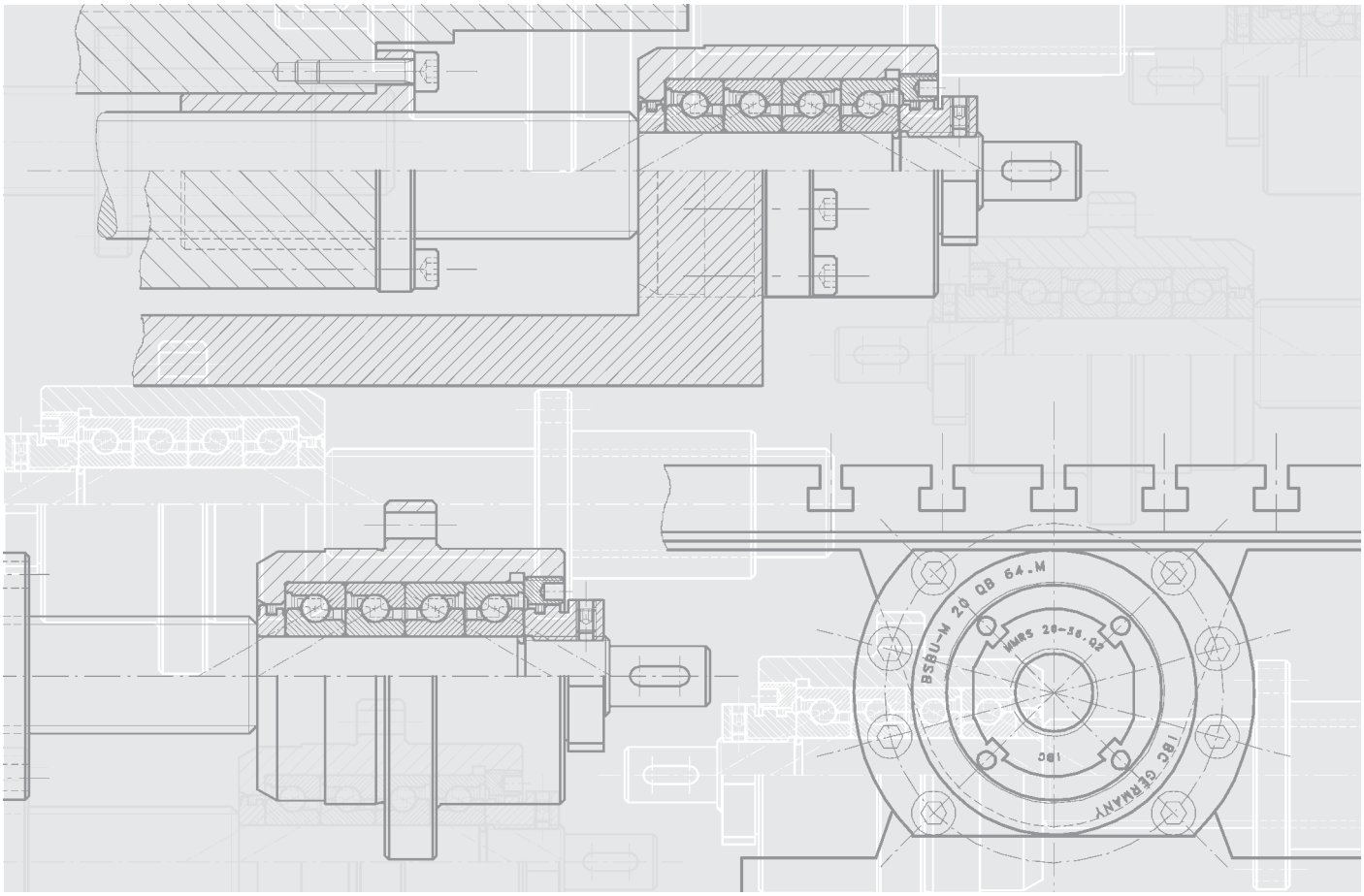
IBC




# Ball Screw Support Bearings

## 60° Angular Contact Bearings

## Precision Bearing Units · Precision Locknuts

**TI-I-5010.2 / E**

IBC

Headquarter of the IBC Wälzlager GmbH at the industrial area of Solms-Oberbiel

## Location with Tradition

The headquarters in Solms-Oberbiel is centrally located in Germany close to the North/South and East/West highways which also provides fo a central location in Europe. The international Airport Frankfurt approx. 80 km away serves as a worldwide link.

## Flexible and Reliable

In the middle of 1996 we opened the central computer controlled high shelf warehouse with more than 2.000 pallet places. It is used for finsihed and semi-finished products as well as for large bearings. This is in addition to our existing two-storage computer controlled service warehouse also with more than 2.500 storage places.

Both warehouse systems provide together with our distribution centre and communication network precise logistics and a worldwide unequaled reliability.

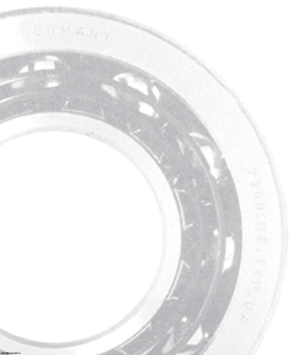
Central Computer Controlled High Shelf Warehouse – Middle 1996


Precise Logistics provide an unequaled worldwide reliability

## Precision with Future

We are future orientated.
We have the creativity and vision to perform and provide.

**This is our exact presentation to solutions with precision.**



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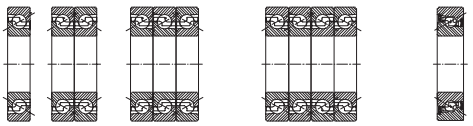
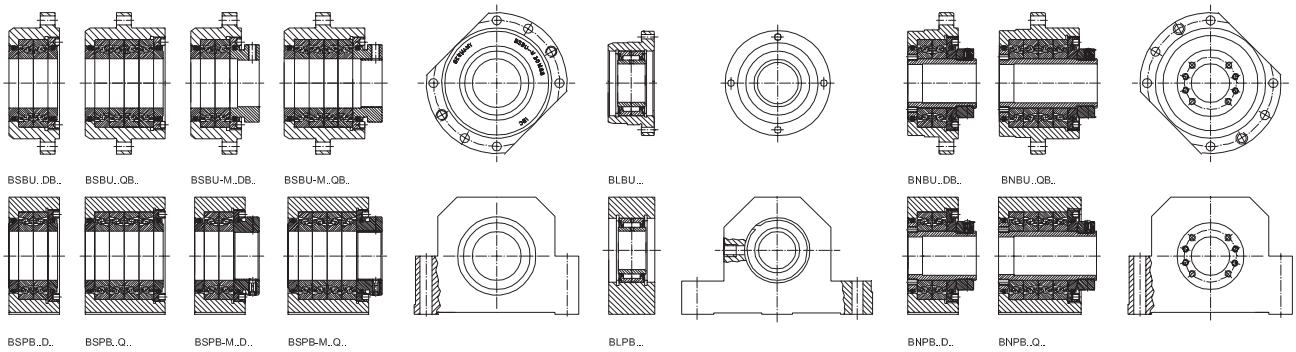


BS... BS...2RSZ...

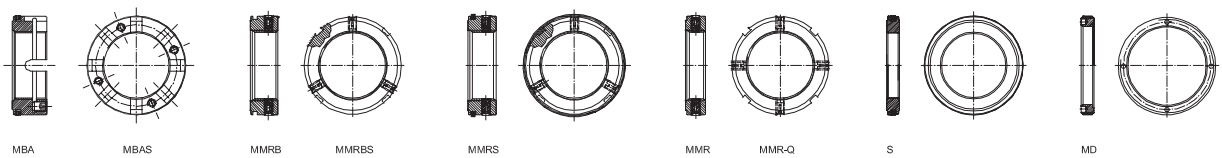




BSBU..DB.. BSBU..QB.. BSBU-M..DB.. BSBU-M..QB.. BLBU... BNBU..DB.. BNBU..QB..

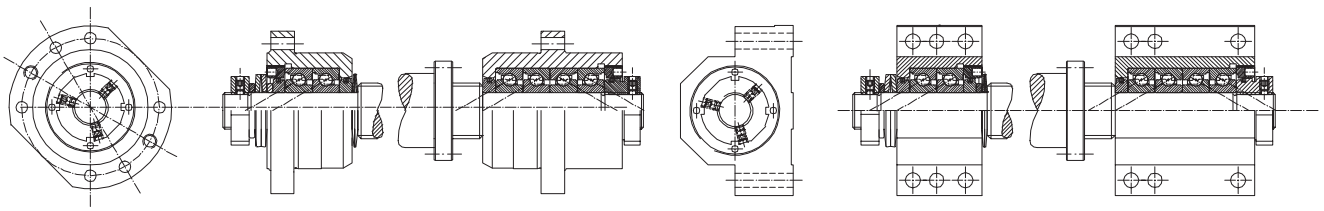
BSPB..D.. BSPB..Q.. BSPB-M..D.. BSPB-M..Q.. BLPB... BNPB..D.. BNPB..Q..





MBA MBAS MMRB MMRBS MMRS MMR MMR-Q S MD





# 1. Overview

**Range of IBC Precision Products for Support of Ball Screws**
Fields of application of 60° super precision angular contact ball bearings and units:
Rigid but fairly low-friction assembly of ball screws or satellite screws for conversion of rotary movement into linear movement (among others, also in worm gears for rotating tables or in tailstocks).
In particular 60° precision angular contact ball bearings are used for machine tools or machines and devices with similar high requirements regarding precision, speed but also rigidity and a lower friction behaviour and thus a less heating up of the bearings or components.

**Advantages**
Of course easy assembly, a long life time, the option of lifetime lubrication or circulating oil lubrication, as sometimes employed for driven ball screw nuts are other features which should be adjusted to match each other optimally. Next to the open 60° bearings, several sizes are manufactured with a non-contact rubber seal at both ends.

**High axial loads**
Whereas contact ball bearings with small contact angles of 15°, 25° mainly absorb radial loads and only qualified axial loads, the ratio is different in case of 60° super precision angular contact thrust ball bearings because the axial load is to be predominated here.

**Different preloads**
Depending on the required rotational speeds and rigidity, it is possible to choose between light, medium and heavy preload.

**Rotational speeds**
If required, the steel balls are replaced by ceramic balls to achieve a 35 % increase in rotational speed.

**Precision bearing units**
For 20 years IBC Wälzlager GmbH has been mounting open bearings into housings with labyrinth seals. Two series for driven spindles and driven nuts have turned out to be the most effective:
a) Cartridge Units with Flanged Housing
b) Pillow Block Units
The cartridge units with integrated labyrinth seal and life-time lubrication have been revised and designed to allow for easier mounting. The seat diameter was enlarged to be able to slide a pre-assembled module (ball screw with it's nut + bearing unit, if applicable) through the attachment bore of the unit. This proved to be helpful for maintenance.

**Standard models and options**
The units are available as standard, duplex and quadruplex units with lifetime lubrication. The DB duplex units, which are flattened on both sides can also be provided as DT tandem unit for applications with longer spindles and a second bearing side (see page 33). The matching disc springs and spacers for preloading or a slight stretching of the spindle are part of the delivery.
Quadruplex units are mainly mounted in QBC tandem-O-tandem arrangements but can also be delivered in a QBT arrangement, i.e. 3:1 stacking of the bearings (of interest for vertical axes with a preferred direction of load). If required by the customer, additional attachment bores, e.g. for bellows of the ball screw or additional centring locations for direct flange mounted servo motor mounts can be integrated.

**Securable precision locknuts and labyrinth seals** for preloading of the bearings (units) complete the product range.

# 2. Designation of Bearing Size – Lifetime calculation

## 2.1 Load carrying capacity and lifetime

For calculation of lifetime according to DIN ISO 281, the shares of radial and axial load are summarized using the following equations for dynamic-equivalent (axial) load $P_{(a)}$ and static-equivalent (axial) load $P_{(ao)}$

$$P_a = X \cdot Fr + Y \cdot Fa \quad [2.2]$$

$$P_{ao} = X_o \cdot Fr + Y_o \cdot Fa \quad [2.3]$$

| For individual bearings and tandem arrangement, ØØ or multiple arrangements in one direction. | | | | | | Individual bearing in X or or O arrangements or double row bearings ØØ or ØØ | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| $\frac{Fa}{Fr} \leqq 2{,}17$ | | $\frac{Fa}{Fr} > 2{,}17$ | | | | $\frac{Fa}{Fr} \leqq 2{,}17$ | | $\frac{Fa}{Fr} > 2{,}17$ | | | |
| X | Y | X | Y | $X_o$ | $Y_o$ | X | Y | X | Y | $X_o$ | $Y_o$ |
| not appropr. | | 0.92 | 1 | 4 | 1 | 1.9 | 0.55 | 0.92 | 1 | 1 | 0.58 |

*Table 2.1: Radial and axial load factors X, Y, $X_o$, $Y_o$*

**Bearing combinations**
The dynamic axial load rating of several similar single-row 60° super precision angular contact thrust ball bearings with load in the same direction is calculated as follows:

$$C_{aSet} = i^{0,7} \cdot C_{aSingle\ bearing} \quad [2.4]$$

$$C_{aoSet} = i \cdot C_{aoSingle\ bearing} \quad [2.5]$$

Static safety factor: $S_{ao}=C_{ao}/P_{ao}$ (chose $S_{ao} > 2{,}5$) [2.6]

| | | |
|---|---|---|
| $P_a$ | [N] | Dynamic equivalent axial load (60° bearings) |
| $P_{(r)o}$ | [N] | Static equivalent radial load |
| $P_{ao}$ | [N] | Static equivalent axial load (60° bearings) |
| $F_r$ | [N] | Radial component of load |
| $F_a$ | [N] | Axial component of load |
| $X$, $X_o$ | | Radial factor of bearings, Table 2.1 |
| $Y$, $Y_o$ | | Axial factor of bearings, Table 2.1 |

In case of bearing sets with a bearing number i which is larger than two and a rigid preload Fv, the life time per single bearing should be calculated as follows:

## Life Time Calculation

| Direction of load | Mounting arrangement | | Direction of load | Unloading starting at Fae > X · Fv | Load distribution relative to single bearing ($F_{aE}$) Until unloading for Fae < X · Fv | | After unloading for Fae > X · Fv | |
|---|---|---|---|---|---|---|---|---|
| | A | B | | X | A | B | A | B |
| Fae --> | < | > | | 2.83 | Fv + 0.67 Fae [2.8] | Fv – 0.33 Fae [2.9] | Fae | 0 |
| Fae --> | < < | > | | 5.66 | 0.84 Fv + 0.47 Fae [2.10] | 1.36 Fv – 0.24 Fae [2.11] | 0.617 Fae | 0 |
| | < < | > | <-- Fae | 2.83 | 0.84 Fv – 0.30 Fae [2.12] | 1.36 Fv + 0.52 Fae [2.13] | 0 | Fae |
| Fae --> | < < < | > | | 8.49 | 0.73 Fv + 0.38 Fae [2.14] | 1.57 Fv – 0.18 Fae [2.15] | 0.463 Fae | 0 |
| | < < < | > | <-- Fae | 2.83 | 0.73 Fv – 0.26 Fae [2.16] | 1.57 Fv + 0.45 Fae [2.17] | 0 | Fae |
| Fae --> | < < < < | > | | 11.30 | 0.65 Fv + 0.32 Fae [2.18] | 1.71 Fv – 0.15 Fae [2.19] | 0.379 Fae | 0 |
| | < < < < | > | <-- Fae | 2.83 | 0.65 Fv – 0.23 Fae [2.20] | 1.71 Fv + 0.45 Fae [2.21] | 0 | Fae |
| Fae --> | < < | > > | | 5.66 | 0.84 Fv + 0.40 Fae [2.22] | 0.84 Fv – 0.22 Fae [2.23] | 0.617 Fae | 0 |
| Fae --> | < < < | > > | | 8.49 | 1.12 Fv + 0.33 Fae [2.24] | 1.49 Fv – 0.18 Fae [2.25] | 0.463 Fae | 0 |
| | < < < | > > | <-- Fae | 5.66 | 1.12 Fv – 0.20 Fae [2.26] | 1.49 Fv + 0.35 Fae [2.27] | 0 | 0.617 Fae |
| Fae --> | < < < < | > > | | 11.30 | 1.03 Fv + 0.29 Fae [2.28] | 1.68 Fv – 0.15 Fae [2.29] | 0.379 Fae | 0 |
| | < < < < | > > | <-- Fae | 5.66 | 1.03 Fv – 0.18 Fae [2.30] | 1.68 Fv + 0.33 Fae [2.31] | 0 | 0.617 Fae |

*Table 2.2: Resulting axial load $F_{aE}$ of the single bearing for different mounting arrangements as function of the applied preload Fv and the outer load Fae*

a) Radial load is distributed among all bearings in the set. (Belt forces are mostly negligible).

$$F_{rE} = \frac{F_r}{i_{ges}^{0,7}}$$

[2.7]

| iges | Number of bearings per set | | | | |
|---|---|---|---|---|---|
| i | 2 | 3 | 4 | 5 | 6 |
| $i^{0.7}$ | 1.62 | 2.12 | 2.64 | 3.09 | 3.51 |
| $1/i^{0.7}$ | 0.617 | 0.463 | 0.379 | 0.324 | 0.285 |

b) The axial load in respect of a single bearing is obtained using the equations 2.8 to 2.31 according to table 2.2. Only the number of bearings in load direction can bear a specific share – in load counter-direction a different or no-share will be borne, having overcome preload X · Fv.

