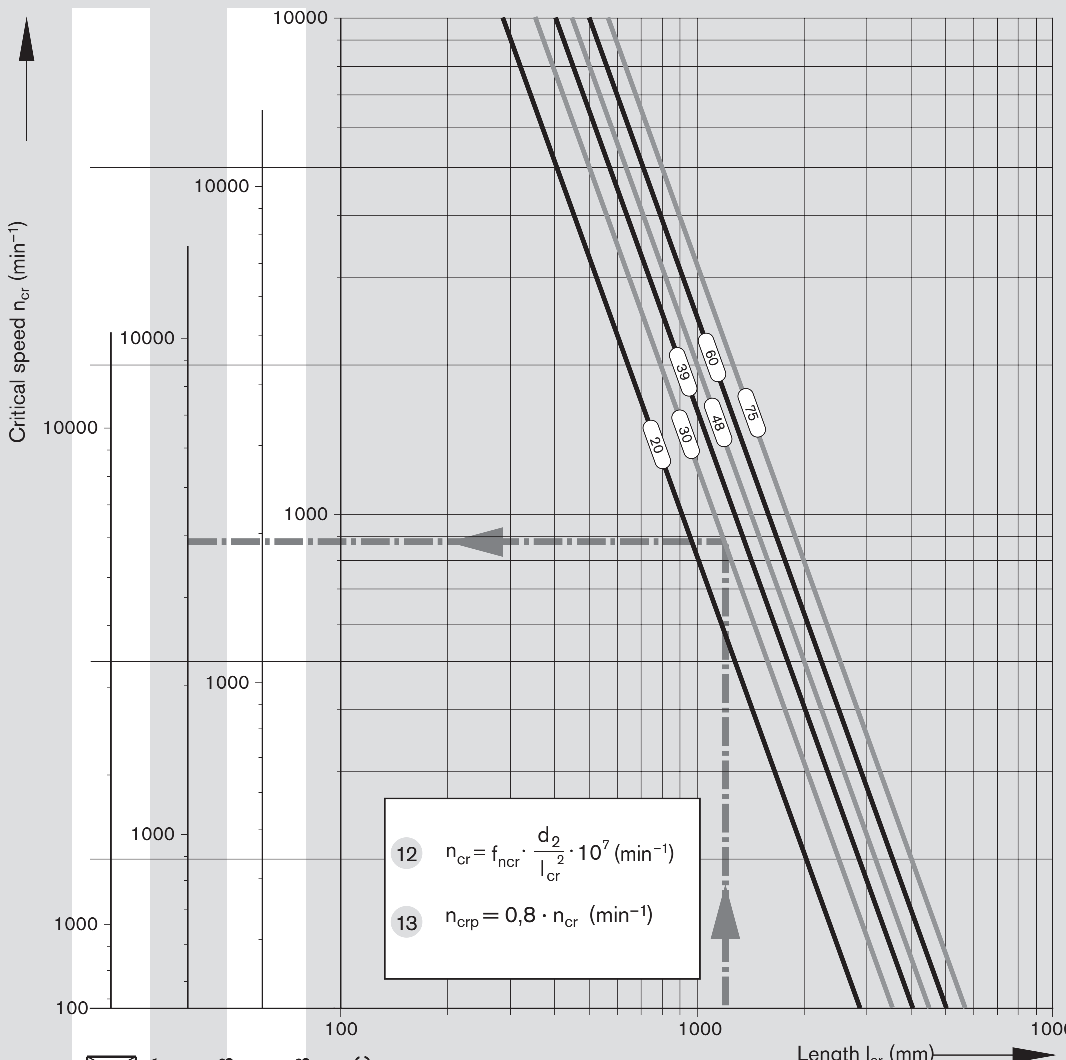
The characteristic speed and the max. permissible linear speed must be taken into account, see "Technical Notes".

**Example**

Screw diameter = 63 mm
Length $l_{cr}$ = 1200 mm
End fixity II (fixed bearing - floating bearing)

According to the graph, the critical speed is 3900 $min^{-1}$.
The permissible operating speed is thus 3900 $min^{-1}$ x 0.8 = 3120 $min^{-1}$.

The maximum operating speed in our calculation example of $n_4$ = 1000 $min^{-1}$ is therefore below the permissible operating speed.

