# SNR Linear Motion : Ball screws

Industry

# SNR – A global manufacturer of bearings.


For almost a century, SNR has designed, developed and manufactured bearings to meet the most demanding of applications. In April 2008, SNR and the Japanese Group NTN joined forces.

As one the 3 largest companies in the manufacture of bearings, our group offers its customers added value in terms of service, quality and products.

The NTN-SNR Group is distinguished by its global presence and by its company-wide quality assurance system.

We have been active in linear ball rail systems since 1985 and our complete range, based on innovative, high-quality products, has developed significantly.

Today, we can offer a solution for a vast range of applications that need linear motion systems.

This catalogue aims to help you discover our new standard range of ball screw products in rolled and ground versions.

The large range of nuts, options for custom machining and our extensive technical knowledge enable us to design and propose custom-made solutions for our customers.

Ball rail systems find applications in a diverse range of industries such as machine tools for metal, wood, plastic, specialist machinery, aeronautics, automated assembly lines and semi-conductor industries.

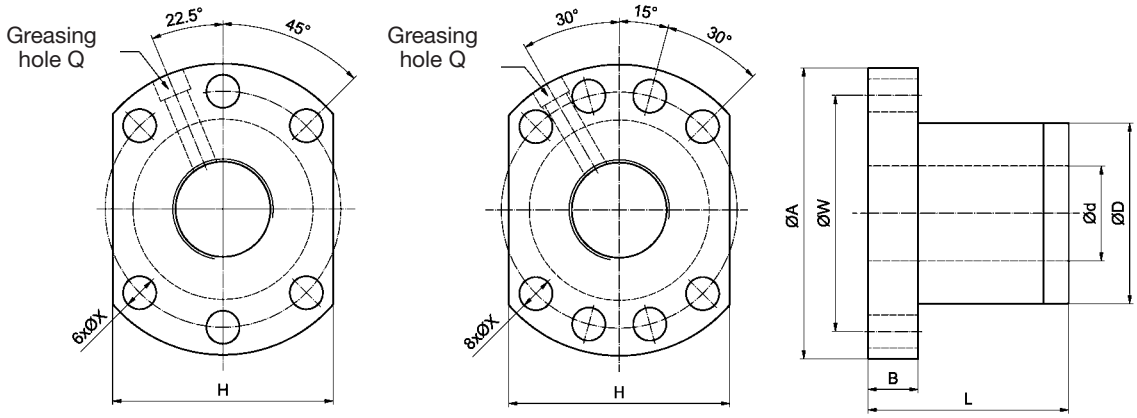
Our technical department draws on many years of experience in all these areas and is available to help you develop solutions suited to your needs.

With that in mind, this technical documentation was designed as a basis for dialogue. Our technical and sales engineers will provide you with any technical information you may require.

*SNR cannot be held responsible for consequences arising from any errors or omissions that may be contained in this documentation, although every care has been taken in its preparation. As part of our programme of continuous research and development, we reserve the right to make comprehensive or partial modifications to products and data appearing in this technical catalogue without prior notice.*

# Standard programme
# Ball nut

**Type SC** single compact flange nut to DIN 69051, for rolled screws




up to 03232 — Form B

from size 04005 — Form B

| Size | Thread | Dimensions [mm] | | | | | | | | | | | | Num-ber* | Load rating [kN] | | Stiffness K [N/µm] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | d | p | Ball-ø | D g6 | A | B | L | W | H | | X | Q | | dyn. $C_a$ | stat. $C_{a0}$ | |
| **01205-2,8** | R | 12 | 5 | 2,500 | 24 | 40 | 10 | 31 | 32 | 30 | ±0,10 | 4,5 | | 2,8x1 | 6,49 | 12,90 | 186 |
| **01605-3,8** | R | 15 | 5 | 2,778 | 28 | 48 | 10 | 38 | 38 | 40 | ±0,15 | 5,5 | M6x1P | 3,8x1 | 10,90 | 24,59 | 294 |
| **01610-2,8** | R | | 10 | 2,778 | 28 | 48 | 10 | 47 | 38 | 40 | ±0,15 | 5,5 | M6x1P | 2,8x1 | 8,23 | 17,86 | 226 |
| **01616-1,8** | R | | 16 | 2,778 | 28 | 48 | 10 | 45 | 38 | 40 | ±0,15 | 5,5 | M6x1P | 1,8x1 | 5,42 | 11,15 | 137 |
| **01616-2,8** | R | | 16 | 2,778 | 28 | 48 | 10 | 61 | 38 | 40 | ±0,15 | 5,5 | M6x1P | 2,8x1 | 7,92 | 17,34 | 216 |
| 01620-1,8 | R | | 20 | 2,778 | 28 | 48 | 10 | 57 | 38 | 40 | ±0,15 | 5,5 | M6x1P | 1,8x1 | 5,43 | 11,47 | 137 |
| **02005-3,8** | R | 20 | 5 | 3,175 | 36 | 58 | 10 | 40 | 47 | 44 | ±0,15 | 6,6 | M6x1P | 3,8x1 | 15,55 | 36,10 | 363 |
| **02010-3,8** | R | | 10 | 3,175 | 36 | 58 | 10 | 60 | 47 | 44 | ±0,15 | 6,6 | M6x1P | 3,8x1 | 14,87 | 37,59 | 392 |
| **02020-1,8** | R | | 20 | 3,175 | 36 | 58 | 10 | 57 | 47 | 44 | ±0,15 | 6,6 | M6x1P | 1,8x1 | 7,96 | 17,24 | 186 |
| **02020-2,8** | R | | 20 | 3,175 | 36 | 58 | 10 | 77 | 47 | 44 | ±0,15 | 6,6 | M6x1P | 2,8x1 | 10,96 | 26,81 | 284 |
| **02505-3,8** | R | 25 | 5 | 3,175 | 40 | 62 | 10 | 40 | 51 | 48 | ±0,15 | 6,6 | M6x1P | 3,8x1 | 16,18 | 45,68 | 422 |
| **02510-3,8** | R | | 10 | 3,175 | 40 | 62 | 12 | 62 | 51 | 48 | ±0,15 | 6,6 | M6x1P | 3,8x1 | 16,06 | 45,43 | 441 |
| **02525-1,8** | R | | 25 | 3,175 | 40 | 62 | 12 | 70 | 51 | 48 | ±0,15 | 6,6 | M6x1P | 1,8x1 | 8,26 | 21,57 | 2156 |
| **02525-2,8** | R | | 25 | 3,175 | 40 | 62 | 12 | 95 | 51 | 48 | ±0,15 | 6,6 | M6x1P | 2,8x1 | 12,08 | 33,55 | 333 |
| **03205-3,8** | R | 32 | 5 | 3,175 | 50 | 80 | 12 | 42 | 65 | 62 | ±0,15 | 9,0 | M6x1P | 3,8x1 | 18,03 | 59,10 | 500 |
| **03210-3,8** | R | 31 | 10 | 3,969 | 50 | 80 | 13 | 62 | 65 | 62 | ±0,15 | 9,0 | M6x1P | 3,8x1 | 24,13 | 71,15 | 539 |
| **03220-2,8** | R | | 20 | 3,969 | 50 | 80 | 12 | 80 | 65 | 62 | ±0,15 | 9,0 | M6x1P | 2,8x1 | 18,70 | 53,76 | 422 |
| **03232-1,8** | R | | 32 | 3,969 | 50 | 80 | 13 | 84 | 65 | 62 | ±0,15 | 9,0 | M6x1P | 1,8x1 | 12,33 | 33,60 | 265 |
| **03232-2,8** | R | | 32 | 3,969 | 50 | 80 | 13 | 116 | 65 | 62 | ±0,15 | 9,0 | M6x1P | 2,8x1 | 18,02 | 52,30 | 412 |
| **04005-3,8** | R | 40 | 5 | 3,175 | 63 | 93 | 15 | 45 | 78 | 70 | ±0,15 | 9,0 | M8x1P | 3,8x1 | 19,80 | 74,42 | 588 |
| **04010-3,8** | R | 38 | 10 | 6,350 | 63 | 93 | 14 | 63 | 78 | 70 | ±0,15 | 9,0 | M8x1P | 3,8x1 | 49,37 | 136,73 | 657 |
| **04020-2,8** | R | | 20 | 6,350 | 63 | 93 | 14 | 82 | 78 | 70 | ±0,15 | 9,0 | M8x1P | 2,8x1 | 38,82 | 105,08 | 533 |
| **04040-1,8** | R | | 40 | 6,350 | 63 | 93 | 15 | 105 | 78 | 70 | ±0,15 | 9,0 | M8x1P | 1,8x1 | 25,35 | 65,19 | 333 |
| **04040-2,8** | R | | 40 | 6,350 | 63 | 93 | 15 | 145 | 78 | 70 | ±0,15 | 9,0 | M8x1P | 2,8x1 | 37,07 | 101,41 | 510 |
| **05005-3,8** | R | 50 | 5 | 3,175 | 75 | 110 | 15 | 45 | 93 | 85 | ±0,15 | 11,0 | M8x1P | 3,8x1 | 21,65 | 93,58 | 667 |
| **05010-3,8** | R | 48 | 10 | 6,350 | 75 | 110 | 18 | 68 | 93 | 85 | ±0,15 | 11,0 | M8x1P | 3,8x1 | 55,29 | 175,07 | 775 |
| **05020-3,8** | R | | 50 | 6,350 | 75 | 110 | 18 | 108 | 93 | 85 | ±0,15 | 11,0 | M8x1P | 3,8x1 | 56,38 | 181,27 | 853 |