The equivalent load $P_{(a)}$ is determined according to the equation [2.2] using $F_{rE}$ and $F_{aE}$

Regarding the axial bearing load, the outer load $F_{aE}$ has to be taken into account in addition to the bearing preload Fv. As forces Fv and Fae are already provided for each single bearing in Table 2.2 and according to equation [2.8 through 2.31] the nominal life time is calculated using the basic load rating of the single bearing. In case of spindles, where different work may be performed in +/– axis direction it may be necessary to verify lifetime for both directions.

For spring preloaded bearings the following applies to the bearing (set) exposed to the larger load.

$$F_a = F_{Spring} + F_{ae} \qquad [2.32]$$

$$F_{a\ Single\ bearing} = \frac{1}{i^{0,7}} \cdot (F_{Spring} + F_{ae}) \qquad [2.33]$$

A load range consisting of different forces, rotational speeds and corresponding percentage of time results in a medium equivalent load $P_{ma}$:

$$P_{ma} = \frac{\sqrt[3]{P_1^3 \cdot t_1 \cdot n_1 + ... + P_n^3 \cdot t_n \cdot n_n}}{n_m \cdot 100} \qquad [2.34]$$

$$n_m = \frac{t_1 \cdot n_1 + ... + t_n \cdot n_n\ t_1}{100} \text{ bis } t_n \text{ in [\%]} \qquad [2.35]$$

| | | |
|---|---|---|
| $P_1$ .. $P_n$ | | equivalent load per load case |
| $t_1$ .. $t_n$ | [%] | time component |
| $n_1$ .. $n_n$ | [$min^{-1}$] | rotational speed |
| $n_m$ | [$min^{-1}$] | medium rotational speed |

**Nominal life time $L_{10}$**
For 90 % of the same type of bearings no fatique of material is appearing at that time.

$$L_{10} = \left(\frac{C_a}{P_{ma}}\right)^P \cdot \frac{1{,}000{,}000}{60 \cdot n}\ [h] \qquad [2.37]$$

| | | |
|---|---|---|
| n | [$min^{-1}$] | rotational speed |
| $C_a$ | [N] | dynamic load rating, axial, single bearing |
| $P_{ma}$ | [N] | dynamic equivalent load, axial |
| p | | life time exponential for ball bearings p = 3; for roller bearings p = 10/3 |

**Modified lifetime $L_{na}$** Special safety demands, alternative materials and operating conditions are taken into account in this context.

$$L_{na} = a_1 \cdot a_2 \cdot a_3 \cdot L_{10} \quad [h] \qquad [2.38]$$

| | | |
|---|---|---|
| $a_1$ | | life adjustment factor for reliability |
| $a_2$ | | life adjustment factor for bearing material $a_2 = a_{2l} \cdot a_{2w}$ [2.39] |
| $a_3$ | | life adjustment factor for application conditions |

| Reliability % | $L_{na}$ | $a_1$ |
|---|---|---|
| 90 | $L_{10a}$ | 1 |
| 95 | $L_{5a}$ | 0,62 |
| 96 | $L_{4a}$ | 0,53 |
| 97 | $L_{3a}$ | 0,44 |
| 98 | $L_{2a}$ | 0,33 |
| 99 | $L_{1a}$ | 0,21 |

| Raceway material | $a_{21}$ | Rolling element material | $a_{2w}$ |
|---|---|---|---|
| uncoated | 1 | 100Cr6 | 1 |
| IR & AR ATC | 1,5 | $Si_3N_4$ balls | 2 |

**$a_2$ life adjustment factor for special bearing material**
When employing high-quality bearing steel such as 100Cr6 (1.3505) the $a_2$ life adjustment factor 1 for bearing material is commonly used. Surface coatings and using ceramic rolling elements (silicon nitride) are increasing the $a_2$ factor.

**$a_3$ life adjustment factor for application conditions**
Operating conditions such as adequateness of lubrication at operating speed and temperature, absolute cleanliness at the lubricating location or existing particles are influencing lifetime.

## Life Time Calculation

The GH62 special grease with a basic oil viscosity of 150 mm²/s at 40 °C and 18 mm²/s at 100 °C has a good load behaviour and will always allow for an $a_3$ value >1 in case of clean conditions (see general catalogue). Having calculated the life of single bearings, that of sets, modules or units is calculated now.

**Life time of modules**:

$$L_{10\,unit} = \frac{1}{\left(\frac{i_{(A)}}{L_{10(A)}^{1.11}} + \frac{i_{(B)}}{L_{10(B)}^{1.11}}\right)^{0,9}} \text{ [h]} \qquad [2.39]$$

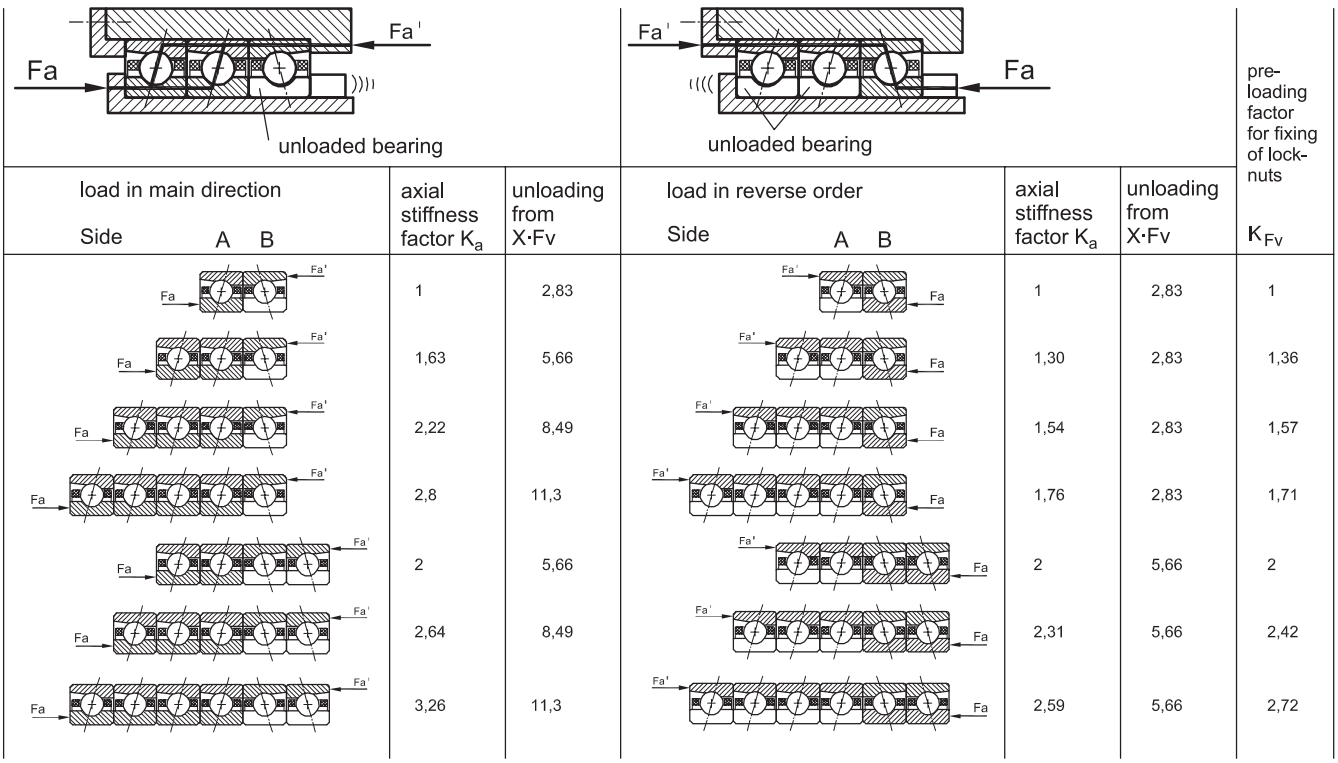
$i_{(A)}$: number of bearings in the same direction, mounting arrangement A
$i_{(B)}$: number of bearings in opposite direction, mounting arrangement B
$L_{10(A)}$: lifetime of bearings A
$L_{10(B)}$: lifetime of bearings B

Note:
The general reduction of the dynamic set load rating on page 22 according to [2.4] for the bearing units consisting of four bearings – two per direction – in accordance with DIN ISO 281 to the value $i^{0.7}$ x $C_a$, that is to $2^{0.7}$= 1.62 $C_a$ in this case, is linked with the following assumption: bearings with normal tolerances have slightly deviating bore and outer diameters within a set and thus varying load shares.
The bearings shown in this catalogue, however, are manufactured to the stricter tolerances of P4A or P2H and thus provide a certain guarantee for an even load behaviour. (Since the forces have been multiplied by the value $1/i^{0.7}$ in accordance with the equations [2.7] and table 2.2, the load rating $C_a$ of the single bearing according to p. 8 has to be used. If the type is not known, the load rating of the quadruplex set can be divided by 1.62 to obtain the $C_a$ of the single bearing).

## 2.2 Selection of preloads – axial stiffness and unloading factors in comparison

Operating the rolling elements with at least a minimum preload prevents an uneven wear of the balls. This wear is caused by a partial sliding instead of rolling of the balls with clearance in the no-load range between the bearing rings and the balls. In case of the O-arrangement (DB), starting at an outer axial load larger than 3 times the preload, the bearing facing away from the load becomes gradually unloaded. The balls in this bearing will start to slide with increasing load. (In case of the less frequently used X arrangement (DF), the bearing facing the load would be unloaded as load is applied to the inner ring.)

Relatively to the more frequently employed types of O arrangement, the X*Fv characteristic values for unloading the bearings which are not positioned directly in the flow of force, the axial stiffness factors in both load directions and the $K_{Fv}$ preload factor for determination of the tightening torque of the nut are given (see page 27). ($K_{Fv}$ does not take into account possible press fittings.) Bearing arrangements with a different number of bearings per direction result in a differing axial stiffness corresponding to the number of bearings in the respective direction.
Preload values Fv see page 9.




| load in main direction<br>Side A B | axial stiffness factor $K_a$ | unloading from X·Fv | load in reverse order<br>Side A B | axial stiffness factor $K_a$ | unloading from X·Fv | pre-loading factor for fixing of lock-nuts $K_{Fv}$ |
|---|---|---|---|---|---|---|
| Fa Fa' | 1 | 2,83 | Fa' Fa | 1 | 2,83 | 1 |
| Fa Fa' | 1,63 | 5,66 | Fa' Fa | 1,30 | 2,83 | 1,36 |
| Fa Fa' | 2,22 | 8,49 | Fa' Fa | 1,54 | 2,83 | 1,57 |
| Fa Fa' | 2,8 | 11,3 | Fa' Fa | 1,76 | 2,83 | 1,71 |
| Fa Fa' | 2 | 5,66 | Fa' Fa | 2 | 5,66 | 2 |
| Fa Fa' | 2,64 | 8,49 | Fa' Fa | 2,31 | 5,66 | 2,42 |
| Fa Fa' | 3,26 | 11,3 | Fa' Fa | 2,59 | 5,66 | 2,72 |

*Picture 2.2: Comparison of axial stiffness of similar bearings, unloading factors and fixing factors of locknuts for different arrangements.*

# 3. 60° Super Precision Angular Contact Thrust Ball Bearings

IBC angular contact thrust ball bearings have been developed to meet the demands of high thrust load for ball screw support application.
The large contact angle of 60° allows for high thrust load with high stiffness. The radial load should not extend 90 % of the preload.
As angular contact bearings can carry load only in one direction they therefore have to be adjusted to another bearing of the same kind.
The bearings are primarily supplied as single ones or in sets of 2 or 4 bearings to be mounted in back-to-back arrangements.
Angular contact thrust bearings are manufactured for universal matching, thus they can be rearranged and can be mounted in any arrangement.
As a standard single bearings have a medium or high preload, sets have a V-marking, single doesn't.

**Precision grades**: Bore and O.D. are manufactured to precision class P4A; axial run out $S_d$ and $S_{ia}$ are restricted to P2A (see page 10).

**Preload**
60°-Angular contact bearings are available with light, medium and high preload. They are apt for mounting in sets. For preloading we recommend the locknuts of series MMRB or MMRS (starting page 28). With tight fits the preload will be enhanced.

**Material of rings and balls**
Standard: bearing steel 100Cr6 (1.3505)

**Options**:
CB: ceramic $Si_3N_4$ with speed increase of 35 %
AC: rings thin dense chromium ATCoated (details to the option see page 34, glossary)

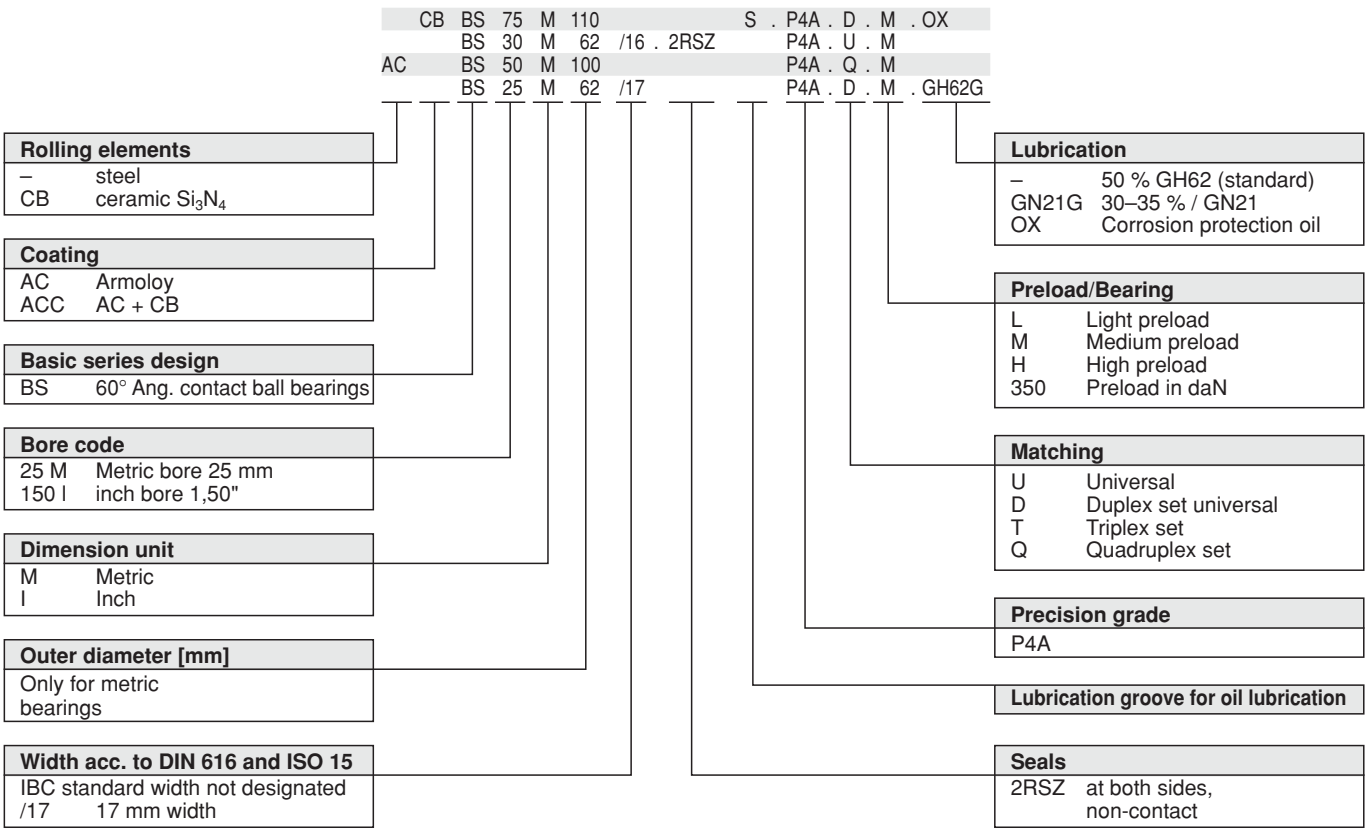
**Cage:** The one-piece glass fibre, reinforced polyamide cage is ball guided. As standard this is not designated. Themperature range –30 to 120 °C.

**Lubrication:**
The bearings are supplied with approved special greases as standard:
a) For lower and medium speed: with the high viscose BearLub GH62
b) For top speed range: with BearLub GN21. For this grease the speed limits are given in the data tables on page 9 and 22. For technical information on greases see page 34.

(Bearings with oil lubrication holes on request).

**Sealing**
Most of the bearings are supplied as open bearings and can be combined with labyrinth-seals of series S acc. to page 29.
The types on page 8 marked with + are also manufactured with non-touching seals .2RSZ.