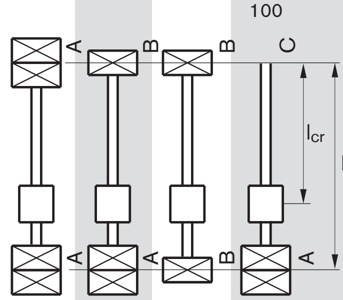



(12) $$n_{cr} = f_{ncr} \cdot \frac{d_2}{l_{cr}^2} \cdot 10^7 \ (min^{-1})$$

(13) $$n_{crp} = 0,8 \cdot n_{cr} \ (min^{-1})$$

**End fixity:**

A = fixed bearing
B = floating bearing
C = without bearing




| End fixity | I | II | III | IV |
|---|---|---|---|---|
| $f_{ncr}$ - value | 27.4 | 18.9 | 12.1 | 4.3 |

| | | | |
|---|---|---|---|
| $n_{cr}$ | = | critical speed | ($min^{-1}$) |
| $n_{crp}$ | = | permissible operating speed | ($min^{-1}$) |
| $f_{ncr}$ | = | corrector value determined by bearing | |
| $d_2$ | = | root diameter (see Dimension Tables) | (mm) |
| $l_{cr}$ | = | critical length for preloaded nut systems | (mm) |
| $l_s$ | = | distance between bearing and bearing | (mm) |

For non-preloaded nut systems $l_{cr} = l_s$
For screw ends form 312 the end fixity can be assumed to be "fixed".

## Permissible axial load on screw $F_c$ (buckling load)

The permissible axial load on the screw $F_c$ depends on the diameter of the screw, the type of end fixity and the effective free (unsupported) length $l_c$. A safety factor of $s \geq 2$ should be taken into consideration when determining the permissible axial load.

**Example**

Screw diameter = 30 mm,
Length $l_c$ = 1200 mm
End fixity IV (fixed bearing - floating bearing)

According to the graph, the theoretically permissible axial load is 115 kN.
A permissible axial load on the screw of 115 kN / : 2 = 57.5 kN is achieved when applying the safety factor 2.

This therefore lies above the maximum operating load of $F_1$ = 50 kN used in our calculation example.
For more information on buckling, see next page.