Ball nut sizes shown in bold are available ex stock.

* Number of circuits

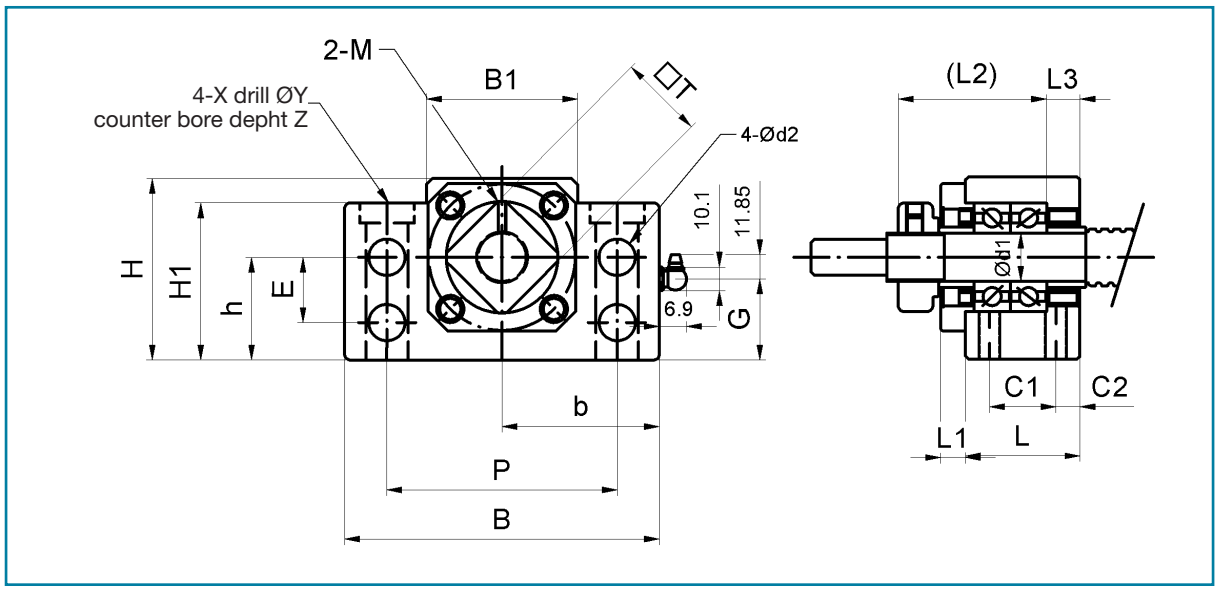
P-Pitch

**Fixed bearing unit BK**

The fixed bearing unit consists of:

- Pillow block housing made of black oxided steel
- Two angular contact ball bearings
- Two seals with contact rings
- Slotted nut