## 3.1 Designation of IBC 60° Super Precision Angular Contact Ball Bearings

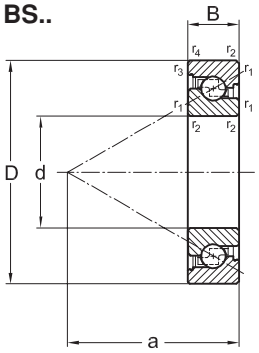



(not all combinations are possible)

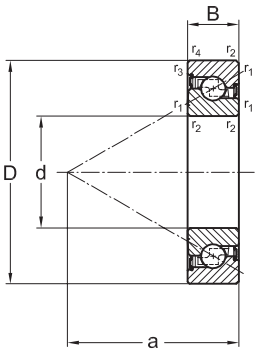
**54-901**

## 3.2 Super Precision 60° Angular Contact Thrust Ball Bearings metric, inch

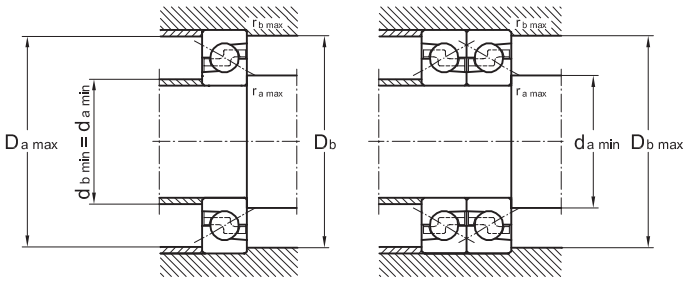
**BS..**




54-001 **BS..M..**




54-002 **BS..M...2RSZ**




54-601

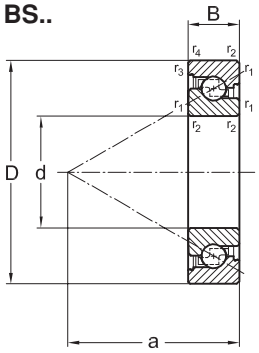
| Dimensions | | | | | | Basic bearing no. | Abutment and fillet dimensions | | | | | Basic load ratings | | Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| d | D | B | $r_{1,2}$ | $r_{34}$ | a | | $r_{amax}$ | $r_{bmax}$ | $d_{amin}$ | $D_{amax}$ | $D_{bmax}$ | $C_a$ | $C_{oa}$ | |
| | mm | | min | min | ~ | | | | mm | | | N | | kg |
| 17 | 47 | 15 | 0.6 | 0.6 | 36.5 | **BS17M47** | 1.0 | 0.6 | 26 | 38 | 40 | 25000 | 32100 | 0.13 |
| 20 | 47 | 14 | 0.6 | 0.6 | 36 | **BS20M47/14*** | 1.0 | 0.6 | 28 | 38 | 40 | 25000 | 32100 | 0.14 |
| 20 | 47 | 15 | 0.6 | 0.6 | 36.5 | **BS20M47** | 1.0 | 0.6 | 28 | 38 | 40 | 25000 | 32100 | 0.14 |
| 25 | 52 | 15 | 1.0 | 0.6 | 39 | **BS25M52** + | 1.0 | 0.6 | 34 | 44 | 45 | 26500 | 37000 | 0.22 |
| 25 | 62 | 15 | 1.0 | 0.6 | 46.5 | **BS25M62** + | 1.0 | 0.6 | 34 | 52 | 54 | 29200 | 42800 | 0.27 |
| 25 | 62 | 17 | 1.0 | 0.6 | 47.5 | **BS25M62/17*** + | 1.0 | 0.6 | 34 | 52 | 54 | 29200 | 42800 | 0.27 |
| 30 | 62 | 15 | 1.0 | 0.6 | 46 | **BS30M62** + | 1.0 | 0.6 | 38 | 52 | 54 | 29200 | 42800 | 0.25 |
| 30 | 62 | 16 | 1.0 | 0.6 | 47 | **BS30M62/16*** + | 1.0 | 0.6 | 38 | 52 | 54 | 29200 | 42800 | 0.25 |
| 30 | 72 | 15 | 1.0 | 0.6 | 56 | **BS30M72** + | 1.0 | 0.6 | 39 | 63 | 64 | 35600 | 55000 | 0.32 |
| 30 | 72 | 19 | 1.0 | 0.6 | 58 | **BS30M72/19*** + | 1.0 | 0.6 | 39 | 63 | 64 | 35600 | 55000 | 0.32 |
| 35 | 72 | 15 | 1.0 | 0.6 | 56 | **BS35M72** + | 1.0 | 0.6 | 43 | 63 | 64 | 35600 | 55000 | 0.29 |
| 35 | 72 | 17 | 1.0 | 0.6 | 57 | **BS35M72/17*** + | 1.0 | 0.6 | 43 | 63 | 64 | 35600 | 55000 | 0.34 |
| 35 | 100 | 20 | 1.0 | 0.6 | 75 | **BS35M100** + | 1.0 | 0.6 | 47 | 86 | 89 | 70500 | 116000 | 1.05 |
| 40 | 72 | 15 | 1.0 | 0.6 | 56 | **BS40M72** + | 1.0 | 0.6 | 48 | 63 | 64 | 35600 | 55000 | 0.28 |
| 40 | 90 | 20 | 1.0 | 0.6 | 71.5 | **BS40M90** + | 1.0 | 0.6 | 49 | 80 | 82 | 59000 | 90000 | 0.64 |
| 40 | 90 | 23 | 1.0 | 0.6 | 73 | **BS40M90/23*** + | 1.0 | 0.6 | 49 | 80 | 82 | 59000 | 90000 | 0.72 |
| 40 | 100 | 20 | 1.0 | 0.6 | 75 | **BS40M100** + | 1.0 | 0.6 | 49 | 86 | 89 | 70500 | 116000 | 1.00 |
| 45 | 75 | 15 | 1.0 | 0.6 | 60 | **BS45M75** | 1.0 | 0.6 | 53 | 65 | 67 | 37900 | 61400 | 0.29 |
| 45 | 100 | 20 | 1.0 | 0.6 | 75 | **BS45M100** + | 1.0 | 0.6 | 54 | 86 | 89 | 70500 | 116000 | 0.95 |
| 50 | 90 | 20 | 1.0 | 0.6 | 71.5 | **BS50M90** | 1.0 | 0.6 | 59 | 80 | 82 | 59000 | 90000 | 0.60 |
| 50 | 100 | 20 | 1.0 | 0.6 | 75 | **BS50M100** + | 1.0 | 0.6 | 59 | 86 | 89 | 70500 | 116000 | 0.89 |
| 55 | 90 | 15 | 1.0 | 0.6 | 73 | **BS55M90** + | 1.0 | 0.6 | 64 | 78 | 81 | 40700 | 74400 | 0.42 |
| 55 | 100 | 20 | 1.0 | 0.6 | 75 | **BS55M100** | 1.0 | 0.6 | 65 | 86 | 89 | 70500 | 116000 | 0.71 |
| 55 | 120 | 20 | 1.0 | 0.6 | 88 | **BS55M120** | 1.0 | 0.6 | 65 | 106 | 108 | 80800 | 137000 | 1.43 |
| 60 | 120 | 20 | 1.0 | 0.6 | 88 | **BS60M120** | 1.0 | 0.6 | 70 | 100 | 108 | 80800 | 137000 | 1.36 |
| 75 | 110 | 15 | 1.0 | 0.6 | 89 | **BS75M110** | 1.0 | 0.6 | 85 | 98 | 100 | 44500 | 93800 | 0.48 |
| 100 | 150 | 22.5 | 1.0 | 0.6 | 118 | **BS100M150** | 1.0 | 0.6 | 114 | 135 | 137 | 86400 | 192000 | 1.00 |
| 127 | 180 | 22.225 | 1.0 | 0.6 | 143 | **BS127M180** | 1.0 | 0.6 | 140 | 165 | 168 | 85200 | 239300 | 1.24 |
| 20 | 47 | 15.875 | 1.0 | 0.6 | 38 | **BS078 I** | 1.0 | 0.6 | 28 | 38 | 40 | 25000 | 32100 | 0.14 |
| 23.838 | 62 | 15.875 | 1.0 | 0.6 | 50 | **BS093 I** | 1.0 | 0.6 | 32 | 52 | 54 | 29200 | 42800 | 0.25 |
| 38.100 | 72 | 15.875 | 1.0 | 0.6 | 56 | **BS150 I** | 1.0 | 0.6 | 46 | 62 | 64 | 35600 | 55000 | 0.28 |
| 44.475 | 76.2 | 15.875 | 1.0 | 0.6 | 60 | **BS175 I** | 1.0 | 0.6 | 52 | 66 | 68 | 37900 | 61400 | 0.30 |

* Should no more be used in new applications.

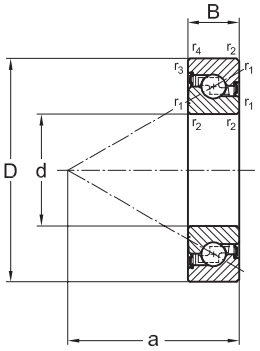
\+ with seals: suffix .2RSZ

# Super Precision 60° Angular Contact Thrust Ball Bearings metric, inch

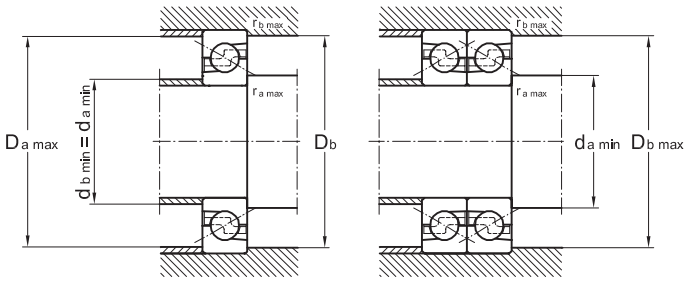
**BS..**




54-001 **BS..M..**




54-002 **BS..M...2RSZ**




54-601

| d | Preload Fv | | | Axial stiffness $S_{ax}$* | | | Limiting speed (grease $n_F$**) | | | Drag torque $M_r$*** | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | L | M | H | L | M | H | L | M | H | L | M | H |
| mm | N | | | N/µm | | | $min^{-1}$ | | | Nm | | |
| 17 | 875 | 1750 | 3500 | 460 | 580 | 740 | 14300 | 12500 | 6200 | 0.04 | 0.08 | 0.16 |
| 20 | 875 | 1750 | 3500 | 460 | 580 | 740 | 14300 | 12500 | 6200 | 0.04 | 0.08 | 0.16 |
| 20 | 875 | 1750 | 3500 | 460 | 580 | 740 | 14300 | 12500 | 6200 | 0.04 | 0.08 | 0.16 |
| 25 | 1000 | 1900 | 3900 | 500 | 630 | 800 | 12500 | 10900 | 5400 | 0.05 | 0.07 | 0.18 |
| 25 | 1125 | 2250 | 4500 | 650 | 830 | 1050 | 10500 | 9100 | 4500 | 0.06 | 0.11 | 0.22 |
| 25 | 1125 | 2250 | 4500 | 650 | 830 | 1050 | 10500 | 9100 | 4500 | 0.06 | 0.11 | 0.22 |
| 30 | 1125 | 2250 | 4500 | 650 | 830 | 1050 | 10500 | 9100 | 4500 | 0.06 | 0.11 | 0.22 |
| 30 | 1125 | 2250 | 4500 | 650 | 830 | 1050 | 10500 | 9100 | 4500 | 0.06 | 0.11 | 0.22 |
| 30 | 1700 | 3400 | 6800 | 780 | 990 | 1260 | 8600 | 7500 | 3700 | 0.06 | 0.11 | 0.22 |
| 30 | 1700 | 3400 | 6800 | 780 | 990 | 1260 | 8600 | 7500 | 3700 | 0.06 | 0.11 | 0.22 |
| 35 | 1700 | 3400 | 6800 | 780 | 990 | 1260 | 8600 | 7500 | 3700 | 0.06 | 0.11 | 0.22 |
| 35 | 1700 | 3400 | 6800 | 780 | 990 | 1260 | 8600 | 7500 | 3700 | 0.06 | 0.11 | 0.22 |
| 35 | 3200 | 6400 | 12800 | 1090 | 1390 | 1760 | 6400 | 5600 | 2800 | 0.13 | 0.26 | 0.51 |
| 40 | 1700 | 3400 | 6800 | 780 | 990 | 1260 | 8600 | 7500 | 3700 | 0.06 | 0.11 | 0.22 |
| 40 | 2500 | 5000 | 10000 | 1035 | 1320 | 1680 | 6900 | 6000 | 3000 | 0.12 | 0.24 | 0.48 |
| 40 | 2500 | 5000 | 10000 | 1035 | 1320 | 1680 | 6900 | 6000 | 3000 | 0.12 | 0.24 | 0.48 |
| 40 | 3200 | 6400 | 12800 | 1090 | 1390 | 1760 | 6400 | 5600 | 2800 | 0.13 | 0.26 | 0.51 |
| 45 | 1700 | 3400 | 6800 | 890 | 1090 | 1390 | 8000 | 7000 | 3500 | 0.07 | 0.14 | 0.28 |
| 45 | 3200 | 6400 | 12800 | 1090 | 1390 | 1760 | 6400 | 5600 | 2800 | 0.13 | 0.26 | 0.51 |
| 50 | 2500 | 5000 | 10000 | 1035 | 1320 | 1680 | 6900 | 6000 | 3000 | 0.12 | 0.24 | 0.48 |
| 50 | 3200 | 6400 | 12800 | 1090 | 1390 | 1760 | 6400 | 5600 | 2800 | 0.13 | 0.26 | 0.51 |
| 55 | 1975 | 3950 | 7900 | 1030 | 1310 | 1660 | 6900 | 6000 | 3000 | 0.11 | 0.21 | 0.41 |
| 55 | 3200 | 6400 | 12800 | 1090 | 1390 | 1760 | 6400 | 5600 | 2800 | 0.13 | 0.26 | 0.51 |
| 55 | 3900 | 7800 | 15600 | 1340 | 1690 | 2150 | 5300 | 4600 | 2300 | 0.17 | 0.34 | 0.68 |
| 60 | 3900 | 7800 | 15600 | 1340 | 1690 | 2150 | 5300 | 4600 | 2300 | 0.17 | 0.34 | 0.68 |
| 75 | 2500 | 5000 | 10000 | 1280 | 1620 | 2060 | 5200 | 4500 | 2250 | 0.13 | 0.25 | 0.50 |
| 100 | 5250 | 10500 | 21000 | 1800 | 2280 | 2900 | 3800 | 3300 | 1650 | 0.27 | 0.54 | 1.09 |
| 127 | 4550 | 9100 | 18200 | 2100 | 2480 | 3160 | 3100 | 2700 | 1350 | 0.27 | 0.54 | 1.08 |
| 20 | | | 3500 | | | 750 | | | 4950 | | | 0.17 |
| 23.838 | | | 4500 | | | 1050 | | | 3450 | | | 0.23 |
| 38.100 | | | 7000 | | | 1300 | | | 3000 | | | 0.23 |
| 44.475 | | | 7000 | | | 1380 | | | 2850 | | | 0.28 |

* For multiple arrangement see picture 2.2: factors $K_a$
** Stated values are for Duplex sets in O-arrangement; for X-arrangement factor 0.6; for Quad sets QBT 0.75; QBC 0.7; max. rotational speed for L and M are valid for lubrication with GN21G
*** For multiple arrangement see picture 2.2: factor $K_{Fv}$

## 3.3 Tolerances of Super Precision 60° Angular Contact Thrust Bearings

Data table in µm

| | Inner ring [mm] | Precision | Ø 0.6 to 10 | 10 18 | 18 30 | 30 50 | 50 80 | 80 120 | 120 150 |
|---|---|---|---|---|---|---|---|---|---|
| $\Delta d_{mp}$ | Max. deviation of the mean bore diameter from the nominal | P4A | –4 | –4 | –4 | –5 | –5 | –6 | –7.5 |
| $K_{ia}$ | Radial runout of assembled bearing inner ring | P4A | 2.5 | 2.5 | 2.5 | 4 | 4 | 5 | 6 |
| $S_d$ | Side face runout referring to bore of inner ring | P2A | 1.3 | 1.3 | 1.3 | 1.3 | 1.3 | 2.5 | 2.5 |
| $S_{ia}$ | Side face runout with reference to the raceway of the assembled bearing inner ring | P2A | 1.3 | 1.3 | 2.5 | 2.5 | 2.5 | 2.5 | 2.5 |
| $\Delta B_s$ | Deviation of single inner ring width | P4A, P2A | –200 | –200 | –200 | –200 | –250 | –320 | –370 |
| $V_{Bs}$ | Ring width variation | P4A | 2.5 | 2.5 | 2.5 | 2.5 | 4 | 4 | 5 |

| | Outer ring [mm] | Precision | Ø 18 to 30 | 30 50 | 50 80 | 80 120 | 120 150 | 150 180 | 180 250 |
|---|---|---|---|---|---|---|---|---|---|
| $\Delta D_{mp}$ | Max. deviation of mean outside diameter to nominal | P4A, P2H | –5 | –5 | –5 | –7.5 | –9 | –10 | –10 |
| $K_{ea}$ | Radial runout of assembled bearing outer ring | P4A | 4 | 5 | 5 | 5 | 7 | 7.5 | 10 |
| $S_D$ | Variation in inclination of outside cylindrical surface to outer ring side face | P2A | 1.3 | 1.3 | 1.3 | 2.5 | 2.5 | 2.5 | 3.8 |
| $S_{ea}$ | Side face runout referring to raceway of assembled bearing outer ring | P2A | 2.5 | 2.5 | 3.8 | 5 | 5 | 5 | 6.4 |

The width tolerances of the outer ring ($\Delta Cs$, $Vc_s$) correspond to those of inner ring ($\Delta_{Bs}$; $V_{Bs}$).
The total width tolerance of a bearing set is the sum of the ones of the single bearings.