(14) $$F_c = f_{Fc} \cdot \frac{d_2^4}{l_c^2} \cdot 10^4 \text{ (N)}$$

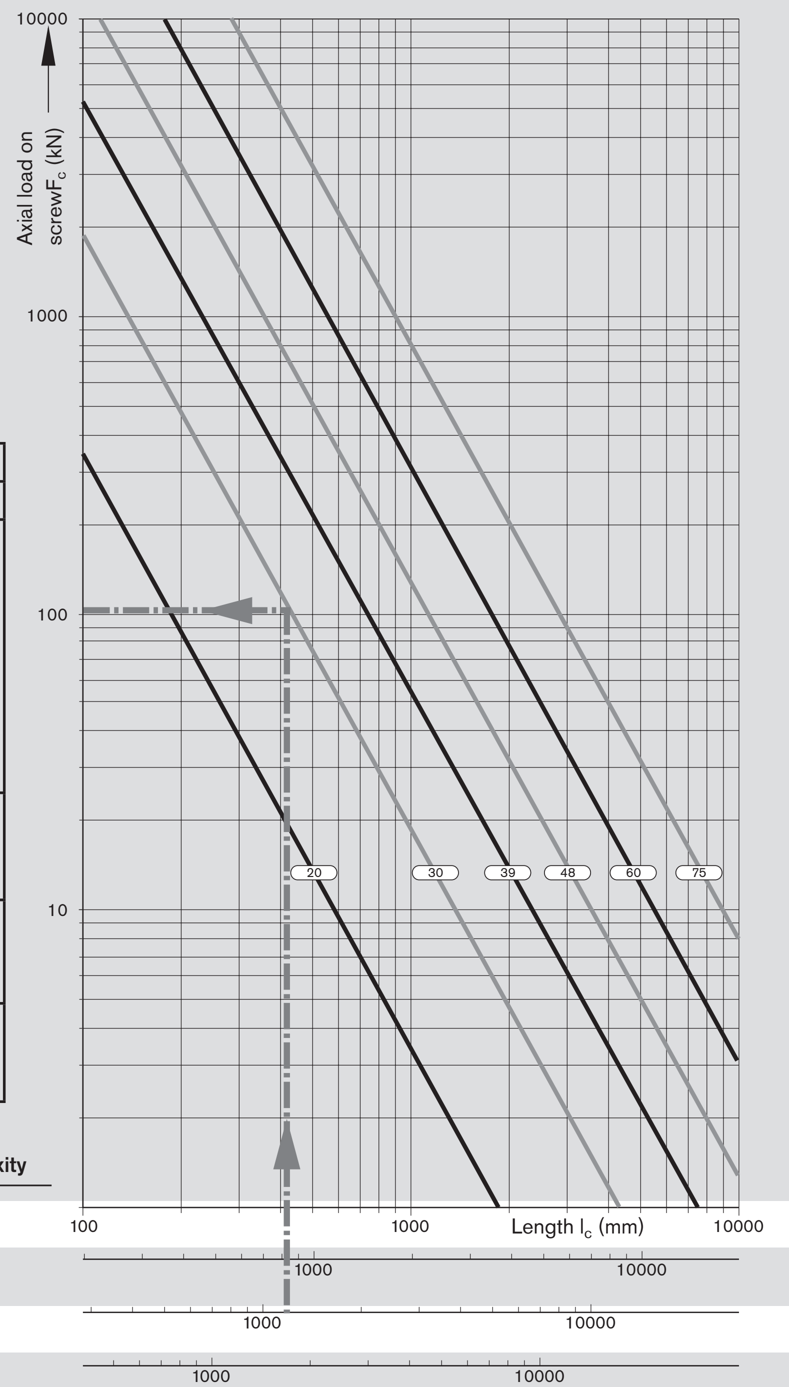
(15) $$F_{cp} = \frac{F_c}{2} \text{ (N)}$$

$F_c$ = theoretically permissible axial load on screw
$F_{cp}$ = permissible axial load during operation
$f_{Fc}$ = corrector value determined by bearing
$d_2$ = root diameter (mm), see Dimension Tables
$l_c$ = unsupported threaded length (mm)

| End fixity | $f_{Fc}$- value | |
|---|---|---|
| | nut fixed | nut lose |
| A – A, A – B, A – C | End fixity I 40,6 | End fixity IV 20,4 |
| B – B | End fixity II / IV 20,4 | End fixity V 10,2 |
| A – C | End fixity III / VI 2,6 | |
| A – C | | End fixity VI 2,6 |

**End fixity:**
A = fixed bearing
B = floating bearing
C = without bearing

| $f_{Fc}$- value | End fixity |
|---|---|
| 2.6 | III / VI |
| 10.2 | V |
| 20.4 | II / IV |
| 40.6 | I |



End Bearings

# Notes on buckling

The effective buckling length lc of the screw is the maximum unsupported screw length in the direction of the force's flow between the nut unit and the fixed bearing (center-to-center distance) or between the nut unit and the screw end.

For buckling load calculations the nut unit is taken into consideration as a bearing.

For "nut unit fixed," the following conditions must be met:
- zero-backlash nut unit,
- rigid attachment of the nut to the linear guide,
- the nut unit is not subjected to moment loads, i.e. a linear guide absorbs any arising moments,
- no distortive stresses due to external factors (e.g. temperature).

In linear motion systems from Bosch Rexroth the nut unit can be considered to be a fixed bearing.
If one or more of the conditions for "nut unit fixed" are not met, the appropriate coefficient for "nut unit floating" must be used instead.
**Case III** occurs in applications with driven nuts, for example, when the nut is stationary and the screw rotates. The nut unit can then be considered as a fixed bearing.
**Case VI** arises only when the nut unit is not supported by any linear guide.