*Suitable for standard spindle ends type F1, F2 (see page 21)*



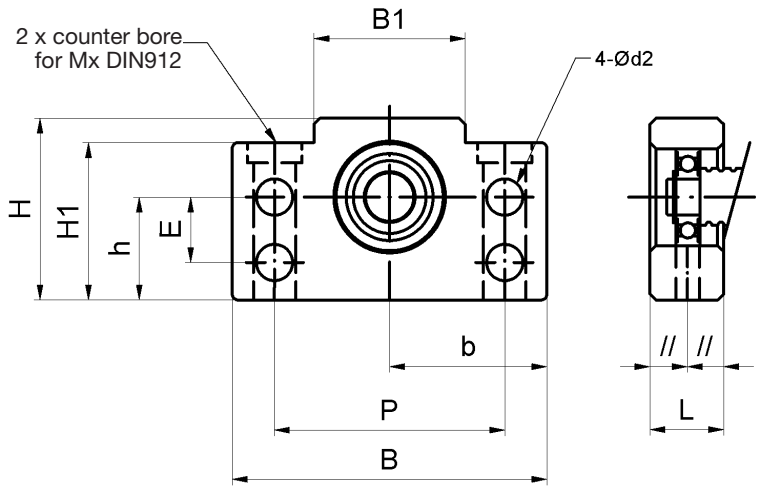

| Unit | Spindle Nominal Dia-meter | Pitch | d1 | L | L1 | L2 | L3 | B | H | b ±0,02 | h ±0,02 | B1 | H1 | E | P | C1 | C2 | d2 | MX | M | T | G | Q | Weight [kg] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BK10 | 16 | 4 / 5 | 10 | 25 | 5 | 29 | 5 | 60 | 39 | 30 | 22 | 34 | 32,5 | 15 | 46 | 13 | 6 | 5,5 | 6 | M3 | 16 | 15 | M6 | 0,4 |
| | 14 | 2 | | | | | | | | | | | | | | | | | | | | | | |
| BK12 | 16 | 10/ 16 | 12 | 25 | 5 | 29 | 5 | 60 | 43 | 30 | 25 | 34 | 32,5 | 18 | 46 | 13 | 6 | 5,5 | 6 | M4 | 19 | 18 | M6 | 0,45 |
| | 20 | 4 / 5 | | | | | | | | | | | | | | | | | | | | | | |
| BK15 | 20 | 10 / 20 | 15 | 27 | 6 | 32 | 6 | 70 | 48 | 35 | 28 | 40 | 38 | 18 | 54 | 15 | 6 | 5,5 | 6 | M4 | 22 | 18 | M6 | 0,69 |
| BK17 | 25 | 5/ 10/ 25 | 17 | 35 | 9 | 44 | 7 | 86 | 64 | 43 | 39 | 50 | 55 | 28 | 68 | 19 | 8 | 6,6 | 8 | M4 | 24 | 30 | M6 | 1,3 |
| BK20 | 32 | 10 | 20 | 35 | 8 | 43 | 8 | 88 | 60 | 44 | 34 | 52 | 50 | 22 | 70 | 19 | 8 | 6,6 | 8 | M4 | 30 | 24 | M6 | 1,3 |
| BK25 | 32 | 4 / 5 / 20/ 32 | 25 | 42 | 12 | 54 | 9 | 106 | 80 | 53 | 48 | 64 | 70 | 33 | 85 | 22 | 10 | 9 | 10 | M5 | 35 | 37 | M6 | 2,4 |
| BK30 | 40 | 5 /10 / 40 | 30 | 45 | 14 | 61 | 9 | 128 | 89 | 64 | 51 | 76 | 78 | 33 | 102 | 23 | 11 | 11 | 10 | M6 | 40 | 37 | M6 | 3,4 |
| BK35 | 50 | 10 /20 | 35 | 50 | 14 | 67 | 12 | 140 | 96 | 70 | 52 | 88 | 79 | 35 | 114 | 26 | 12 | 11 | 12 | M8 | 50 | 37 | M6 | 4,4 |
| BK40 | 50 | 50 | 40 | 61 | 18 | 76 | 15 | 160 | 110 | 80 | 60 | 100 | 90 | 37 | 130 | 33 | 14 | 14 | 16 | M8 | 50 | 43 | M6 | 6,8 |

**Floating bearing unit BF**

The floating bearing unit consists of:

- Bearing housing made of black oxided steel
- Deep grooved ball bearing
- Retaining ring

*Suitable for standard spindle ends type S1 (see page 22)*

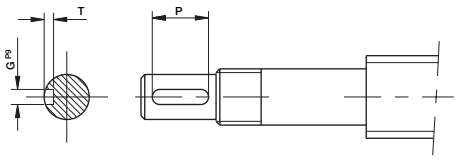



| Unit | Spindle Nominal Dia-meter | Pitch | d1 | L | B | H | b ±0,02 | h ±0,02 | B1 | H1 | E | P | d2 | Mx | Bearing | Safety ring DIN471 | Weight [kg] |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BF10 | 16 | 4 / 5 | 10 | 20 | 60 | 39 | 30 | 22 | 34 | 32,5 | 15 | 46 | 5,5 | 6 | 608ZZ | 8x1 | 0,3 |
| | 14 | 2 | | | | | | | | | | | | | | | |
| BF12 | 16 | 10/ 16 | 12 | 20 | 60 | 43 | 30 | 25 | 34 | 32,5 | 18 | 46 | 5,5 | 6 | 6000ZZ | 10x1 | 0,35 |
| | 20 | 4 / 5 | | | | | | | | | | | | | | | |
| BF15 | 20 | 10 / 20 | 15 | 20 | 70 | 48 | 35 | 28 | 40 | 38 | 18 | 54 | 5,5 | 6 | 6002ZZ | 15x1 | 0,4 |
| BF17 | 25 | 5/ 10/ 25 | 17 | 23 | 86 | 64 | 43 | 39 | 50 | 55 | 28 | 68 | 6,6 | 8 | 6203ZZ | 17x1 | 0,75 |
| BF20 | 32 | 10 | 20 | 26 | 88 | 60 | 44 | 34 | 52 | 50 | 22 | 70 | 6,6 | 8 | 6004ZZ | 20x1,2 | 0,77 |
| BF25 | 32 | 4 / 5 / 20/ 32 | 25 | 30 | 106 | 80 | 53 | 48 | 64 | 70 | 33 | 85 | 9 | 10 | 6205ZZ | 25x1,2 | 1,45 |
| BF30 | 40 | 5 /10 / 40 | 30 | 32 | 128 | 89 | 64 | 51 | 76 | 78 | 33 | 102 | 11 | 12 | 6206ZZ | 30x1,5 | 1,95 |
| BF35 | 50 | 10 /20 | 35 | 32 | 140 | 96 | 70 | 52 | 88 | 79 | 35 | 114 | 11 | 12 | 6207ZZ | 35x1,5 | 2,25 |
| BF40 | 50 | 50 | 40 | 37 | 160 | 110 | 80 | 60 | 100 | 90 | 37 | 130 | 14 | 16 | 6208ZZ | 40x1,75 | 3,3 |