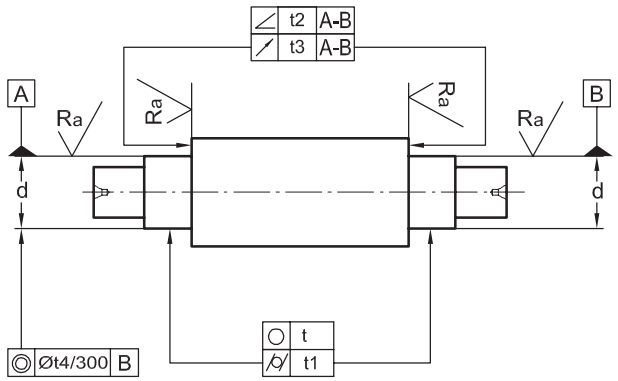
## 3.4 Proposed fits for Super Precision 60° Angular Contact Thrust Bearings

| Nominal diameter d shaft [mm] | Precision | Ø | – | 10 | 18 | 30 | 50 | 80 | 120 |
|---|---|---|---|---|---|---|---|---|---|
| | | incl. | 10 | 18 | 30 | 50 | 80 | 120 | 180 |
| Shaft tolerance | P4A | max. | –3 | –3 | –3 | –4 | –4 | –5 | –6 |
| $\Delta d_1$ fixed bearing | | min. | –7 | –7 | –7 | –8 | –9 | –10 | –12 |
| **Nominal diameter** | **Precision** | **Ø** | 18 | 30 | 50 | 80 | 120 | 150 | 180 |
| **D housing [mm]** | | incl. | 30 | 50 | 80 | 120 | 150 | 180 | 250 |
| Housing tolerance | P4A | max. | +5 | +5 | +5 | +5 | +7 | +7 | +7 |
| $\Delta D_G$ fixed bearing | | min. | 0 | 0 | 0 | –1 | –1 | –2 | –2 |

*Table 3.4: Summary of tolerances for adjacent parts for Super Precision 60° Angular Contact Thrust Bearings.*

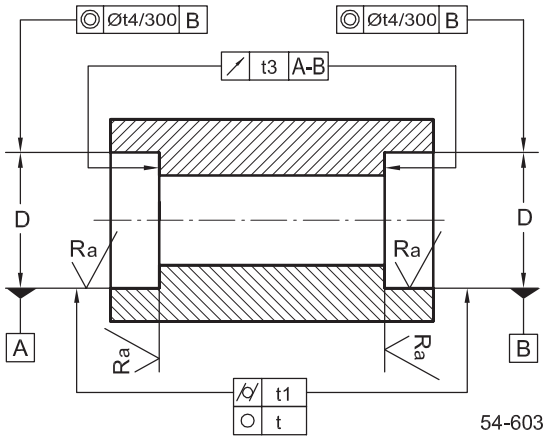
## 3.5 Tolerances of associated parts for Precision Angular Contact Thrust Bearings

Accuracy of form for shafts




54-602

Accuracy of form for housings




54-603

| Characteristic | Tolerance Symbol | Tolerance Designation | Accuracy of form, Tolerance grade, Roughness class for Tolerance class of bearings | | |
|---|---|---|---|---|---|
| | | | P5 | P4A | P2A |
| Circularity | ○ | t | IT3/2 | IT2/2 | IT1/2 |
| Cylindricity | ⌭ | t1 | IT3/2 | IT2/2 | IT1/2 |
| Angularity | ∠ | t2 | – | IT3/2 | IT2/2 |
| Runout | ↗ | t3 | IT3 | IT3 | IT2 |
| Coaxiality | ◎ | t4 | IT5 | IT4 | IT3 |
| Roughness $R_a$ | | | | | |
| d ≦ 80 mm | | – | N4 | N4 | N3 |
| d > 80 mm | | – | N5 | N5 | N4 |

*Table 3.5.1: Accuracy of form for shafts*

| Characteristic | Tolerance Symbol | Tolerance Designation | Accuracy of form, Tolerance grade, Roughness class for Tolerance class of bearings | | |
|---|---|---|---|---|---|
| | | | P5 | P4A | P2A |
| Circularity | ○ | t | IT3/2 | IT2/2 | IT1/2 |
| Cylindricity | ⌭ | t1 | IT3/2 | IT2/2 | IT1/2 |
| Runout | ↗ | t3 | IT3 | IT3 | IT2 |
| Coaxiality | ◎ | t4 | IT5 | IT4 | IT3 |
| Roughness $R_a$ | | | | | |
| D ≦ 80 mm | | – | N5 | N5 | N4 |
| 80 < D ≦ 250 | | – | N6 | N6 | N5 |
| D < 250 mm | | – | N7 | N7 | N6 |

*Table 3.5.2: Accuracy of form for housings*

| ISO Basic Tolerance Grades acc. to DIN 7151 | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Nominal Diameter | | Tolerance grades | | | | | | | |
| Over | incl. | IT0 | IT1 | IT2 | IT3 | IT4 | IT5 | IT6 | IT7 |
| mm | | µm | | | | | | | |
| 6 | 10 | 0.6 | 1 | 1.5 | 2.5 | 4 | 6 | 9 | 15 |
| 10 | 18 | 0.8 | 1.2 | 2 | 3 | 5 | 8 | 11 | 28 |
| 18 | 30 | 1 | 1.5 | 2.5 | 4 | 6 | 9 | 13 | 21 |
| 30 | 50 | 1 | 1.5 | 2.5 | 4 | 7 | 11 | 16 | 25 |
| 50 | 80 | 1.2 | 2 | 3 | 5 | 8 | 13 | 19 | 30 |
| 80 | 120 | 1.5 | 2.5 | 4 | 6 | 10 | 15 | 22 | 35 |
| 120 | 180 | 2 | 3.5 | 5 | 8 | 12 | 18 | 25 | 40 |
| 180 | 250 | 3 | 4.5 | 7 | 10 | 14 | 20 | 29 | 46 |
| 250 | 315 | 4 | 6 | 8 | 12 | 16 | 23 | 32 | 52 |
| 315 | 400 | 5 | 7 | 9 | 13 | 18 | 25 | 36 | 57 |
| 400 | 500 | 6 | 8 | 10 | 15 | 20 | 27 | 40 | 63 |

*Table 3.5.1: Basic tolerance grades acc. to DIN 7151*

Roughness $R_a$ of the axial shoulder at shaft, housing or spacers:
N6 = 0,8 µm

| Surface roughness Class | Roughness |
|---|---|
| | µm |
| N3 | 0.1 |
| N4 | 0.2 |
| N5 | 0.4 |
| N6 | 0.8 |
| N7 | 1.6 |

*Table 3.5.4: Roughness*

## 4. Precision Bearing Units with 60°-Angular Contact Thrust Bearings – Selection Criteria

**Applications** of units with labyrinth seals greased for life: Ball screws (bs), satellite roller screws, worm gear drives (e. g. for circular tables, index tables) special purposes.

Basically the units are used on ball screws in machine tool (boring-, milling-, turning-, grinding-, spark erosion machines, machining centers, endfacing machines, gear cutting and finishing machines), measuring machines, industrial robots, sheet metal cutting machines, (presses, levelling machines, bending centers, laser cutting machines, laser marking machines, forming machines), woodworking machines and special purpose machines.

The big amount of applications have created a unit assembly system with their different needs regarding
– axial stiffness and capacity
– reduced heat development by less friction (labyrinth seal)
– speed (also with ceramic balls available)
– running accuracy
– form (flange or pillow block)
– arrangement.

**Great flexibility**
Some precision bearing units can be supplied with the same outside dimensions but with different bore sizes. This has been very helpful in the design of machine families of different length and table stroke, where the ball screws of smaller dia. would have reached the critical speed and therefore a bigger one had to be used. (Bearings with same outside diameter and width but different bore allow a standardisation of adjacent parts at low cost).

**Simply mounting**
Whereas at the beginning (a) ball screw bearings had to be built in separately with other parts, now the ready-to-mount units are the state of art. The mounting of complete subassemblies eases and speeds up the mounting. The avoidance of an axial reference face in the housing bore simplifies surrounding parts.

For the flange housings only a hole with a machined wall square to the housing axes is needed. The unit can then radially still be adjusted (b).

Users who machine the centering hole for the flange into their supports on CNC machines with the needed accuracy mount as shown in (c).

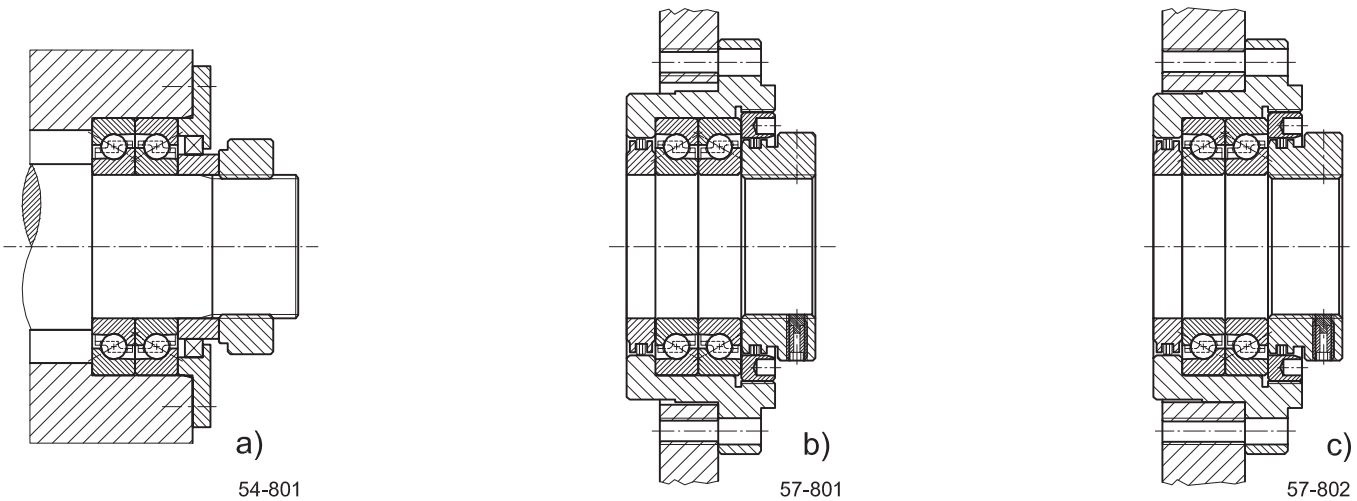



*Figure 4.1: Development to easier to machine and to mount applications for ball screw supports.*

## Precision Bearing Units with 60°-Angular Contact Thrust Bearings – Selection Criteria

**Easy-to-mount BSBU, BSBU-M Precision Cartridge Units**
The cartridge units flattened on both sides are characterized by easy handling in the planning and mounting phase.

The fact that they are flattened on both sides results in a low height, corresponding to the cartridge diameter. It was chosen so that in case of usual grading of the shaft seat, the cartridge outside diameter of the nut is slightly smaller than the bearing unit seat diameter.

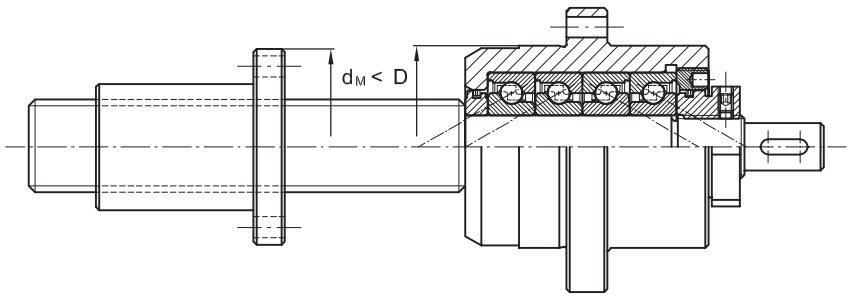
When service is necessary, in case of a machine tool crash, the mounting personnel on site will appreciate that the module is easy to change (ball screw + bearing unit).

Owing to the skilfully selected diameter ratio (see drawing 57-803 and 57-804), it is possible to pull out the entire module easily.

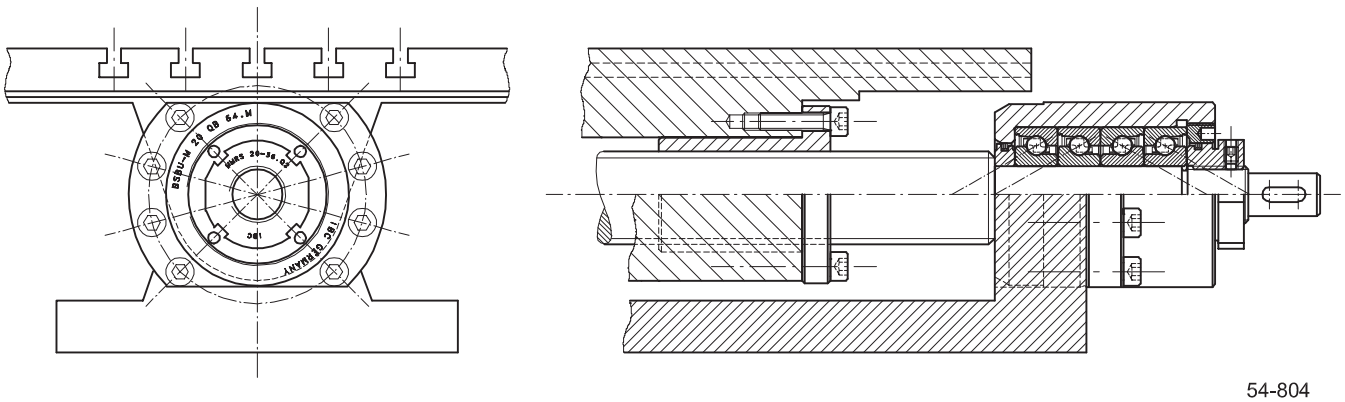
In the same manner, a pre-assembled module is built in again quickly, so that maintenance times and thus standstill times are reduced.

The locknut with matching labyrinth seal, which has already been integrated into the BSBU-M series, allows for simple and secure preloading of precision cartridge units.

In case the cartridge unit has to be mounted from inside against a wall the locknut MMRS and the sealing S can be exchanged vice versa. The same applies for the pillow block series BSPB-M… as well as for the adapter of the nut bearing units BNBU and BNPB.




57-803



54-804

**Advantages of pillow block units**
Whereas cartridge units had to be placed on supports in the past, the pillow block units are saving construction space and mounting time.

The tight-tolerance bases of the fixed and floating end units with the same reference dimensions of the BSPB, BSPB-M and BLPB series have proven to be beneficial (see abutment dimensions on page 24). The contact edge for the units can thus be machined with those of the guides. Pre-drilled pin-holes allow accurate fixing.

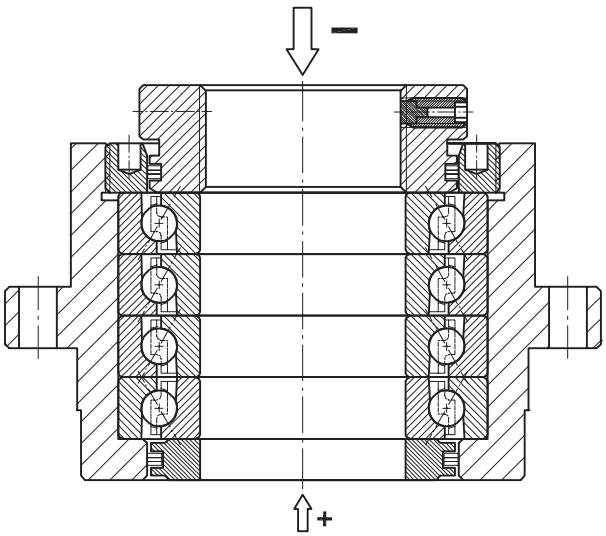
**Mounting of driven nuts**
IBC precision bearing units of the series BNBU and BNPB with integrated adapter are available for mounting on ball screw nuts (according to DIN 69051). These are used in particular for long ball screws. It is an advantage to drive the nut for its less accelerated mass.

A further advantage of a driven spindle clamped between two fixed end bearings is the fact that in case of an alternative nut drive, the bearings do not need to accommodate stretching loads.

The stretching of the spindle to compensate elongation when it warms up can easily be carried out there at the clamping points.

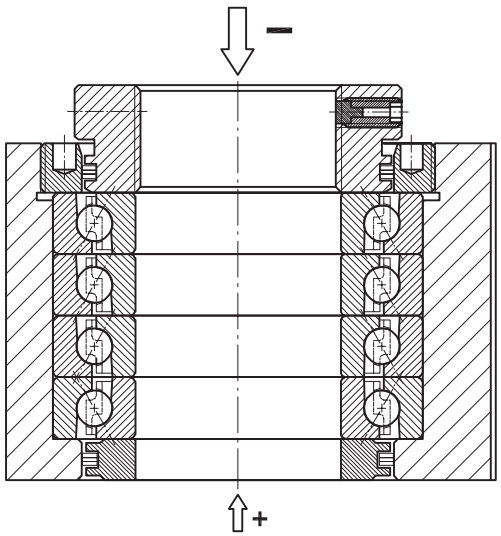
Depending on the requirements regarding stiffness, limit rotational speed or drag torque, units can be chosen with light (L), medium (M) or heavy (H) preload. The order code consists of the basic type and a suffix for the preload. For adapter units, it is possible to choose the hole pattern and the way of mounting, the cartridge form can additionally be chosen.

For bearing units with an integrated lubrication system for the ball screw nut (BNBUS) separate data sheets are available.




57-805

*Figure 4.2: BSBU-M 40Q128 QBTM with arrangement Ø Ø Ø ⦰*




57-806

*BSPB.M 40Q65 QBTM with arrangement Ø Ø Ø ⦰*

**Units for predominating loads in one direction**
Bearings of vertical or inclined spindles, which have to support a sometimes-considerable weight of the table, one direction may be predominant for all load cycles owing to inertia. In that case a unit with the bearing arrangement 3:1 (with the designation QBT before the preload) can be selected (see figure 4.2). The load shares of the single bearing result from the equations (page 5), stiffness, unloading values and tightening factors in figure 2.2, page 6 in connection with the specification for single bearings according to pages 8 and 9.