# Design Calculations

## Resulting and equivalent bearing loads

**For angular-contact thrust ball bearings LGN and LFG**
Angular-contact thrust ball bearings are preloaded. The chart shows the resulting axial bearing load $F_{ax}$ as a function of preload and axial operating load $F_{Lax}$.
For a purely axial load $F_{comb} = F_{ax}$.

| $\alpha = 60°$ | X | Y |
|---|---|---|
| $\frac{F_{ax}}{F_{rad}} \leq 2.17$ | 1.90 | 0.55 |
| $\frac{F_{ax}}{F_{rad}} > 2.17$ | 0.92 | 1.00 |

$\alpha$ = pressure angle
$F_{ax}$ = resulting bearing load
$F_{Lax}$ = operating load
X, Y = dimensionless factor

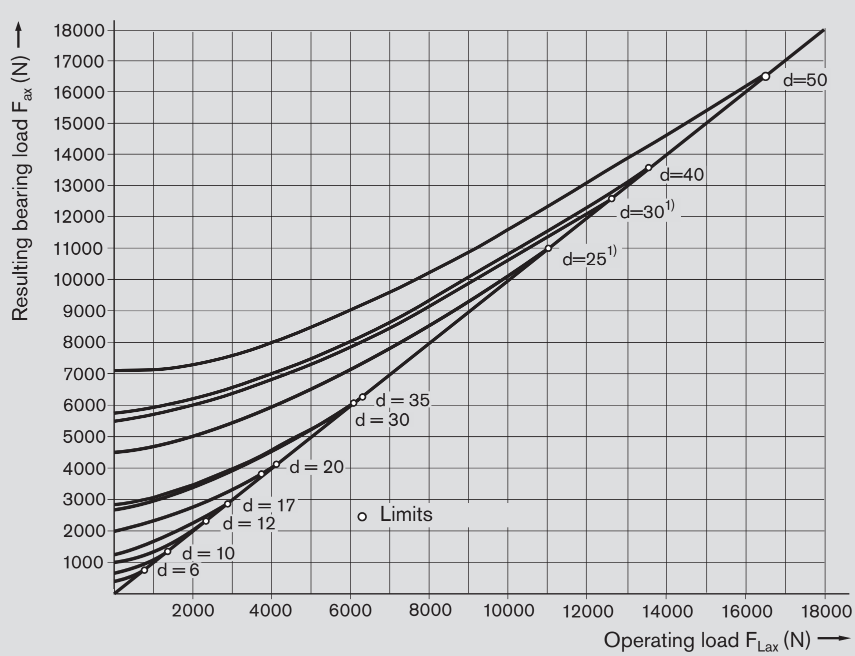
If the radial operating forces are not insignificant, the equivalent bearing loads are calculated according to formula 20.

Bearings for PLSAs are also able to accommodate tilting moments. As a rule, the moments that usually occur due to the weight and drive motion of the screw do not need to be incorporated in the calculation of the equivalent bearing load.

$$F_{comb} = X \cdot F_{rad} + Y \cdot F_{ax} \quad (20)$$

$F_{ax}$ = resulting axial bearing load (N)
$F_{comb}$ = combined equivalent bearing load (N)
$F_{rad}$ = radial bearing load (N)

**Internal preload limit and resulting bearing load**




[1] Four row version

## Permissible static axial load for bearing series LGF

The permissible static axial load of LGF-series bearings in screw-down direction is:

$$F_{0ax\,p} \leq \frac{C_0}{2}$$

$F_{0ax\,p}$ = permissible static axial bearing load (N)

The static axial load rating $C_0$ is stated in the Dimension Tables.

### Average speed and average bearing load

When the bearing load varies in steps over a specific period of time, calculate the dynamic equivalent bearing load using formula 22.
When the speed varies, use formula 23.
In these formulas $\mathbf{q_t}$ denotes the discrete time steps for the individual phases in %.

$$F_m = \sqrt[3]{F_{comb1}^{3} \cdot \frac{|n_1|}{n_m} \cdot \frac{q_{t1}}{100} + F_{comb2}^{3} \cdot \frac{|n_2|}{n_m} \cdot \frac{q_{t2}}{100} + \ldots + F_{combn}^{3} \cdot \frac{|n_n|}{n_m} \cdot \frac{q_{tn}}{100}} \quad (22)$$

$$n_m = \frac{q_{t1}}{100} \cdot |n_1| + \frac{q_{t2}}{100} \cdot |n_2| + \ldots + \frac{q_{tn}}{100} \cdot |n_n| \quad (23)$$

| | | | |
|---|---|---|---|
| $F_{comb1} \ldots F_{combn}$ | = | combined equivalent axial load in phases 1 … n | (N) |
| $F_m$ | = | dynamic equivalent bearing load | (N) |
| $n_1 \ldots n_n$ | = | speeds in phases 1 … n | ($min^{-1}$) |
| $n_m$ | = | average speed | ($min^{-1}$) |
| $q_{t1} \ldots q_{tn}$ | = | discrete time steps in phases 1 … n | (%) |