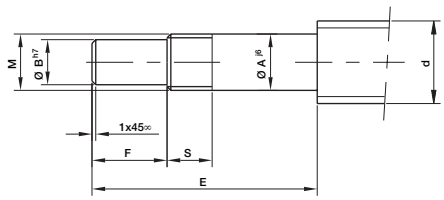
# Standard spindle ends

**Machining for fixed bearings**

Typ F2/F4




Typ F1/F3




Model F1/F2

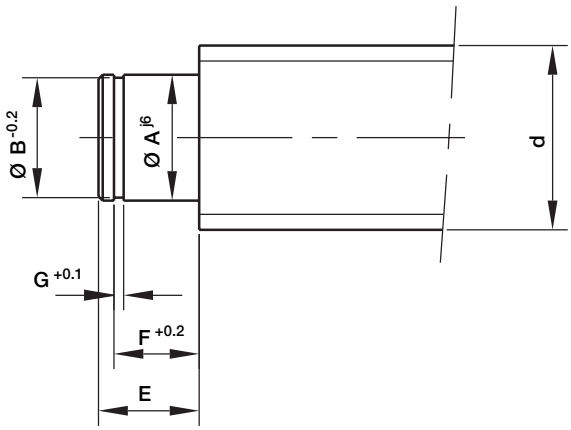
| Unit | Spindle Nominal Diameter | Pitch | ØA j6 | ØB h7 | E | F | M | S | Typ F2 (with cotter pin) | | | Recom-mended bearing unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | G | T | P | |
| 5 | 6 | 1 | 5 | 4 | 31 | 6 | M5x0,5 | 7 | - | - | - | EK5 |
| 6 | 8 | 1/ 2/ 2,5 | 6 | 4 | 38 | 8 | M6x0,75 | 8 | - | - | - | EK6 |
| 8 | 10 | 2/ 4 | 8 | 6 | 44 | 9 | M8x1 | 10 | - | - | - | EK8 |
| | 12 | 2/ 4/ 5 | | | | | | | | | | |
| 10 | 14 | 2 | 10 | 8 | 54 | 15 | M10x1 | 16 | 2 | 1,2 | 11 | BK10 |
| | 16 | 4 / 5 | | | | | | | | | | |
| 12 | 16 | 10/ 16 | 12 | 10 | 54 | 15 | M12x1 | 14 | 3 | 1,8 | 12 | BK12 |
| | 20 | 4 / 5 | | | | | | | | | | |
| 15 | 20 | 10 / 20 | 15 | 12 | 60 | 20 | M15x1 | 15 | 4 | 2,5 | 16 | BK15 |
| 17 | 25 | 5/ 10/ 25 | 17 | 15 | 76 | 23 | M17x1 | 20 | 5 | 3 | 20 | BK17 |
| 20 | 32 | 10 | 20 | 17 | 78 | 25 | M20x1 | 15 | 5 | 3 | 21 | BK20 |
| 25 | 32 | 4 / 5 / 20/ 32 | 25 | 20 | 95 | 30 | M25x1,5 | 18 | 6 | 3,5 | 25 | BK25 |
| 30 | 40 | 5 /10 / 40 | 30 | 25 | 110 | 38 | M30x1,5 | 25 | 8 | 4 | 32 | BK30 |
| 35 | 50 | 10 /20 | 35 | 30 | 128 | 45 | M35x1,5 | 28 | 8 | 4 | 40 | BK35 |
| 40 | 50 | 50 | 40 | 35 | 148 | 50 | M40x1,5 | 35 | 10 | 5 | 45 | BK40 |

Model F3/F4

| Unit | Spindle Nominal Diameter | Pitch | ØA h6 | ØB h7 | M | E | S | F | Typ F4 (Key) | | | Recom-mended bearing unit |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | G | P | T | |
| 10 | 16 | 4/5 | 10 | 8 | M10x1 | 50 | 12 | 20 | - | - | - | PBUF10 |
| 12 | 16 | 10/16 | 12 | 10 | M12x1 | 60 | 12 | 25 | 3 | 20 | 1.8 | PBUF12 |
| | 20 | 4/5 | | | | | | | | | | |
| 15 | 20 | 10/20 | 15 | 12 | M15x1 | 65 | 17 | 25 | 4 | 20 | 2.5 | PBUF15 |
| 17 | 25 | 5/10/25 | 17 | 15 | M17x1 | 70 | 19 | 28 | 5 | 22 | 3 | PBUF17 |
| 20 | 32 | 10 | 20 | 15 | M20x1 | 75 | 19 | 30 | 6 | 25 | 3.5 | PBUF20 |
| 25 | 32 | 4/5/20/32 | 25 | 22 | M25x1,5 | 76 | 21 | 30 | 6 | 25 | 3.5 | PBUF25 |
| 30 | 40 | 5/10/40 | 30 | 25 | M30x1,5 | 86 | 23 | 38 | 8 | 32 | 4 | PBUF30 |
| 35 | 50 | 10/20 | 35 | 30 | M35x1,5 | 110 | 28 | 50 | 8 | 36 | 4 | PBUF35 |
| 40 | 50 | 50 | 40 | 36 | M40x1,5 | 132 | 28 | 60 | 10 | 40 | 5 | PBUF40 |
| 50 | 63 | 10/20 | 50 | 40 | M50x1,5 | 154 | 32 | 70 | 12 | 50 | 5 | PBUF50 |
| | 80 | 10/20 | | | | | | | | | | |

## Machining for floating bearings

Form S1/S2




Model S1

| Model | Nominal diameter of the spindle | Pitch | A | E | B | G | F | Recommended bearing unit |
|---|---|---|---|---|---|---|---|---|
| 10 | 14 | 2 | 10 | 11 | 9,6 | 1,15 | 9,15 | BF10 |
| | 16 | 4 / 5 | | | | | | |
| 12 | 16 | 10/ 16 | 12 | 11 | 9,6 | 1,15 | 9,15 | BF12 |
| | 20 | 4 / 5 | | | | | | |
| 15 | 20 | 10 / 20 | 15 | 13 | 14,3 | 1,15 | 10,15 | BF15 |
| 17 | 25 | 5/ 10/ 25 | 17 | 16 | 16,2 | 1,15 | 13,15 | BF17, PBUL17 |
| 20 | 32 | 10 | 20 | 16 | 19 | 1,35 | 13,35 | BF20 |
| 25 | 32 | 4 / 5 / 20/ 32 | 25 | 20 | 23,9 | 1,35 | 16,35 | BF25, PBUL25 |
| 30 | 40 | 5 /10 / 40 | 30 | 21 | 28,6 | 1,75 | 17,75 | BF30, PBUL30 |
| 35 | 50 | 10 /20 | 35 | 22 | 33 | 1,75 | 18,75 | BF35 |
| 40 | 50 | 50 | 40 | 24 | 38 | 1,95 | 19,95 | BF40 |

Model S2

| Model | Nominal diameter of the spindle | Pitch | ØA j6 | ØB | | E | F | G H13 | Recom-mended bearing unit |
|---|---|---|---|---|---|---|---|---|---|
| 10 | 16 | 4 / 5 | 10 | 9,6 | h10 | 12 | 10,1 | 1,1 | PBUL10 |
| 12 | 16 | 10/ 16 | 12 | 11,5 | h11 | 13 | 11,1 | 1,1 | PBUL12 |
| | 20 | 4 / 5 | | | | | | | |
| 15 | 20 | 10 / 20 | 15 | 14,3 | h11 | 14 | 12,1 | 1,1 | PBUL15 |
| 17 | 25 | 5/ 10/ 25 | S1 (use) | | | | | | PBUL17 |
| 20 | 32 | 10 | 20 | 19 | h11 | 18 | 15,3 | 1,3 | PBUL20 |
| 25 | 32 | 4 / 5 / 20/ 32 | S1 (use) | | | | | | PBUL25 |
| 30 | 40 | 5 /10 / 40 | S1 (use) | | | | | | PBUL30 |
| 35 | 50 | 10 /20 | 35 | 33 | h12 | 22 | 18,6 | 1,6 | PBUL35 |
| 40 | 50 | 50 | 40 | 37,5 | h12 | 28 | 24,85 | 1,85 | PBUL40 |
| 50 | 63 | 10/ 20 | 50 | 47 | h12 | 27 | 29,15 | 2,15 | PBUL50 |
| | 80 | 10/ 20 | | | | | | | |

# Axial clearance and preloading

Through the preloading the axial clearance of the ball screw is removed and the stiffness is increased. In addition the positional accuracy is also improved.