## 4.1 Designation of IBC Precision Bearing Units for Ball Screws

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BSBU | -M | 25 | D | B | 88. | | | | | | | | M | | | |
| BSBU | -M | 40 | Q | B | 128. | | | | | | | QBT | M | | | |
| BSPB | | 30 | Q | | 50. | | | | | | | | L | | | |
| BNBU | | 63 | Q | B | 138. | | | | 2 | | | | L | -M2 | | |
| BNPB | | 95 | D | | 105. | | | | 2 | | | | M | -M2 | | |
| BLPB | | 20 | N | | 32. | 2RS | | | | | | | | | | |

**Bearing Units for Ball Screws**
- BS Fixed End Unit for Spindle Ends
- BN Bearing Unit for BS Nuts
- BL Floating End Unit

**Execution**
- BU Flange Unit
- PB Pillow Block

**Integrated Locknut**
- M integrated
- – order locknut separately (MMRB)

**Inner Diameter [mm]**

**Design**
- D Duplex-Set
- Q Quadruplex-Set
- N Needle Roller for Floating End Units

**Form of Flange**
- A round (at BLPB)
- B flattened on both sides
- C flattened on one side

**Reference dimension**
- flange seat diameter
- center height of the pillow block

**Lubrication**
- – 50 % GH62 (standard)
- GN21G 30–35 % / GN21

**Mounting of adapter**
- for BN units
- M2 as shown
- M1 mounted when twisted 180°

**Preload/Bearing**
- L Light preload
- M Medium preload
- H High preload

**Bearing arrangement**
- DB, QBC standard
- QBT see picture 4.2
- DT Tandem Bearings for spring preloaded units

**Adapter sleeve (DIN 69051)**
- 1 hole pattern 1
- 2 hole pattern 2

**Sealing**
- 2RS Sealing for floating end units
- – Labyrinth sealing

**Options (prefixes)**
- CB with ceramic balls $Si_3N_4$
- AC with ATCoating of bearings

Not all combinations are available

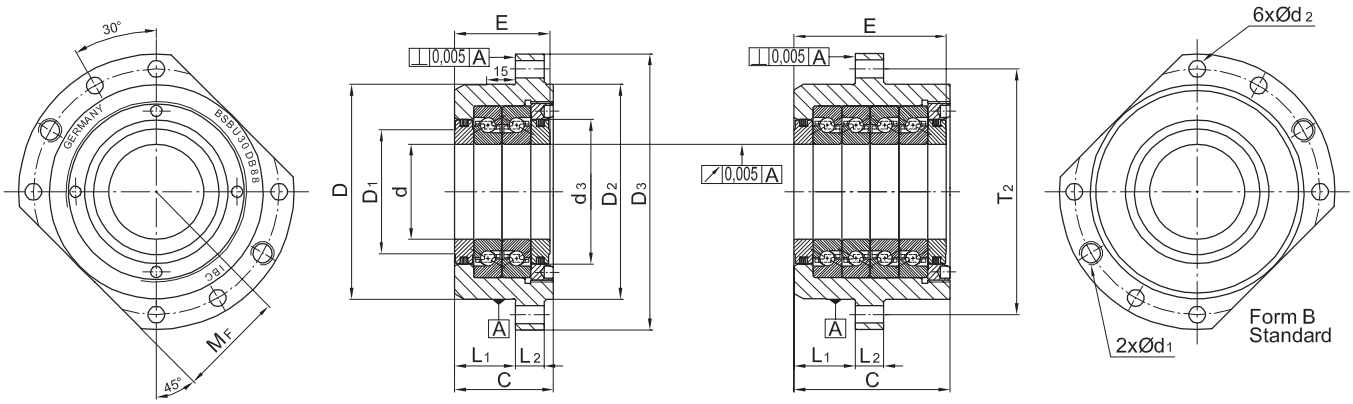
57-901

For fixed end bearing units for higher speed, also bearings with ceramic balls (CB) can be offered. On request also with ATCoat (AC) for bearings.

Bearing units with more bearings on request, as well as special housings with integrated coupling.

**Lubrication**
Bearings with standard lubrication GH 62; without suffix.
Bearings with grease for higher speed: suffix GN21G (for more than 60 % of mentioned max. speed).
Grease details see page 34.

## 4.2 High Precision Flange Units for Spindle Ends of Ball Screws Support Bearings




**BSBU..DB..** **BSBU..QB..** 57-001

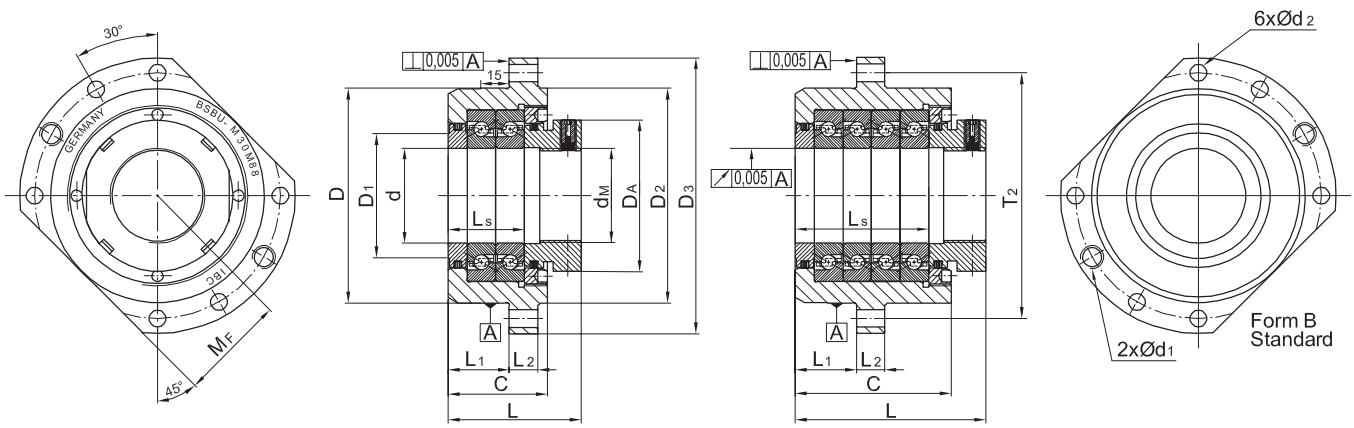
| Shaft | Unit | d | D | $M_F$ | C | E | $d_1$ | $d_2$ | $d_3$ | $D_1$ | $D_2$ | $D_3$ | Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | | mm | | | | | | | | | | | kg |
| **Medium Serie** | | | | | | | | | | | | | |
| **17** | **BSBU 17 DB 64** | 17 | 64 | 32 | 47 | 44 | M8 | 6.6 | 36 | 26 | 64 | 90 | 1.1 |
| | **BSBU 17 QB 64** | | | | 77 | 74 | | | | | | | 1.7 |
| **20** | **BSBU 20 DB 64** | 20 | | | 47 | 44 | | | | | | | 1.1 |
| | **BSBU 20 QB 64** | | | | 77 | 74 | | | | | | | 1.7 |
| **25** | **BSBU 25 DB 88** | 25 | 88 | 44 | 52 | 50 | M12 | 9.2 | 50 | 40 | 88 | 120 | 2.3 |
| | **BSBU 25 QB 88** | | | | 82 | 80 | | | | | | | 3.5 |
| **30** | **BSBU 30 DB 88** | 30 | | | 52 | 50 | | | | | | | 2.2 |
| | **BSBU 30 QB 88** | | | | 82 | 80 | | | | | | | 3.4 |
| | **BSBU 30 DB 98** | | 98 | 49 | 52 | 50 | | | 60 | 46 | 98 | 130 | 3.3 |
| | **BSBU 30 QB 98** | | | | 82 | 80 | | | | | | | 4.7 |
| **35** | **BSBU 35 DB 98** | 35 | | | 52 | 50 | | | | | | | 3.2 |
| | **BSBU 35 QB 98** | | | | 82 | 80 | | | | | | | 4.6 |
| **40** | **BSBU 40 DB 98** | 40 | | | 52 | 50 | | | | 50 | | | 3.1 |
| | **BSBU 40 QB 98** | | | | 82 | 80 | | | | | | | 4.5 |
| **45** | **BSBU 45 DB 98** | 45 | | | 52 | 50 | | | 60 | 55 | | | 3.8 |
| | **BSBU 45 QB 98** | | | | 82 | 80 | | | | | | | 4.6 |
| **55** | **BSBU 55 DB 113** | 55 | 113 | 56.5 | 52 | 50 | | | 76 | 68 | 113 | 145 | 3.4 |
| | **BSBU 55 QB 113** | | | | 82 | 80 | | | | | | | 5.1 |
| **75** | **BSBU 75 DB 138** | 75 | 138 | 69 | 54 | 50 | | | 99 | 86 | 138 | 170 | 4.1 |
| | **BSBU 75 QB 138** | | | | 84 | 80 | | | | | | | 6.3 |
| **Heavy Serie** | | | | | | | | | | | | | |
| **35** | **BSBU 35 DB 128** | 35 | 128 | 64 | 66 | 64 | M14 | 11.4 | 76 | 66 | 128 | 165 | 6.3 |
| | **BSBU 35 QB 128** | | | | 106 | 104 | | | | | | | 10.1 |
| **40** | **BSBU 40 DB 128** | 40 | | | 66 | 64 | | | | | | | 6.1 |
| | **BSBU 40 QB 128** | | | | 106 | 104 | | | | | | | 9.7 |
| **45** | **BSBU 45 DB 128** | 45 | | | 66 | 64 | | | | | | | 6.0 |
| | **BSBU 45 QB 128** | | | | 106 | 104 | | | | | | | 9.5 |
| **50** | **BSBU 50 DB 128** | 50 | | | 66 | 64 | | | | | | | 5.9 |
| | **BSBU 50 QB 128** | | | | 106 | 104 | | | | | | | 9.3 |
| **55** | **BSBU 55 DB 148** | 55 | 148 | 74 | 66 | 64 | | | 99 | 86 | 148 | 185 | 8.2 |
| | **BSBU 55 QB 148** | | | | 106 | 104 | | | | | | | 12.9 |
| **60** | **BSBU 60 DB 148** | 60 | | | 66 | 64 | | | | | | | 7.9 |
| | **BSBU 60 QB 148** | | | | 106 | 104 | | | | | | | 12.5 |

| Tolerances | d | D | E (Duplex) | E (Quad) |
|---|---|---|---|---|
| BSBU 17 DB/QB 64 – BSBU 30 DB/QB 88 | 0 / – 0.005 | 0 / – 0.013 | 0 / – 1.02 | 0 / – 1.52 |
| BSBU 30 DB/QB 98 – BSBU 45 DB/QB 98 | 0 / – 0.005 | 0 / – 0.015 | 0 / – 1.02 | 0 / – 1.52 |
| BSBU 55 DB/QB 113 – BSBU 60 DB/QB 148 | 0 / – 0.005 | 0 / – 0.018 | 0 / – 1.02 | 0 / – 1.52 |

Technical data see page 22.

Recommended locknuts serie MMRB... starting on page 30.

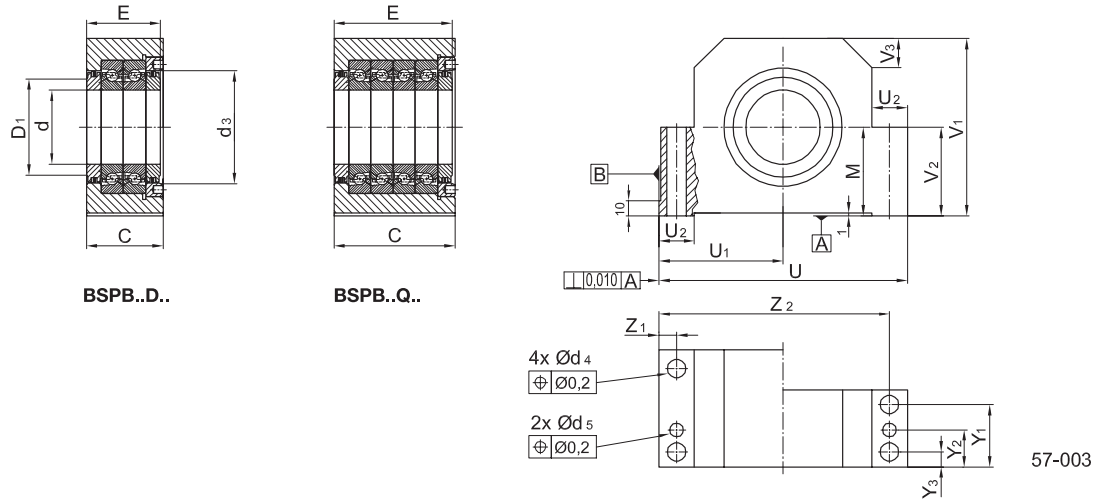
## . . . for Spindle Ends of Ball Screw Support Bearings with integrated lock nut




**BSBU-M..DB..** **BSBU-M..QB..** 57-002

| $T_2$ | $L_1$ | $L_2$ | $D_A$ | $L_S$ | L | Integrated locknut see page 28 | **Unit** | **Shaft** |
|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | mm |
| **Medium Serie** | | | | | | | | |
| 76 | 32 | 13 | 38 | 37 | 57 | MMRS 17-36 | **BSBU-M 17 DB 64** | 17 |
| | | | | 64 | 87 | | **BSBU-M 17 QB 64** | |
| | | | | 37 | 57 | MMRS 20-36 | **BSBU-M 20 DB 64** | 20 |
| | | | | 67 | 87 | | **BSBU-M 20 QB 64** | |
| 102 | | 15 | 58 | 40 | 65 | MMRS 25-50 | **BSBU-M 25 DB 88** | 25 |
| | | | | 70 | 95 | | **BSBU-M 25 QB 88** | |
| | | | | 40 | 65 | MMRS 30-50 | **BSBU-M 30 DB 88** | 30 |
| | | | | 70 | 95 | | **BSBU-M 30 QB 88** | |
| 113 | | | 70 | 40 | 68 | MMRS 30-60 | **BSBU-M 30 DB 98** | |
| | | | | 70 | 98 | | **BSBU-M 30 QB 98** | |
| | | | | 40 | 68 | MMRS 35-60 | **BSBU-M 35 DB 98** | 35 |
| | | | | 70 | 98 | | **BSBU-M 35 QB 98** | |
| | | | | 40 | 68 | MMRS 40-60 | **BSBU-M 40 DB 98** | 40 |
| | | | | 70 | 98 | | **BSBU-M 40 QB 98** | |
| | | | | 40 | 68 | MMRS 45-60 | **BSBU-M 45 DB 98** | 45 |
| | | | | 70 | 98 | | **BSBU-M 45 QB 98** | |
| 129 | | | 80 | 40 | 70 | MMRS 55-76 | **BSBU-M 55 DB 113** | 55 |
| | | | | 70 | 100 | | **BSBU-M 55 QB 113** | |
| 154 | | | 105 | 40 | 70 | MMRS 75-99 | **BSBU-M 75 DB 138** | 75 |
| | | | | 70 | 100 | | **BSBU-M 75 QB 138** | |
| **Heavy Serie** | | | | | | | | |
| 146 | 43.5 | 17 | 80 | 52 | 82 | MMRS 35-76 | **BSBU-M 35 DB 128** | 35 |
| | | | | 92 | 122 | | **BSBU-M 35 QB 128** | |
| | | | | 52 | 82 | MMRS 40-76 | **BSBU-M 40 DB 128** | 40 |
| | | | | 92 | 122 | | **BSBU-M 40 QB 128** | |
| | | | | 52 | 82 | MMRS 45-76 | **BSBU-M 45 DB 128** | 45 |
| | | | | 92 | 122 | | **BSBU-M 45 QB 128** | |
| | | | | 52 | 82 | MMRS 50-76 | **BSBU-M 50 DB 128** | 50 |
| | | | | 92 | 122 | | **BSBU-M 50 QB 128** | |
| 166 | | | | 52 | 82 | MMRS 55-99 | **BSBU-M 55 DB 148** | 55 |
| | | | | 92 | 122 | | **BSBU-M 55 QB 148** | |
| | | | 105 | 52 | 82 | MMRS 60-99 | **BSBU-M 60 DB 148** | 60 |
| | | | | 92 | 122 | | **BSBU-M 60 QB 148** | |