### Service life and load safety factor

**Nominal life**

The nominal life is calculated as follows:

**Note:**
Take into account the dynamic load rating of the nut!

$$L = \left(\frac{C}{F_{comb}}\right)^3 \cdot 10^6 \quad (24)$$

$$L_h = \frac{16666}{n_m}\left(\frac{C}{F_{comb}}\right)^3 \quad (25)$$

| | | | |
|---|---|---|---|
| $C$ | = | dynamic bearing load rating | (N) |
| $F_{comb}$ | = | combined equivalent bearing load | (N) |
| $L$ | = | nominal service life in revolutions | (–) |
| $L_h$ | = | nominal service life in operating hours | (h) |
| $n_m$ | = | average speed | ($min^{-1}$) |

### Static load safety factor

The static load safety factor for machine tools should not be lower than 4.

$$S_0 = \frac{C_0}{F_{0max}} \quad (26)$$

| | | | |
|---|---|---|---|
| $F_{0max}$ | = | maximum static load | (N) |
| $C_0$ | = | static load rating | (N) |
| $S_0$ | = | static load safety factor | (–) |

Design Calculation Service Form

Bosch Rexroth AG
Linear Motion and
Assembly Technologies
97419 Schweinfurt / Germany

**Find your local contact person here:**
www.boschrexroth.com/addresses

Application: New design ☐ Revised design ☐

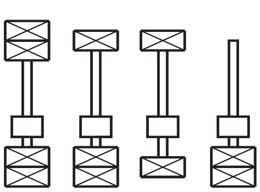
## Operating conditions

| **Loads (N)** | **Speeds (1/min)** | **Discrete time steps (%)** |
|---|---|---|
| $F_1 =$ | at $n_1 =$ | for $q_1 =$ |
| $F_2 =$ | at $n_2 =$ | for $q_2 =$ |
| $F_3 =$ | at $n_3 =$ | for $q_3 =$ |
| $F_4 =$ | at $n_4 =$ | for $q_4 =$ |
| $F_5 =$ | at $n_5 =$ | for $q_5 =$ |
| $F_6 =$ | at $n_6 =$ | for $q_6 =$ |
| Average load (see page 57) | Average speed (see page 57) | Sum of time steps |
| $F_m =$ | $n_m =$ | Q = 100% |
| Maximum static load: | N | |
| Required service life | Operating hours or | x $10^6$ PLSA revolutions |

Screw end fixity: horizontal ☐ vertical ☐

**Screw end fixity**

A B B C



A A B A

Ⓘ Ⓘ Ⓘ Ⓘ (see pages 54/55)

**Selected:**

Installation conditions (enclose drawings/sketches if possible!)

Drawing enclosed ☐

A = fixed bearing
B = floating bearing
C = without bearing

Type of lubrication:
Operating temperature: °C - min/max. / °C
Exceptional operating conditions:

**Sender**
OEM ☐ User ☐ Distributor ☐
Company
Address

Name
Department
Telephone
Fax
e-mail

Bosch Rexroth AG
Linear Motion and
Assembly Technologies
97419 Schweinfurt / Germany

**Find your local contact person here:**
www.boschrexroth.com/addresse

**Inquiry/Order Form**

For elucidations, see page 8/9.
Note: The processing of Inquiries/Orders based on customer drawings is also possible of course.

**Example of an order**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PLSA | FEM-E-S | 20 x 5R | 1 | 2 | T7 | R | 812Z120 | 412Z120 | 1250 | 1 | 1 |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PLSA | | x | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PLSA | | x | | | | | | | | | |

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| PLSA | | x | | | | | | | | | |

Comments:

**Sender**

OEM ☐ User ☐ Distributor ☐

Company

Address

Name

Department

Telephone

Fax

e-mail

The Drive & Control Company

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R310EN 3308 (2014-01)
Replaces: R310EN 3308 (2013-03)