The preloading of the single nut is achieved by installing balls of selected dimensions.

The preloading of the double nut is created by tensioning two nuts against each other.

**Combination of axial clearance and preloading**

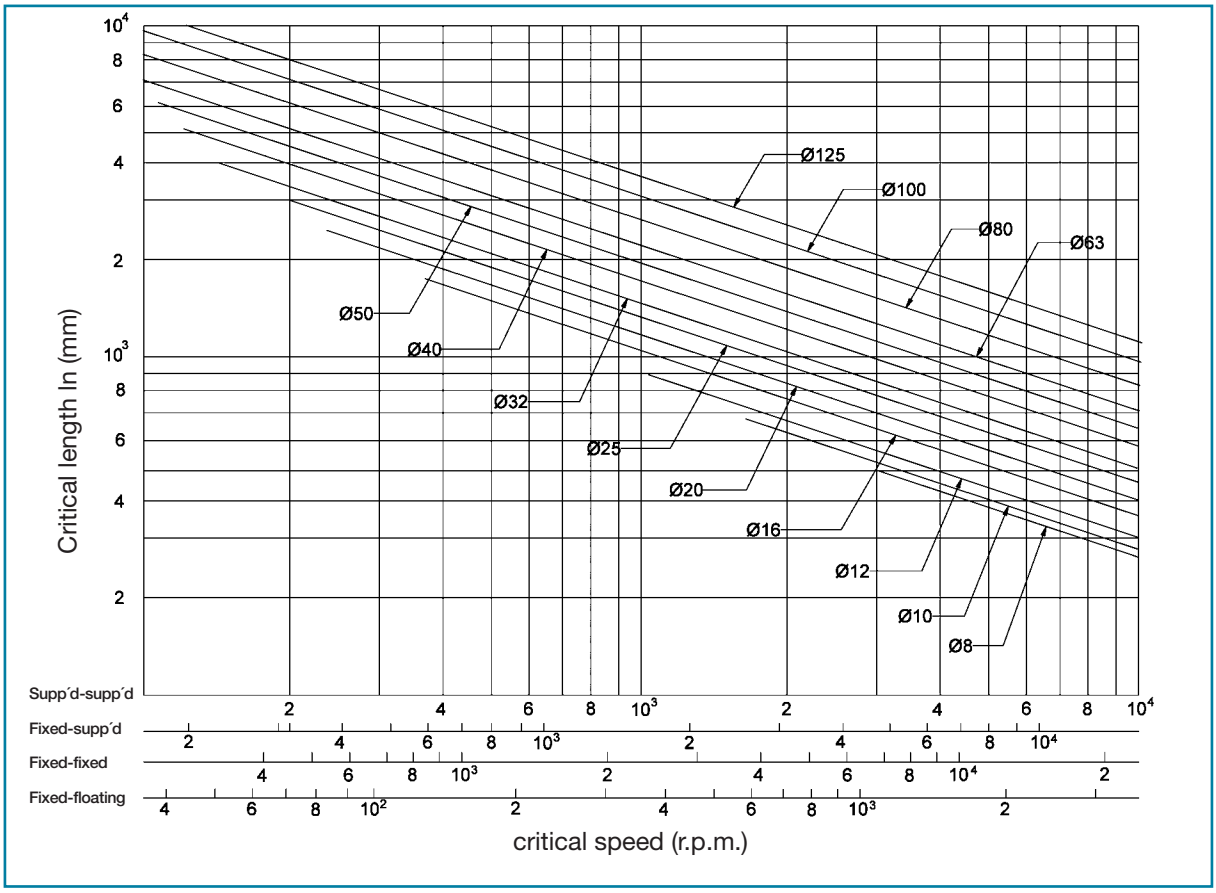
| Symbol | 0 | 1 | 2 | 3 | 4 |
|---|---|---|---|---|---|
| Axial clearance | yes | no | no | no | no |
| Preloading | no | no | light | medium | high |
| % of dynamic load rating | - | - | ~3 | ~5 | ~7 |

| | CI | SK | SC | DC | SU | DU | SE |
|---|---|---|---|---|---|---|---|
| 0 | • | • | • | • | • | • | • |
| 1 | • | • | • | • | • | • | • |
| 2 | • | | • | • | • | • | |
| 3 | | | | • | | • | |
| 4 | | | | • | | • | |

**Combination of axial clearance 0**

| Spindle diameter [mm] | rolled ball screw axial clearance [mm] |
|---|---|
| 04-14 | 0,05 |
| 15-40 | 0,08 |
| 50-100 | 0,12 |

# Critical speed of ball screws




As with any rotating shaft, a ball screw has a critical speed, which is a harmonic vibration. Running the ballscrew in the critical speed area consistently will shorten its operational life, and could affect the performance of a machine as the vibration passes through the machine chassis. For example: On a machine tool it could cause flaws in the surface finish as ball screw reaches its critical speed, as the vibration is transmitted to other parts of the machine. The critical speed is a function of the diameter and length of the ball screw shaft, and the mounting configuration. The axial clearance of the nut has no influence on the critical speed $n_k$.
The operating speed should be kept at or below 80% of the critical speed. The formula below, for calculating the admissible speed $n_{kzyl}$, takes account of this 0.8 safety factor.

$$n_{kzyl} = \alpha * \frac{60 * \lambda^2}{2 * \pi * l_k^2} \sqrt{\frac{E * I * g}{\gamma * A}} = f * \frac{d_2}{l_k^2} * 10^7 \quad (1/min)$$

| | |
|---|---|
| $n_k$ | critical speed (r.p.m.) |
| $n_{kzyl}$ | permissible operating speed (r.p.m.) |
| $\alpha$ | safety factor (=0.8) |
| E | elasticity modulus (E=2.06x105 N/mm²) |
| I | geometric moment of inertia (mm²) |
| $d_2$ | diameter at the ball screw root (mm) |
| $\gamma$ | specific material density (7,6x10$^{-5}$ N/mm³) |
| g | earth's gravitational constant (9,8x10³ mm/s²) |
| A | cross section of the ball screw (mm²) |
| $l_k$ | unsupported length between the two housings |
| *f* | correction factor due to mounting |

| | | |
|---|---|---|
| supported-supported | λ=3,14 | f=9,7 |
| fixed-supported | λ=3,927 | f=15,1 |
| fixed-fixed | λ=4,730 | f=21,9 |
| fixed-floating | λ=1,875 | f=3,4 |

The maximum permissible speed of the ball screw is limited by the DN value in addition to the critical speed.