## 4.3 High Precision Pillow Block Units for Spindle Ends of Ball Screw Support Bearings



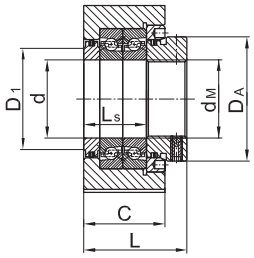

| Shaft | Unit | d | M | C | E | $d_3$ | $D_1$ | U | $U_1$ | $U_2$ | $V_1$ | $V_2$ | V3 | Weight |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | | mm | | | | | | | | | | | | kg |
| **Medium Serie** | | | | | | | | | | | | | | |
| **17** | **BSPB 17 D 32** | 17 | 32 | 47 | 44 | 36 | 26 | 94 | 47 | 17 | 62 | 32 | 15 | 1.5 |
| | **BSPB 17 Q 32** | | | 77 | 74 | | | | | | | | | 2.6 |
| **20** | **BSPB 20 D 32** | 20 | | 47 | 44 | | | | | | | | | 1.5 |
| | **BSPB 20 Q 32** | | | 77 | 74 | | | | | | | | | 2.6 |
| **25** | **BSPB 25 D 42** | 25 | 42 | 52 | 50 | 50 | 40 | 125 | 62.5 | 20 | 82 | 42 | | 2.8 |
| | **BSPB 25 Q 42** | | | 82 | 80 | | | | | | | | | 4.6 |
| **30** | **BSPB 30 D 42** | 30 | | 52 | 50 | | | | | | | | | 2.7 |
| | **BSPB 30 Q 42** | | | 82 | 80 | | | | | | | | | 4.5 |
| | **BSPB 30 D 50** | | 50 | 52 | 50 | 60 | 46 | 136 | 68 | 20.5 | 95 | 50 | | 3.9 |
| | **BSPB 30 Q 50** | | | 82 | 80 | | | | | | | | | 6.3 |
| **35** | **BSPB 35 D 50** | 35 | | 52 | 50 | | | | | | | | | 3.8 |
| | **BSPB 35 Q 50** | | | 82 | 80 | | | | | | | | | 6.2 |
| **40** | **BSPB 40 D 50** | 40 | | 52 | 50 | | 50 | | | | | | | 3.7 |
| | **BSPB 40 Q 50** | | | 82 | 80 | | | | | | | | | 6.0 |
| **45** | **BSPB 45 D 50** | 45 | | 52 | 50 | 60 | 55 | | | | | | | 3.6 |
| | **BSPB 45 Q 50** | | | 82 | 80 | | | | | | | | | 5.9 |
| **55** | **BSPB 55 D 65** | 55 | 65 | 52 | 50 | 76 | 68 | 154 | 77 | 23 | 118 | 65 | 30 | 4.5 |
| | **BSPB 55 Q 65** | | | 82 | 80 | | | | | | | | | 7.2 |
| **75** | **BSPB 75 D 65** | 75 | 65 | 54 | 50 | 99 | 86 | 174 | 87 | | 129 | | | 5.0 |
| | **BSPB 75 Q 65** | | | 84 | 80 | | | | | | | | | 8.0 |
| **Heavy Serie** | | | | | | | | | | | | | | |
| **35** | **BSPB 35 D 65** | 35 | 65 | 66 | 64 | 76 | 66 | 190 | 95 | 30 | 130 | 65 | 15 | 9.7 |
| | **BSPB 35 Q 65** | | | 106 | 104 | | | | | | | | | 15.9 |
| **40** | **BSPS 40 D 65** | 40 | | 66 | 64 | | | | | | | | | 9.5 |
| | **BSPB 40 Q 65** | | | 106 | 104 | | | | | | | | | 15.7 |
| **45** | **BSPB 45 D 65** | 45 | | 66 | 64 | | | | | | | | | 9.3 |
| | **BSPB 45 Q 65** | | | 106 | 104 | | | | | | | | | 15.4 |
| **50** | **BSPB 50 D 65** | 50 | | 66 | 64 | | | | | | | | | 9.1 |
| | **BSPB 50 Q 65** | | | 106 | 104 | | | | | | | | | 15.1 |
| **55** | **BSPB 55 D 85** | 55 | 85 | 66 | 64 | 99 | 86 | 200 | 100 | | 155 | 85 | | 9.1 |
| | **BSPB 55 Q 85** | | | 106 | 104 | | | | | | | | | 15.1 |
| **60** | **BSPB 60 D 85** | 60 | | 66 | 64 | | | | | | | | | 9.1 |
| | **BSPB 60 Q 85** | | | 106 | 104 | | | | | | | | | 15.1 |

| Tolerances | d | M | $U_1$ | E (Duplex) | E (Quad) |
|---|---|---|---|---|---|
| BSPB 17 D/Q 32 – BSPB 30 D/Q 42 | 0 / – 0.005 | 0 / – 0.013 | 0 / – 0.013 | 0 / – 1.02 | 0 / – 1.52 |
| BSPB 30 D/Q 50 – BSPB 45 D/Q 50 | 0 / – 0.005 | 0 / – 0.015 | 0 / – 0.015 | 0 / – 1.02 | 0 / – 1.52 |
| BSPB 55 D/Q 65 – BSPB 60 D/Q 85 | 0 / – 0.005 | 0 / – 0.018 | 0 / – 0.018 | 0 / – 1.02 | 0 / – 1.52 |

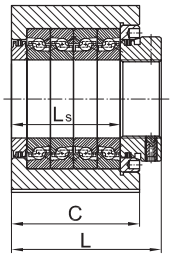
Technical data see page 22.

Recommended locknuts serie MMRB... starting on page 30.

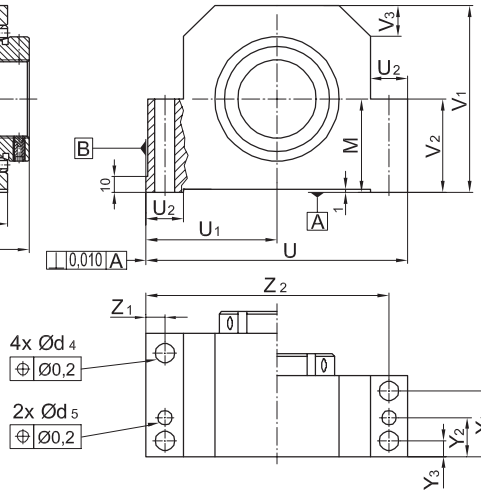
## . . . for Spindle Ends of Ball Screw Support Bearings with integrated lock nut




BSPB-M..D..



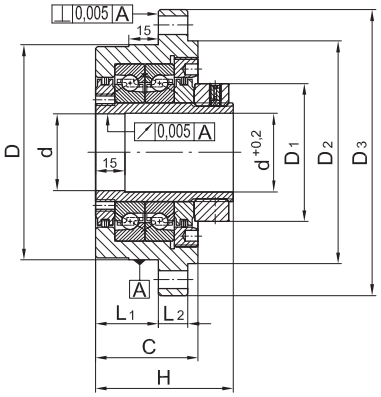

BSPB-M..Q..



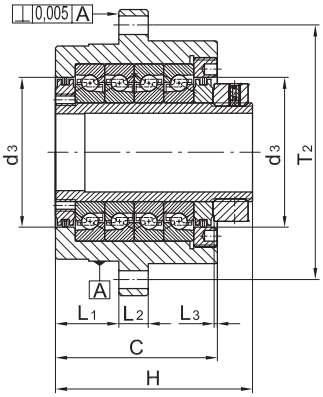

57-004

| $Y_1$ | $Y_2$ | $Y_3$ | $Z_1$ | $Z_2$ | $d_4$ | $d_5$ | $D_A$ | $L_S$ | L | Integrated locknut see page 28 | **Unit** | **Shaft** |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | | | | | | | | | | | | mm |
| **Medium Serie** | | | | | | | | | | | | |
| 38 | 22.0 | 9 | 8.5 | 85.5 | 9 | 7.8 | 38 | 37 | 57 | MMRS 17-36 | **BSPB-M 17 D 32** | 17 |
| 68 | | | | | | | | 67 | 87 | | **BSPB-M 17 Q 32** | |
| 38 | | | | | | | | 37 | 57 | MMRS 20-36 | **BSPB-M 20 D 32** | 20 |
| 68 | | | | | | | | 67 | 87 | | **BSPB-M 20 Q 32** | |
| 42 | 25.0 | 10 | 10 | 115.0 | 11 | 9.8 | 58 | 40 | 65 | MMRS 25-50 | **BSPB-M 25 D 42** | 25 |
| 72 | | | | | | | | 70 | 95 | | **BSPB-M 25 Q 42** | |
| 42 | | | | | | | | 40 | 65 | MMRS 30-50 | **BSPB-M 30 D 42** | 30 |
| 72 | | | | | | | | 70 | 95 | | **BSPB-M 30 Q 42** | |
| 42 | | | | 126.0 | 13 | | 70 | 40 | 68 | MMRS 30-60 | **BSPB-M 30 D 50** | |
| 72 | | | | | | | | 70 | 98 | | **BSPB-M 30 Q 50** | |
| 42 | | | | | | | | 40 | 68 | MMRS 35-60 | **BSPB-M 35 D 50** | 35 |
| 72 | | | | | | | | 70 | 98 | | **BSPB-M 35 Q 50** | |
| 42 | | | | | | | | 40 | 68 | MMRS 40-60 | **BSPB-M 40 D 50** | 40 |
| 72 | | | | | | | | 70 | 98 | | **BSPB-M 40 Q 50** | |
| 42 | | | | | | | | 40 | 68 | MMRS 45-60 | **BSPB-M 45 D 50** | 45 |
| 72 | | | | | | | | 70 | 98 | | **BSPB-M 45 Q 50** | |
| 40.5 | 26.0 | 11.5 | 11.5 | 142.5 | | | 80 | 40 | 70 | MMRS 55-76 | **BSPB-M 55 D 65** | 55 |
| 70.5 | | | | | | | | 70 | 100 | | **BSPB-M 55 Q 65** | |
| 40.5 | | | | 162.5 | | | 105 | 40 | 70 | MMRS 75-99 | **BSPB-M 75 D 65** | 75 |
| 70.5 | | | | | | | | 70 | 100 | | **BSPB-M 75 Q 65** | |
| **Heavy Serie** | | | | | | | | | | | | |
| 53 | 32.0 | 13 | 15 | 175.0 | 18 | 11.8 | 80 | 52 | 82 | MMRS 35-76 | **BSPB-M 35 D 65** | 35 |
| 93 | | | | | | | | 92 | 122 | | **BSPB-M 35 Q 65** | |
| 53 | | | | | | | | 52 | 82 | MMRS 40-76 | **BSPB-M 40 D 65** | 40 |
| 93 | | | | | | | | 92 | 122 | | **BSPB-M 40 Q 65** | |
| 53 | | | | | | | | 52 | 82 | MMRS 45-76 | **BSPB-M 45 D 65** | 45 |
| 93 | | | | | | | | 92 | 122 | | **BSPB-M 45 Q 65** | |
| 53 | | | | | | | | 52 | 82 | MMRS 50-76 | **BSPB-M 50 D 65** | 50 |
| 93 | | | | | | | | 92 | 122 | | **BSPB-M 50 Q 65** | |
| 53 | | | | 185.0 | | | | 52 | 82 | MMRS 55-99 | **BSPB-M 55 D 85** | 55 |
| 93 | | | | | | | | 92 | 122 | | **BSPB-M 55 Q 85** | |
| 53 | | | | | | | 105 | 52 | 82 | MMRS 60-99 | **BSPB-M 60 D 85** | 60 |
| 93 | | | | | | | | 92 | 122 | | **BSPB-M 60 Q 85** | |

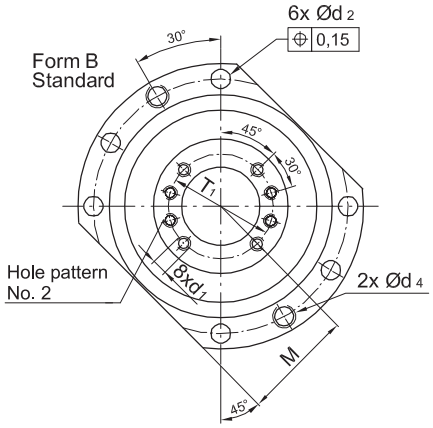
## 4.4 High Precision Flange Units for Ball Screw Nuts



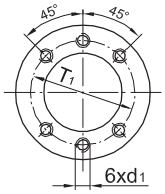

**BNBU...DB...**




**BNBU...QB...**




Hole pattern No. 1




57-005

Hole pattern No. 1 and 2 for direct mounting on bs nuts according to DIN 69051 for ball screws (Adapter sleeves for other bs nuts on request)

| KGT | Unit | d | D | M | C | H | $d_1$ | $d_2$ | $d_3$ | $d_4$ | $D_1$ | $D_2$ | $D_3$ | $T_1$ | $T_2$ | $L_1$ | $L_2$ | $L_3$ | Hole |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| do x P | | mm | | | | | | | | | | | | | | | | | pattern |
| **16x 5** | **BNBU 28 DB 98** | 28 | 98 | 49 | 52 | 70 | M5 | 9.2 | 60 | M12 | 70 | 98 | 130 | 38 | 113 | 32 | 15 | 2 | 1 |
| **20x 5** | **BNBU 36 DB 98** | 36 | | | 52 | 70 | M6 | | | | | | | 47 | | | | | |
| **25x 5** | **BNBU 40 DB 113** | 40 | 113 | 56.5 | 52 | 70 | | | 76 | | 80 | 113 | 145 | 51 | 129 | | | | |
| **25x10** | **BNBU 40 QB 113** | | | | 82 | 100 | | | | | | | | | | | | | |
| **32x 5** | **BNBU 50 DB 138** | 50 | 138 | 69 | 54 | 70 | M8 | | 99 | | 105 | 138 | 170 | 65 | 154 | | | 4 | |
| **32x10** | **BNBU 50 QB 138** | | | | 84 | 100 | | | | | | | | | | | | | |
| **40x 5** | **BNBU 63 DB 138** | 63 | | | 54 | 70 | | | | | | | | 78 | | | | | 2 |
| **40x10** | **BNBU 63 QB 138** | | | | 84 | 100 | | | | | | | | | | | | | |
| **50x 5** | **BNBU 75 DB 178** | 75 | 178 | 89 | 77 | 101 | M10 | 11.4 | 132 | M14 | 140 | 178 | 215 | 93 | 197 | 50 | 20 | | |
| **50x10** | **BNBU 75 QB 178** | | | | 122 | 146 | | | | | | | | | | | | | |
| **63x 5** | **BNBU 90 DB 210** | 90 | 210 | 105 | 77 | 105 | | | 162 | | 175 | 210 | 248 | 108 | 230 | | | | |
| **63x10** | **BNBU 90 QB 210** | | | | 122 | 150 | | | | | | | | | | | | | |
| **63x20** | **BNBU 95 DB 210** | 95 | | | 77 | 105 | M12 | | | | | | | 115 | | | | | |
| | **BNBU 95 QB 210** | | | | 122 | 150 | | | | | | | | | | | | | |
| **80x10** | **BNBU 105 DB 210** | 105 | | | 77 | 105 | | | | | | | | 125 | | | | | |
| | **BNBU 105 QB 210** | | | | 122 | 150 | | | | | | | | | | | | | |

Technical data see page 27

| Tolerances Housing | d | D |
|---|---|---|
| BNBU 28 DB/QB 98 – BNBU 36 D/Q 98 | + 0.003 / – 0.010 | 0 / – 0.015 |
| BNBU 40 DB/QB 113 – BNBU 105 D/Q 210 | + 0.003 / – 0.010 | 0 / – 0.018 |

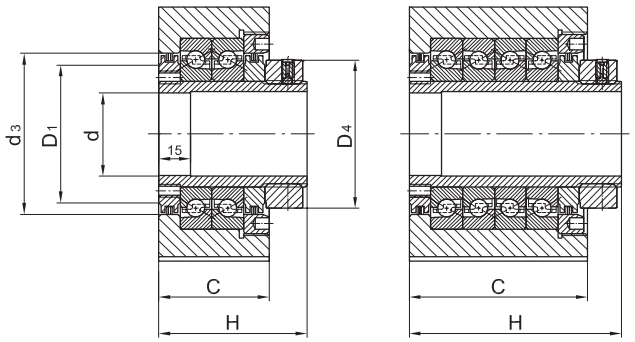
Adapter sleeves for other bs nuts on request.

For bearing units with integrated lubrication of ball screw nuts, please ask for separate data sheets (Serie BNBUS).

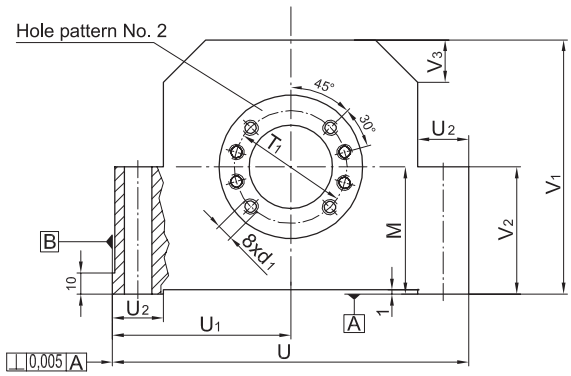
Order example:
For a ballscrew Ø 63 x 10 with abutment dimension acc. to DIN 69051 a standard flange unit with hole pattern no. 2 and two bearings are needed as shown.
Medium preload is chosen: **BNBU 90DB210. 2.M.M2**

Mounting M1: connecting thread on right side, mounted opposite to mounting seat D.