For the nuts SC/DC $d_0 * n_{kzyl} \leq 120.000$

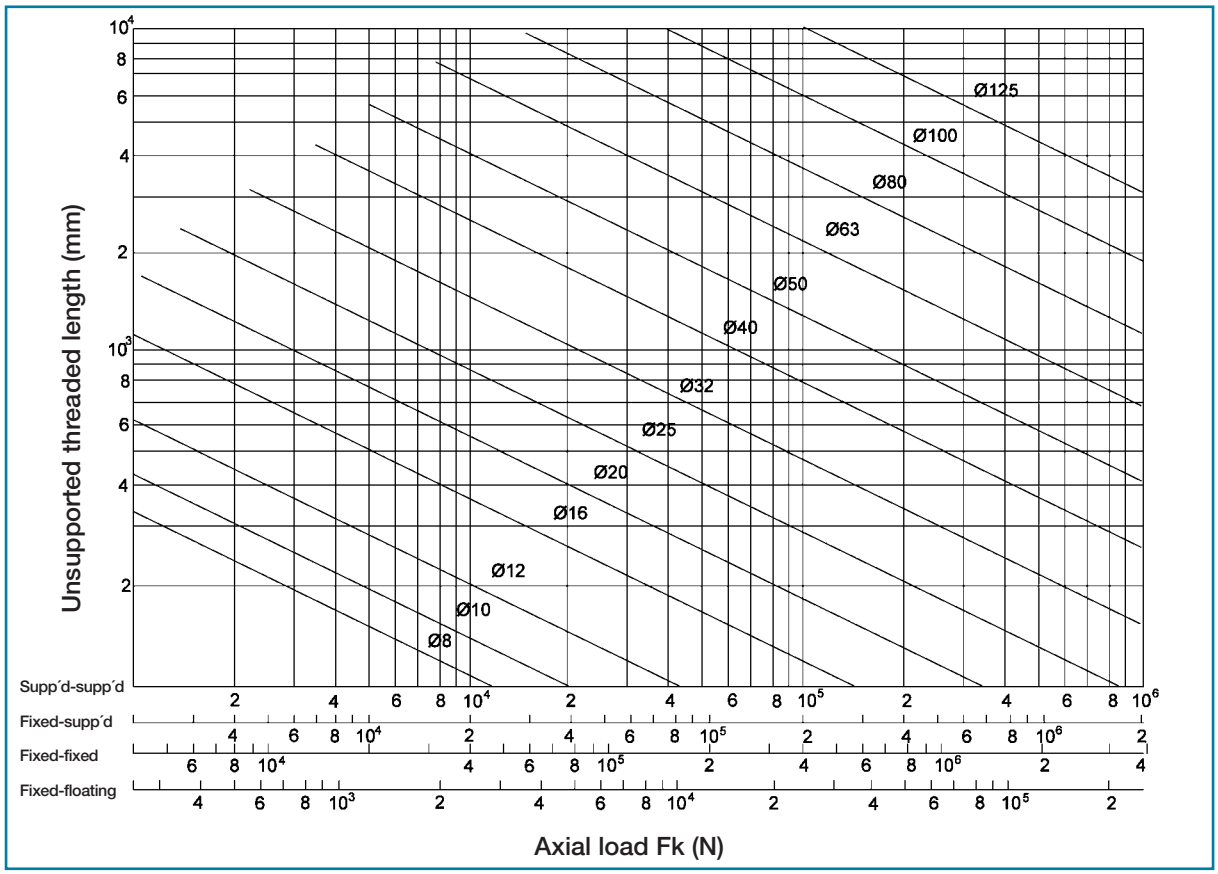
For the nuts CI, SK, SU/DU, SE $d_0 * n_{kzyl} \leq 90.000$

$d_0$ Centre diameter of the spindle, mm

Please contact our application engineers if the required speed exceeds the DN value, or the ball screw is used for higher speeds.

# Permissible axial load for the screw (buckling)

Similar to any shaft, ball screws can only withstand a limited axial load. Any stress greater than the maximum defined values can lead to failure of the screw. The permissible axial compression is a function of the length, diameter and the type of mounting of the screw. The maximum axial compression load should be 50% or less of the theoretical permissible load. The calculation made using the formula below takes this safety factor into account.




$$F_{kzyl} = \alpha * \frac{N * \pi^2 * E}{l_k} = m * \frac{d_2^4}{l_k} * 10^3 \,(N)$$

$F_k$ theoretical maximum permissible axial load (N)
$F_{kzyl}$ maximum permissible working axial load (N)
$\alpha$ safety factor (=0,5)
E modulus of elasticity
($E = 2{,}06 * 10^5$ N/mm²)

I geometric moment of inertia

$$I = \frac{\pi}{64} * d_2 \,(mm^4)$$

$d_2$ diameter at the ball screw root (mm)
$l_k$ unsupported length between the two housings (mm)
m, N factor linked to the

| | | |
|---|---|---|
| supported-supported | m=5,1 | N=1 |
| fixed-supported | m=10,2 | N=2 |
| fixed-fixed | m=20,3 | N=4 |
| fixed-floating | m=1,3 | N=0,25 |

# Mounting the nut on the screw

In case of separate delivery of ball screws and ball nuts, qualified personnel must carry out the assembly of the ball screws. Ball nuts should be mounted only with the help of a fitting sleeve. The fitting sleeve delivered with the nut unit can be used. The start of the thread of the spindle must be aligned, so that the wiper and the internal single parts of the nut unit are not damaged.
As standard SNR ball screws are delivered with an installed nut unit. The nut unit and spindle should not be dismantled (especially applicable for a preloaded nut). If this is unavoidable, please contact our application engineers.

**Proceed with the mounting as follows:**
Remove the rubber washer from one side of the sleeve. Push on the nut with the sleeve on the end of the screw. Press the sleeve against the start of the screw thread.

Screw the nut on to the thread, using a slight axial pressure. Then screw the nut on for its entire length.

Remove the mounting sleeve only when the nut is completely threaded on to the screw. Lock the nut to prevent any unscrewing (using a rubber washer or fixing the sleeve axially).

**What do I do when…**
Balls escape while threading on the nut?

1. Pick up the balls (the nut is only compatible with the original balls). The load capacity is then ensured, even if two or three balls are missing.
2. Carefully clean all the components.
3. Use the sleeve as a mounting jig.
4. Replace the balls.
5. Start with the lowest circuit. Insert the balls into the nut circuit, the sleeve prevents the balls from falling inside.

**Note:**
Ground ball screws, with a single or double nut are always delivered with the nut assembly mounted, similarly to rolled double nut screws.

Please contact us if you absolutely must dismantle a nut assembly.


**Important:**
Use only the original balls!

**Important:**
Do not place the balls in the empty circuit located between the two deflectors!

# Operating and maintenance information for the ball screws

### Operating conditions

In addition to the load rating, the maximum speed, critical bending speed and the permissible buckling force should also be considered. Ball screws are conceptualised as a drive element for creating axial feed force. Radial forces and torques that have an impact on the nut, lead to the reduction of durability. When using a ball screw the ambient temperature shall not exceed 80°C.

### Assembly

During assembly, parallel alignment of the guiding elements should be ensured. Special care must be taken to achieve a concentric assembly of the nut on the spindle. Here attention should be paid to the tolerance relationship between the guiding elements and layout as well as the bearing units and nut housings. By providing alignment options to the nut or to the bearing, good accuracy with lower cost can be realised.

### Lubrication

For maintaining the performance of a ball screw, it must be lubricated adequately. Similar lubricants that are used for rolling bearings should be used. Lubricants containing $MoS_2$ or graphite should not be used. The selection of the lubricant and the type of supply can be adjusted to match the lubrication of the other components of the machine. A one off lifetime lubrication of the ball screw is not adequate based on experience, as the spindle constantly discharges small amounts of lubricant from the nut.
**SNR – ball screws are supplied with the conserving oil "Contraktor Fluid H1"**. "Contraktor Fluid H1" is compatible with the SNR standard lubricant "SNR LUB Heavy Duty".

The lubrication period is dependent on many factors such as:

- Load
- Speed
- Motion sequence
- Temperature

The following factors reduce the lubrication interval:

- Greater load
- High speed
- Short stroke (stroke is smaller than three times the length of the nut)
- Lower ageing resistance of the lubricant

## Grease lubrication

For operation under normal conditions, grease SNR Heavy Duty is used. Specific requirements under certain environmental conditions require the use of a suitable grease. In the food industry and clean room there are special requirement for the lubricant with regard to emission and compatibility. Basically the compatibility of the lubricants against each other should be checked. In case of special ambient conditions we will gladly assist you. Depending on the area of application the following lubricants can be used:

| Name | Oil type, consistency | NLGI-class DIN 51818 | Walk penetration DIN ISO 2137 at 25°C | Ground oil viscosity DIN51562 at 40°C | Density | Temperature range | Properties | Field of application |
|---|---|---|---|---|---|---|---|---|
| | | | [0,1 mm] | [mm²/s] | [kg/m³] | [°C] | | |
| SNR LUB Heavy Duty | Paraffin mineral oil / Lithium – Special - Soap | 2 | 285 | ca. 105 | 890 | -30…+110 | Lower friction, smooth running | General engineering |
| SNR LUB GV+ | Synthetic KW oil / ester oil / Lithium – Special - Soap | 2 | 265…295 | 24 | 900 | -50…+120 | Very good adhesion, very good water resistance | High speeds |
| SNR LUB HIGH TEMP | Synthetic KW oil / mineral oil / polyurea | 2 | 265…295 | 160 | 900 | -40…+160 | High temperature resistance, good corrosion protection, high oxidation resistance | High temperature range |
| SNR LUB FOOD | Paraffin mineral oil / aluminium complex soap | 2 | 265…295 | ca. 240 | 920 | -30…+110 | Good corrosion protection, very good adhesion, high water resistance, NSF H1 registered* | Food industry |
| Microlub GL261 | Mineral oil / Lithium – Special - Soap | 1 | 310…340 | 280 | 890 | -30…+140 | Good wear protection, special pressure resistance additive against tribo corrosion | general engineering high load short-stroke applications, vibrations |
| Klübersynth BEM34-32 | Synthetic CW - oil / special - calcium soap | 2 | 265…295 | ca. 30 | 890 | -30…+140 | Particularly pressure resistant, good wear protection, good ageing resistance low starting torque | Clean-room applications |
| Klübersynth UH1 14-151 | Synthetic CW oil/ester oil / aluminium complex soap | 1 | 310…340 | ca. 150 | 920 | -45…+120 | Good corrosion protection, good ageing resistance, high water resistance, NSF H1 registered* | Pharmaceutical industry Food industry |

** This grease is registered as H1 product: it has been developed for occasional, technically unavoidable contact with foodstuff. Experiences have shown that the grease can also be used for the corresponding applications in the pharmaceutical and cosmetic industry, on the conditions listed in the product information. However, there are no specific test results, for instance, on the biocompatibility, as may be required under certain circumstances in the pharmaceutical area. Therefore, before it is used in this area by equipment manufacturers and distributors, corresponding risk analyses must be performed. If necessary, measures to avoid health hazard and injuries must be taken. Source: Klüber Lubrication)*

At higher speeds (speed parameter DN > 50,000) the quality K1K or KP1K should be selected. Speed parameters under 2,000 require a grease of the consistency class 3 (K3K or KP3K DIN 51825). The required lubrication period is based on the ambient conditions. In general re-lubrication should be carried out every 200-600 operating hours. The following is applicable as a reference value for the lubricant quantity: Per cm spindle diameter ≥ 1 cm3 grease for each nut. Only greases of same soap base should be used for lubrication.

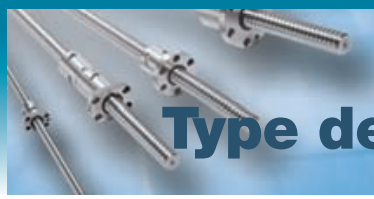
**Oil lubrication**

As a rule, oil lubrication is used in conjunction with centralised lubrication equipment. The advantage of centralised automatic oil lubrication is a continuous lubricant supply to all the lubrication points. Lubricant oils ensure a very good dissipation of friction heat. In contrast there are higher design and assembly requirements for the lubrication lines. Depending on the area of application the following lubricant oils can be used:

| Name | Type of lubricant | Kinematic viscosity DIN51562 at 40°C | Density | Temperature range | Properties | Field of application |
|---|---|---|---|---|---|---|
| | | [mm²/s] | [g/cm³] | [°C] | | |
| Klüberoil GEM 1-100N | Mineral oil | 100 | 880 | -5….+100 | Good corrosion and wear protection | General engineering |
| Klüberoil 4 UH1-68N | Polyalphaolefin | 680 | 860 | -25….+120 | good ageing and wear protection | Food industry |
| | | | | | NSF H1 registered* | Pharmaceutical industry |

** This grease is registered as H1 product: it has been developed for occasional, technically unavoidable contact with foodstuff. Experiences have shown that the grease can also be used for the corresponding applications in the pharmaceutical and cosmetic industry, on the conditions listed in the product information. However, there are no specific test results, for instance, on the biocompatibility, as may be required under certain circumstances in the pharmaceutical area. Therefore, before it is used in this area by equipment manufacturers and distributors, corresponding risk analyses must be performed. If necessary, measures to avoid health hazard and injuries must be taken. Source: Klüber Lubrication)*

At higher speeds (speed parameter DN > 50,000) oils of the viscosity class ISO VG 46-22 should be used. For speed parameters under 2,000 the viscosity ISO VG 150-460 should be used. If the load is above 10% of the dynamic load rating, an oil with additives is recommended for increasing the load capacity (class CLP, DIN 51517 Part 3). With oil bath lubrication the spindle must be 0.5 to 1 mm above the oil level. The oil supply with re-circulation lubrication should be 3 cm³/h for each ball circulation.