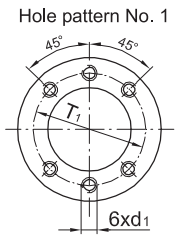
## 4.5 High Precision Pillow Block Units for Ball Screw Nuts

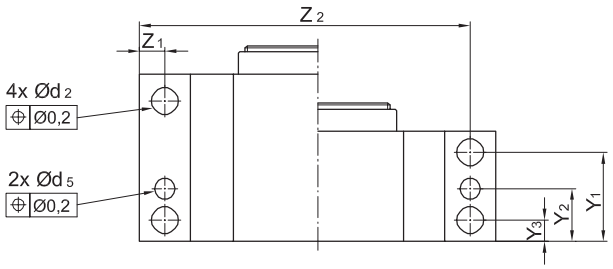



**BNPB...D..** **BNPB...Q..**




Hole pattern No. 1 and 2 for direct mounting on bs nuts according to DIN 69051 for ball screws (Adapter sleeves for other bs nuts on request)




57-006

| KGT | Unit | d | M | C | H | $d_1$* | $d_3$ | $d_4$ | $d_5$ | $D_1$ | $D_4$ | $T_1$ | U | $U_1$ | $U_2$ | $V_1$ | $V_2$ | $V_3$ | $Y_1$ | $Y_2$ | $Y_3$ | $Z_1$ | $Z_2$ | B |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| do x P | | mm | | | | | | | | | | | | | | | | | | | | | | |
| 16x 5 | BNPB 28 D 50 | 28 | 50 | 52 | 70 | M5 | 60 | 13 | 9.8 | 55 | 70 | 38 | 136 | 68 | 20.5 | 98 | 50 | 20 | 42 | 25.0 | 10 | 10 | 126.0 | 1 |
| 20x 5 | BNPB 36 D 50 | 36 | | 52 | 70 | M6 | | | | | | 47 | | | | | | | | | | | | |
| 25x 5 | BNPB 40 D 65 | 40 | 65 | 52 | 70 | | 76 | | | 68 | 80 | 51 | 154 | 77 | 23 | 118 | 65 | | 40.5 | 26.0 | 11.5 | 11.5 | 142.5 | |
| 25x10 | BNPB 40 Q 65 | | | 82 | 100 | | | | | | | | | | | | | | 70.5 | | | | | |
| 32x 5 | BNPB 50 D 65 | 50 | | 54 | 70 | M8 | 99 | | | 89 | 105 | 65 | 174 | 87 | | 129 | | | 40.5 | | | | 162.5 | |
| 32x10 | BNPB 50 Q 65 | | | 84 | 100 | | | | | | | | | | | | | | 70.5 | | | | | |
| 40x 5 | BNPB 63 D 65 | 63 | | 54 | 70 | | | | | | | 78 | | | | | | | 40.5 | | | | | 2 |
| 40x10 | BNPB 63 Q 65 | | | 84 | 100 | | | | | | | | | | | | | | 70.5 | | | | | |
| 50x 5 | BNPB 75 D 85 | 75 | 85 | 77 | 101 | M10 | 132 | 18 | 11.8 | 114 | 140 | 93 | 230 | 115 | 30 | 170 | 85 | 30 | 57 | 37.0 | 17 | 15 | 215.0 | |
| 50x10 | BNPB 75 Q 85 | | | 122 | 146 | | | | | | | | | | | | | | 100 | | | | | |
| 63x 5 | BNPB 90 D 105 | 90 | 105 | 77 | 105 | | 162 | 21 | | 140 | 175 | 108 | 280 | 140 | 35 | 207 | 105 | 50 | 57 | | | 17 | 263.0 | |
| 63x10 | BNPB 90 Q 105 | | | 122 | 150 | | | | | | | | | | | | | | 100 | | | | | |
| 63x20 | BNPB 95 D 105 | 95 | | 77 | 105 | M12 | | | | | | 115 | | | | | | | 57 | | | | | |
| | BNPB 95 Q 105 | | | 122 | 150 | | | | | | | | | | | | | | 100 | | | | | |
| 80x10 | BNPB 105 D 105 | 105 | | 77 | 105 | | | | | | | 125 | | | | | | | 57 | | | | | |
| | BNPB 105 Q 105 | | | 122 | 150 | | | | | | | | | | | | | | 100 | | | | | |

* preferable to be mounted with socket head cap screws to DIN 912, tensile strength class 8.8

| Tolerances | Housing | d | M | $U_1$ |
|---|---|---|---|---|
| BSPB 28 D/Q 50 – | BNPB 36 D/Q 50 | + 0.003 / 0.010 | 0 / – 0.015 | 0 / – 0.013 |
| BSPB 40 D/Q 65 – | BNPB 63 D/Q 65 | + 0.003 / 0.010 | 0 / – 0.018 | 0 / – 0.015 |
| BSPB 75 D/Q 85 – | BNPB 105 D/Q 105 | + 0.003 / 0.010 | 0 / – 0.018 | 0 / – 0.018 |

Adapter sleeves for other bs nuts on request.

Order example:
For a ballscrew Ø 80 x 10 heavy load with 4 bearings, adapter hole pattern No. 2 according to DIN 69051, light preload, mounted as shown above: **BNPB 105Q105 2.L.M2**

(Mounting M1: connecting thread on right side, mounted below outer locknut).

## 4.6 Technical Data Table of Flange and Pillow Block Units

**BSBU..DB.. BSBU-M..DB.. BSPB..D.. BSPB-M..D..**
**BSBU..QB.. BSBU-M..QB.. BSPB..Q.. BSPB-M..Q..**

| Designation | | Axial capacity | | Preload $F_v$ | | | Ax. stiffness $S_{ax}$ | | | Speed grease $n_F$ | | | Drag troque $M_r$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| BSBU | BSPB | Ca | Coa | L | M | H | L | M | H | L | M | H | L | M | H |
| BSBU-M | BSPB-M | N | | N | | | N/µm | | | $min^{-1}$ | | | Nm | | |
| **Duplex Serie** | | | | | | | | | | | | | | | |
| BSBU 17 DB 64<br>BSBU 20 DB 64 | BSPB 17 D 32<br>BSPB 20 D 32 | 25000 | 32000 | 875 | 1750 | 3500 | 450 | 570 | 730 | 14300 | 12500 | 6200 | 0.08 | 0.16 | 0.32 |
| BSBU 25 DB 88<br>BSBU 30 DB 88 | BSPB 25 D 42<br>BSPB 30 D 42 | 29200 | 43600 | 1125 | 2250 | 4500 | 640 | 810 | 1030 | 10500 | 9100 | 4500 | 0.11 | 0.22 | 0.43 |
| BSBU 30 DB 98<br>BSBU 35 DB 98<br>BSBU 40 DB 98 | BSPB 30 D 50<br>BSPB 35 D 50<br>BSPB 40 D 50 | 35600 | 55000 | 1700 | 3400 | 6800 | 770 | 970 | 1240 | 8600 | 7500 | 3700 | 0.11 | 0.22 | 0.43 |
| BSBU 45 DB 98 | BSPB 45 D 50 | 37900 | 62000 | 1700 | 3400 | 6800 | 770 | 970 | 1240 | 8000 | 7000 | 3500 | 0.14 | 0.28 | 0.56 |
| BSBU 55 DB 113 | BSPB 55 D 65 | 40700 | 74000 | 1975 | 3950 | 7900 | 1020 | 1300 | 1640 | 6900 | 6000 | 3000 | 0.22 | 0.42 | 0.82 |
| BSBU 75 DB 138 | BSPB 75 D 65 | 44500 | 94000 | 2500 | 5000 | 10000 | 1320 | 1650 | 2120 | 5200 | 4500 | 2250 | 0.26 | 0.50 | 1.00 |
| Heavy Serie | | | | | | | | | | | | | | | |
| BSBU 35 DB 128<br>BSBU 40 DB 128<br>BSBU 45 DB 128<br>BSBU 50 DB 128 | BSPB 35 D 65<br>BSPB 40 D 65<br>BSPB 45 D 65<br>BSPB 50 D 65 | 70500 | 116000 | 3200 | 6400 | 12800 | 1050 | 1360 | 1740 | 6400 | 5600 | 2800 | 0.26 | 0.51 | 1.07 |
| BSBU 55 DB 148<br>BSBU 60 DB 148 | BSPB 55 D 85<br>BSPB 60 D 85 | 80800 | 137800 | 3900 | 7800 | 15600 | 1320 | 1650 | 2120 | 5300 | 4600 | 2300 | 0.34 | 0.68 | 1.36 |
| **Quadruplex Serie** | | | | | | | | | | | | | | | |
| BSBU 17 QB 64<br>BSBU 20 QB 64 | BSPB 17 Q 32<br>BSPB 20 Q 32 | 40600 | 64000 | 1750 | 3500 | 7000 | 900 | 1040 | 1460 | 10000 | 8700 | 4300 | 0.16 | 0.32 | 0.64 |
| BSBU 25 QB 88<br>BSBU 30 QB 88 | BSPB 25 Q 42<br>BSPB 30 Q 42 | 47500 | 86000 | 2250 | 4500 | 9000 | 1280 | 1620 | 2060 | 7300 | 6300 | 3100 | 0.22 | 0.43 | 0.86 |
| BSBU 30 QB 98<br>BSBU 35 QB 98<br>BSBU 40 QB 98 | BSPB 30 Q 50<br>BSPB 35 Q 50<br>BSPB 40 Q 50 | 57800 | 110000 | 3400 | 6800 | 13600 | 1540 | 1940 | 2480 | 6000 | 5200 | 2600 | 0.22 | 0.43 | 0.86 |
| BSBU 45 QB 98 | BSPB 45 Q 50 | 61600 | 123000 | 3400 | 6800 | 13600 | 1540 | 1940 | 2480 | 5600 | 4900 | 2400 | 0.28 | 0.56 | 1.02 |
| BSBU 55 QB 113 | BSPB 55 Q 65 | 66100 | 178000 | 3950 | 7900 | 15800 | 2040 | 2600 | 3280 | 4800 | 4200 | 2100 | 0.44 | 0.84 | 1.64 |
| BSBU 75 QB 138 | BSPB 75 Q 65 | 72300 | 188000 | 5000 | 10000 | 20000 | 2640 | 3300 | 4240 | 3500 | 3100 | 1550 | 0.52 | 1.00 | 2.00 |
| Heavy Serie | | | | | | | | | | | | | | | |
| BSBU 35 QB 128<br>BSBU 40 QB 128<br>BSBU 45 QB 128<br>BSBU 50 QB 128 | BSPB 35 Q 65<br>BSPB 40 Q 65<br>BSPB 45 Q 65<br>BSPB 50 Q 65 | 114500 | 232000 | 6400 | 12800 | 25600 | 2100 | 2720 | 3480 | 4450 | 3900 | 1950 | 0.52 | 1.02 | 2.04 |
| BSBU 55 QB 148<br>BSBU 60 QB 148 | BSPB 55 Q 85<br>BSPB 60 Q 85 | 131000 | 274000 | 7800 | 15600 | 31200 | 2640 | 3300 | 4220 | 3700 | 3200 | 1600 | 0.68 | 1.36 | 2.72 |

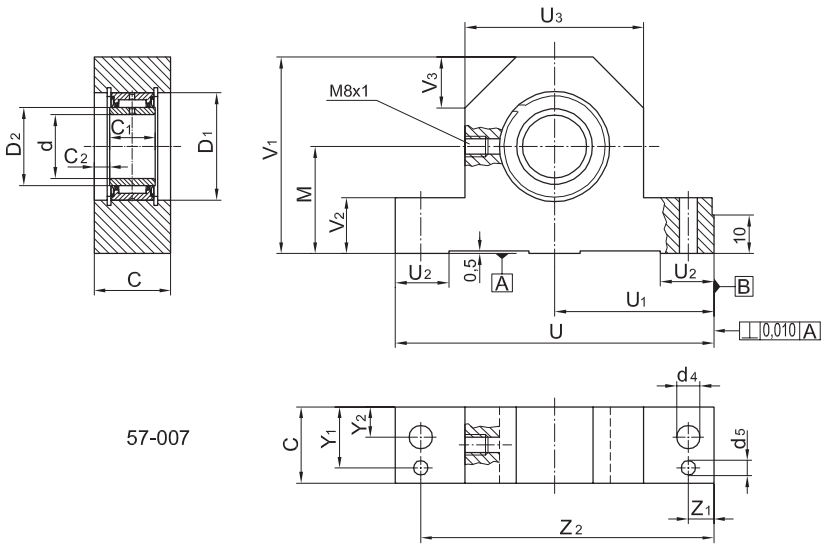
**with adapter sleeve for ball screw nuts acc. to DIN 69051 BNBU..DB.., BNBU..QB.., BNPB..D... BNPB..Q..**

| KGT | Designation | | Axial capacity | | Preload $F_v$ | | | Ax. stiffness $S_{ax}$ | | | Speed grease $n_F$ | | | Drag troque $M_r$ | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| do x P | BNBU | BNPB | Ca | Coa | L | M | H | L | M | H | L | M | H | L | M | H |
| | BNBU-M | BNPB-M | N | | N | | | N/µm | | | $min^{-1}$ | | | Nm | | |
| 16x 5 | BNBU 28 DB 98 | BNPB 28 D 50 | 37900 | 62000 | 1700 | 3400 | 6800 | 840 | 1050 | 1330 | 8600 | 7500 | 3700 | 0.14 | 0.28 | 0.56 |
| 20x 5 | BNBU 36 DB 98 | BNPB 36 D 50 | 37900 | 62000 | 1700 | 3400 | 6800 | 840 | 1050 | 1330 | 8600 | 7500 | 3700 | 0.14 | 0.28 | 0.56 |
| 25x 5 | BNBU 40 DB 113 | BNPB 40 D 65 | 40700 | 74000 | 1975 | 3950 | 7900 | 1010 | 1260 | 1610 | 6900 | 6000 | 3000 | 0.22 | 0.42 | 0.32 |
| 25x10 | BNBU 40 QB 113 | BNPB 40 Q 65 | 66100 | 148000 | 3900 | 7800 | 15600 | 2050 | 2560 | 3250 | 4800 | 4200 | 2100 | 0.44 | 0.84 | 1.64 |
| 32x 5 | BNBU 50 DB 138 | BNPB 50 D 65 | 44500 | 94000 | 2500 | 5000 | 10000 | 1230 | 1570 | 2010 | 5200 | 4500 | 2250 | 0.26 | 0.50 | 1.00 |
| 32x10 | BNBU 50 QB 138 | BNPB 50 Q 65 | 72300 | 188000 | 5000 | 10000 | 20000 | 2500 | 3180 | 4100 | 3500 | 3100 | 1550 | 0.52 | 1.00 | 2.00 |
| 40x 5 | BNBU 63 DB 138 | BNPB 63 D 65 | 44500 | 94000 | 2500 | 5000 | 10000 | 1230 | 1570 | 2010 | 5200 | 4500 | 2250 | 0.26 | 0.50 | 1.00 |
| 40x10 | BNBU 63 QB 138 | BNPB 63 Q 65 | 72300 | 188000 | 5000 | 10000 | 20000 | 2500 | 3180 | 4100 | 3500 | 3100 | 1550 | 0.52 | 1.00 | 2.00 |
| 50x 5 | BNBU 75 DB 178 | BNPB 75 D 65 | 86400 | 192000 | 5200 | 10400 | 20800 | 1800 | 2280 | 2900 | 3800 | 3300 | 1650 | 0.27 | 0.53 | 1.06 |
| 50x10 | BNBU 75 QB 178 | BNPB 75 Q 65 | 140000 | 384000 | 10400 | 20800 | 41600 | 3600 | 4560 | 5800 | 2600 | 2300 | 1150 | 0.54 | 1.06 | 2.12 |
| 63x 5 | BNBU 90 DB 210 | BNPB 90 D 105 | 85200 | 240000 | 4550 | 9100 | 18200 | 1950 | 2500 | 3150 | 3100 | 2700 | 1350 | 0.27 | 0.54 | 1.08 |
| 63x10 | BNBU 90 QB 210 | BNPB 90 Q 105 | 138000 | 480000 | 9100 | 18200 | 36400 | 3900 | 5000 | 6300 | 2100 | 1900 | 950 | 0.54 | 1.08 | 2.16 |
| 63x20 | BNBU 95 DB 210 | BNPB 95 D 105 | 85200 | 240000 | 4550 | 9100 | 18200 | 1950 | 2500 | 3150 | 3100 | 2700 | 1350 | 0.27 | 0.54 | 1.08 |
| | BNBU 95 QB 210 | BNPB 95 Q 105 | 138000 | 480000 | 9100 | 18200 | 36400 | 3900 | 5000 | 6300 | 2100 | 1900 | 950 | 0.54 | 1.08 | 2.16 |
| 80x10 | BNBU 105 DB 210 | BNPB 105 D 105 | 85200 | 240000 | 4550 | 9100 | 18200 | 1950 | 2500 | 3150 | 3100 | 2700 | 1350 | 0.27 | 0.54 | 1.08 |
| | BNBU 105 QB 210 | BNPB 105 Q 105 | 138000 | 480000 | 9100 | 18200 | 36400 | 3900 | 5000 | 6300 | 2100 | 1900 | 950 | 0.54 | 1.08 | 2.16 |

**On request a speed increase of 35 % is possible by use of ceramic balls. Then the static capacity Coa will be reduced to 70 %.**

# 4.7 High Precision Floating End Units

## Super Precision Pillow Block Bearing Units for Supporting Floating End of Shaft BLPB..N.. .2RS



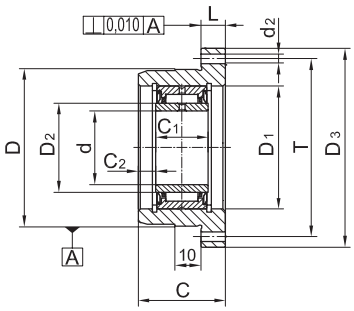

57-007

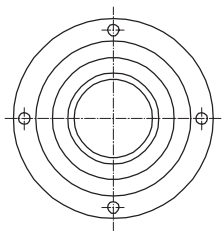
| Tolerances | M | $U_1$ |
|---|---|---|
| BLPB 20 N 32 | 0 / –0,013 | 0 / –0,013 |
| BLPB 25 N 42 | 0 / –0,013 | 0 / –0,013 |
| BLPB 30 N 50 | 0 / –0,015 | 0 / –0,015 |
| BLPB 40 N 65 | 0 / –0,018 | 0 / –0,018 |
| BLPB 50 N 85 | 0 / –0,018 | 0 / –0,018 |

d according PN DIN 620
Maximum speed see cartridge bearing unit

| Shaft | Designation | d | M | C | $C_1$ | $C_2$ | $D_1$ | $D_2$ | U | $U_1$ | $U_2$ | $U_3$ | $V_1$ | $V_2$ | $V_3$ | $Y_1$ | $Y_2$ | $Z_1$ | $Z_2$ | $d_4$ | $d_5$ | C | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | | mm | | | | | | | | | | | | | | | | | | | | N | |
| **20** | **BLPB 20 N 32** | 20 | 32 | 30 | 18 | 6 | 37 | 25 | 94 | 47 | 16 | 56 | 59 | 15 | 15 | 24.0 | 12 | 8.5 | 85.5 | 9 | 5.8 | 17300 | 19900 |
| **25** | **BLPB 25 N 42** | 25 | 42 | 30 | 18 | 6 | 42 | 30 | 125 | 62.5 | 21 | 70 | 77 | 22 | 20 | 24.0 | 12 | 10 | 115 | 9 | 5.8 | 19300 | 24200 |
| **30** | **BLPB 30 N 50** | 30 | 50 | 30 | 18 | 6 | 47 | 35 | 136 | 68 | 21 | 80 | 88 | 28 | 20 | 24.0 | 12 | 10 | 126 | 9 | 5.8 | 21100 | 28500 |
| **40** | **BLPB 40 N 65** | 40 | 65 | 40 | 23 | 8.5 | 62 | 48 | 190 | 95 | 30 | 100 | 108 | 38 | 20 | 30.0 | 15 | 15 | 175 | 13 | 7.8 | 36000 | 53000 |
| **50** | **BLPB 50 N 85** | 50 | 85 | 40 | 23 | 8.5 | 72 | 58 | 200 | 100 | 30 | 110 | 138 | 48 | 30 | 30.0 | 15 | 15 | 185 | 13 | 7.8 | 40000 | 64000 |