# Type designation code

**(1) Product**
- BSC Screw + Nut assembly
- BSH Ball screw
- BNU Nut alone

**(2) Nominal diameter (mm)**

**(3) Pitch (mm)**

**(4) Direction of pitch**
- R right
- L left

**(5) Type of nut**
- CI Single cylindrical nut (Page 7)
- SK Single flanged miniature nut (Page 6)
- SE Single flanged nut (wide pitch) (Page 12)
- SC Single flanged compact nut to DIN 69051 (Page 8)
- DC Double flanged compact nut to DIN 69051 (Page 9)
- SU Single flanged nut to DIN 69051 (Page 10)
- DU Double flanged nut to DIN 69051 (Page 11)
- SH Single threaded nut (Page 13)

For the coding of screws alone:
- 01 Screw for compact series DIN nut
- 00 Screw for special nut types

**(6) Number of circuits**

**(7) Type of flange**
- A DIN 69051 section 5 form A (round)
- B DIN 69051 section 5 form B
- C DIN 69051 section 5 form C
- Z Cylindrical nut

**(8) Precision class (Page 22)**
T0, T1, T2, T3, T5, T7 (in stock), T10

**(9) Model**
- G ground
- R rolled

**(10) Preload types (Page 26)**
- 0 Standard axial clearance
- 1 No axial clearance
- 2 Light preload
- 3 Medium preload
- 4 High preload

**(11) Total length (mm)**

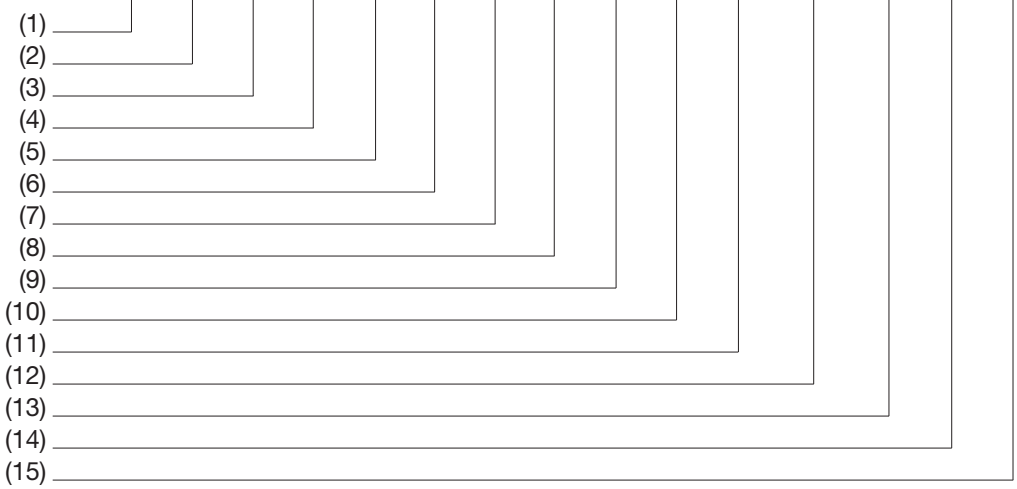
**(12) Right side screw end (Pages 19-20)**
- F, S Form F, S (X depending on customer drawing, 0 with no end machining)
- 1, 2 Model
- 6…60 Diameter of the bearing seat

**(13) Left side screw end, see right side screw end**

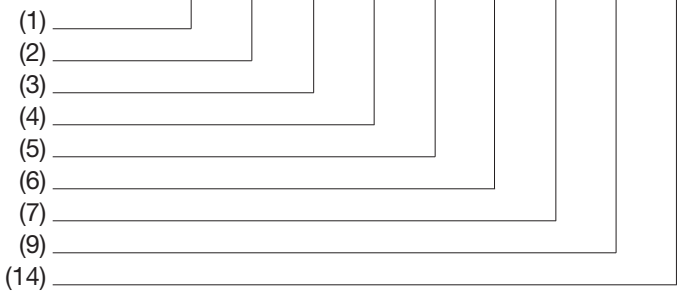
**(14) Lubrication**
- 0 Standard nut greasing
- 1 Anti-corrosion greasing
- 2 Greasing to customer instructions

**(15) Special**
- 0 None
- 1 Taking account of drive torque measurement
- 2 Taking account of pitch error

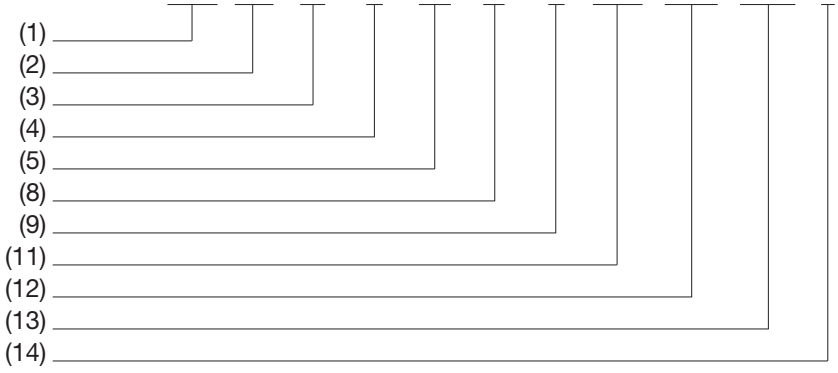
Screw + Nut assembly BSC 020 05 R CI 2 Z T7 R 0 - 1000 - F115 - S115 - 0 - 0




Nut BNU 020 05 R CI 2 Z R - 0




Screw BSH 020 05 R 00 T7 R - 1000 - F115 - S115 - 0



# Your enquiry form

Company

Address | Contact

Position | Telephone | Fax

Description of the application

☐ Isolated need | No. of pieces | ☐ New construction

☐ Production need | Required delivery Weeks | ☐ Technical improvement

Pieces per year | ☐ Cost reduction / Current price €

Delivery of pieces required in Weeks

## Application parameters

Type of mounting: ☐ Horizontal ☐ Vertical | Usable stroke:

Maximum usable load: kg | Additional axial load:

Maximum movement speed: m/s | Maximum acceleration:

Positioning accuracy: mm | Reproducibility: mm

Maximum inversion clearance: mm | Cycle time: sec

Required working life strokes or hours

Ambient conditions of use: | Special circumstances:

## Dimensions and features, if existing application

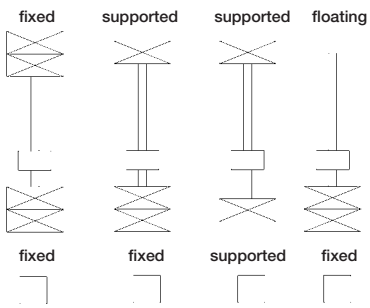
☐ Flange nut: | Maximum dimensions of the nut:

☐ Cylindrical nut | Nominal screw diameter: mm

☐ DIN nut | Pitch: mm

Total length: mm

## Housings




☐ With machining of the ends to drawing no.

☐ Machining of the ends for use with SNR housings

☐ No end machining

The consultation of SNR WÄLZLAGER GMBH is exclusive for the function of the ball screws. As a supplier of a component SNR accepts no liability for the function, operation or performance for the machine, system or assembly to which the ball screw is mounted. This responsibility lies with the machine designer, manufacturer, operator or other relevant parties.