## Cartridge Bearing Units for Supporting Floating End of Shaft BLBU..N... 2RS



57-008

| Shaft | Designation | d | D | C | $C_1$ | $C_2$ | $D_1$ | $D_2$ | $D_3$ | L | T | $d_2$ | $n_{grease}$ | C | Co |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| mm | | mm | | | | | | | | | | | $min^{-1}$ | N | |
| **10** | **BLBU 10 N 32** | 10 | 32 | 25 | 14 | 5.5 | 22 | 14 | 52 | 6 | 42 | 4.5 | 13000 | 6800 | 6900 |
| **12** | **BLBU 12 N 35** | 12 | 35 | 25 | 14 | 5.5 | 24 | 16 | 55 | 6 | 45 | 4.5 | 12000 | 7600 | 8300 |
| **17** | **BLBU 17 N 40** | 17 | 40 | 26 | 14 | 6 | 30 | 20 | 60 | 6 | 50 | 4.5 | 9000 | 8800 | 11000 |
| **20** | **BLBU 20 N 50** | 20 | 50 | 30 | 18 | 6 | 37 | 25 | 70 | 8 | 60 | 4.5 | 7500 | 17300 | 19900 |
| **25** | **BLBU 25 N 55** | 25 | 55 | 30 | 18 | 6 | 42 | 30 | 75 | 8 | 65 | 4.5 | 6500 | 19300 | 24200 |
| **30** | **BLBU 30 N 60** | 30 | 60 | 32 | 18 | 6 | 47 | 35 | 80 | 8 | 70 | 4.5 | 5500 | 21100 | 28500 |
| **35** | **BLBU 35 N 70** | 35 | 70 | 38 | 21 | 8.5 | 55 | 42 | 90 | 10 | 80 | 5.5 | 4800 | 26500 | 39500 |
| **40** | **BLBU 40 N 80** | 40 | 80 | 43 | 23 | 10 | 62 | 48 | 110 | 10 | 95 | 5.5 | 4200 | 36000 | 53000 |
| **45** | **BLBU 45 N 85** | 45 | 85 | 43 | 23 | 10 | 68 | 52 | 110 | 10 | 98 | 5.5 | 3900 | 38000 | 59000 |
| **50** | **BLBU 50 N 90** | 50 | 90 | 44 | 23 | 10.5 | 72 | 58 | 120 | 10 | 105 | 5.5 | 3500 | 40000 | 64000 |

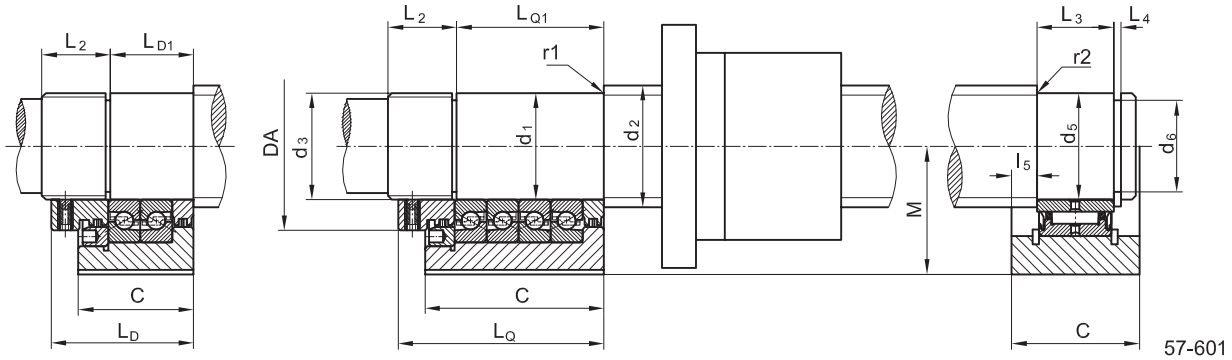
| Tolerances of Cartridge Bearing Units | | | |
|---|---|---|---|
| Inner Diameter | d | | PN DIN 620 |
| Cartridge Diameter | D | 32 – 80 | 0 / –0.013 |
| | | 85 – 90 | 0 / –0.015 |

## 4.8 Mounting Dimensions for Ball Screw Spindles

**BSBU-M..DB..**
**BSPB-M..D..**

**BSBU-M..QB..**
**BSPB-M..Q..**

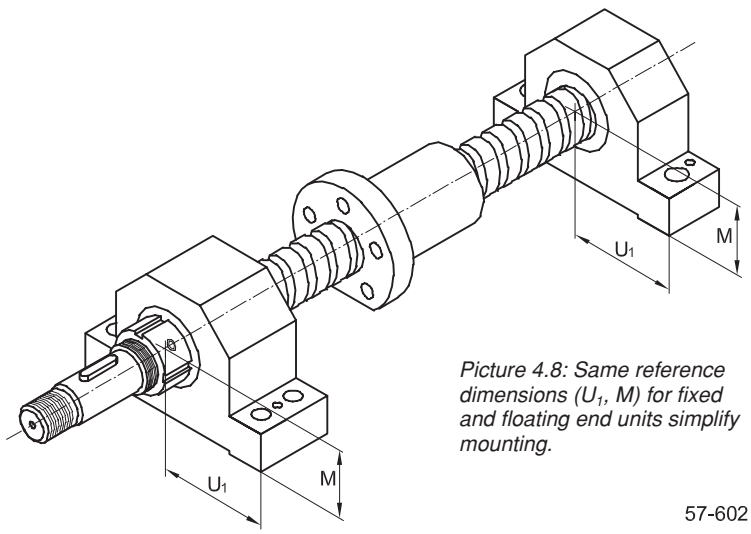
**BLBU..N..**




| Designation | Fixed end | | | | | | | | | | Centre height | Floating end | | | | | | Designation |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $d_1$ | $d_2$ | $d_3$ 4h/6h | $D_A$ | $L_D$ | $L_{D1}$ | $L_Q$ | $L_{Q1}$ | $L_2$ | $r_{1max}$ | **M** | $d_5$ j5 | $d_6$ h11 | $L_3$ | $L_4$ | $l_5$ | $r_{2max}$ | |
| | mm | | | | | | | | | | | | | | | | | |
| **Medium Serie** | | | | | | | | | | | | | | | | | | |
| **BSPB-M 17.32** | 17 | 23 | M 17 x 1 | 38 | 57 | 36 | 87 | 65 | 24 | 0.5 | 32 | 20 | 19.2 | 18 | 1.2 | 6 | 0.3 | **BLPB-20N32** |
| **BSPB-M 20.32** | 20 | 26 | M 20 x 1 | | | | | | | | | | | | | | | |
| **BSPB-M 25.42** | 25 | 35 | M 25 x 1.5 | 58 | 65 | 39 | 95 | 68 | 29 | 0.8 | 42 | 25 | 24 | 18 | 1.2 | 6 | 0.3 | **BLPB-25N42** |
| **BSPB-M 30.42** | 30 | 37 | M 30 x 1.5 | | | | | | | | | | | | | | | |
| **BSPB-M 30.50** | 30 | 37 | M 30 x 1.5 | 70 | 68 | 39 | 98 | 68 | 32 | 0.8 | 50 | 30 | 29 | 18 | 1.5 | 6 | 0.3 | **BLPB-30N50** |
| **BSPB-M 35.50** | 35 | 42 | M 35 x 1.5 | | | | | | | | | | | | | | | |
| **BSPB-M 40.50** | 40 | 47 | M 40 x 1.5 | | | | | | | | | | | | | | | |
| **BSPB-M 45.50** | 45 | 53 | M 45 x 1.5 | | | | | | | | | | | | | | | |
| **BSPB-M 55.65** | 55 | 63 | M 55 x 2 | 80 | 70 | 39 | 100 | 68 | 34 | 0.8 | 65 | 50 | 48.5 | 23 | 1.5 | 8.5 | 0.6 | **BLPB-50N85** |
| **BSPB-M 75.65** | 75 | 84 | M 75 x 2 | 105 | | | | | | | | | | | | | | |
| **Heavy Serie** | | | | | | | | | | | | | | | | | | |
| **BSPB-M 35.65** | 35 | 43 | M 35 x 1.5 | 80 | 82 | 51 | 122 | 90 | 34 | 0.8 | 65 | 40 | 38.5 | 23 | 1.5 | 8.5 | 0.6 | **BLPB-40N65** |
| **BSPB-M 40.65** | 40 | 48 | M 40 x 1.5 | | | | | | | | | | | | | | | |
| **BSPB-M 45.65** | 45 | 54 | M 45 x 1.5 | | | | | | | | | | | | | | | |
| **BSPB-M 50.65** | 50 | 59 | M 50 x 1.5 | | | | | | | | | | | | | | | |
| **BSPB-M 55.85** | 55 | 65 | M 55 x 2 | 105 | 82 | 51 | | 90 | 34 | | 85 | 50 | 48.5 | 23 | 1.5 | 8.5 | 0.6 | **BLPB-50N85** |
| **BSPB-M 60.85** | 60 | 70 | M 60 x 2 | | | | | | | | | | | | | | | |

**The following cartridge units have the same dimensions as pillow block units:**

| Medium Serie | | Tolerance $d_1$ [µm] |
|---|---|---|
| **BSBU-M 17.64** | **BSPB-M 17.32** | – 3 / – 7 |
| **BSBU-M 20.64** | **BSPB-M 20.32** | |
| **BSBU-M 25.88** | **BSPB-M 25.42** | – 3 / – 7 |
| **BSBU-M 30.88** | **BSPB-M 30.42** | |
| **BSBU-M 30.98** | **BSPB-M 30.50** | – 4 / – 8 |
| **BSBU-M 35.98** | **BSPB-M 35.50** | |
| **BSBU-M 40.98** | **BSPB-M 40.50** | |
| **BSBU-M 45.98** | **BSPB-M 45.50** | – 4 / – 8 |
| **BSBU-M 55.113** | **BSPB-M 55.65** | – 4 / – 9 |
| **BSBU-M 75.138** | **BSPB-M 75.65** | – 4 / – 9 |
| **Heavy Serie** | | |
| **BSBU-M 35.128** | **BSPB-M 35.65** | – 4 / – 8 |
| **BSBU-M 40.128** | **BSPB-M 55.85** | |
| **BSBU-M 45.128** | **BSPB-M 45.65** | |
| **BSBU-M 50.128** | **BSPB-M 50.65** | |
| **BSBU-M 55.148** | **BSPB-M 55.85** | – 4 / – 9 |
| **BSBU-M 60.148** | **BSPB-M 60.85** | |




*Picture 4.8: Same reference dimensions ($U_1$, M) for fixed and floating end units simplify mounting.*

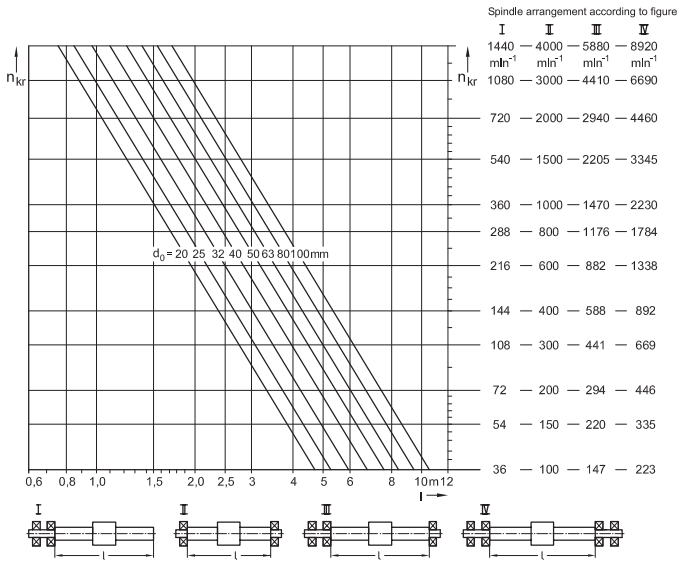
# 4.9 Criteria for Bearing Arrangements at Ball screws

**Application examples – influence of bearing arrangement on critical speed, spindle buckling resistance and stiffness.**

The mounting and bearing arrangement at a spindle influences the critical speed, the buckling behaviour and the total stiffness.

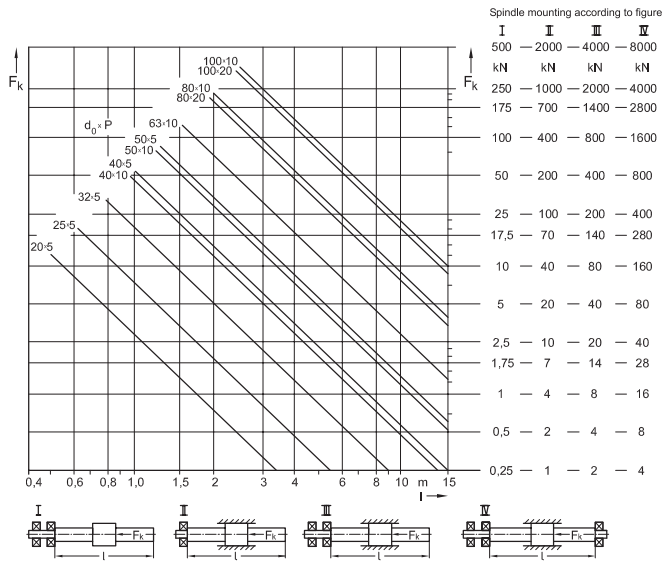
### 4.9.1 Critical Rotational Speed $n_{kr}$

The critical rotational speed (1st order) where the spindle starts to bulge depends on the spindle diameter $d_o$, the non-support spindle length l and the bearing arrangement. The permissible speed should be obtained using factor 0.8 of the diagram value.




### 4.9.2 Buckling

Very long and thin spindles must be checked for buckling. An alternative bearing arrangement increases the permissible axial load.




### 4.9.3 Stiffness

The axial stiffness of a ball screw $Ka_{BS}$ is mainly dependant on (in precisely this order) the stiffness of the spindle as follows:

$$\frac{1}{Ka_{BS}} = \frac{1}{Ka_S} + \frac{1}{Ka_N} + \frac{1}{Ka_B} \qquad [4.9.3]$$

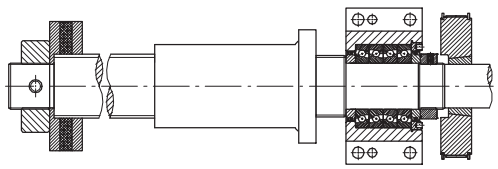
| | | |
|---|---|---|
| $Ka_{BS}$ | [N/µm] | total stiffness |
| $Ka_S$ | [N/µm] | stiffness of spindle |
| $Ka_N$ | [N/µm] | stiffness of ball screw nut |
| $Ka_B$ | [N/µm] | stiffness of bearings |

The fundamentally different type of clamping (of the assembly) determines the stiffness of the spindle as follows:

**1) Fixed clamping at one end**

$$Ka_S = \frac{A \cdot E}{l \cdot 10^3} \left[\frac{N}{\mu m}\right] \qquad [4.9.4]$$

| | | |
|---|---|---|
| A | [mm²] | cross section of the spindle |
| E | [N/mm²] | Young's modulus |
| l | [mm] | distance ball screw nut/bearing |

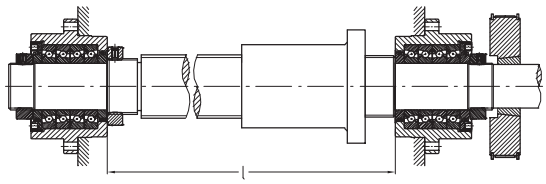


57-807

**2) Fixed clamping at both ends**

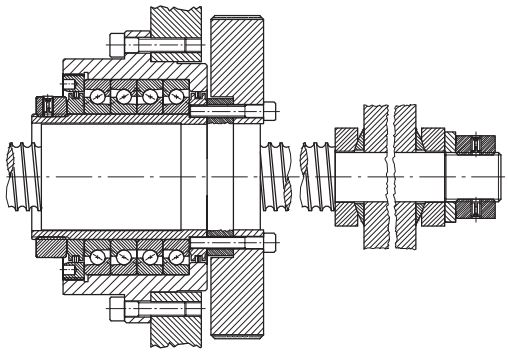
$$Ka_S = \frac{4 \cdot A \cdot E}{l \cdot 10^3} \left[\frac{N}{\mu m}\right] \qquad [4.9.5]$$

**a) for driven spindle (see also page 19, 32)**




57-808

**b) for driven nut (see page 20), e.g. assembled with BNBU 63QB130 2.M.M2 with integrated labyrinth seals, n = 1000 min$^{-1}$. Spindle Ø 40 x 10 fixed at ends.**



57-809

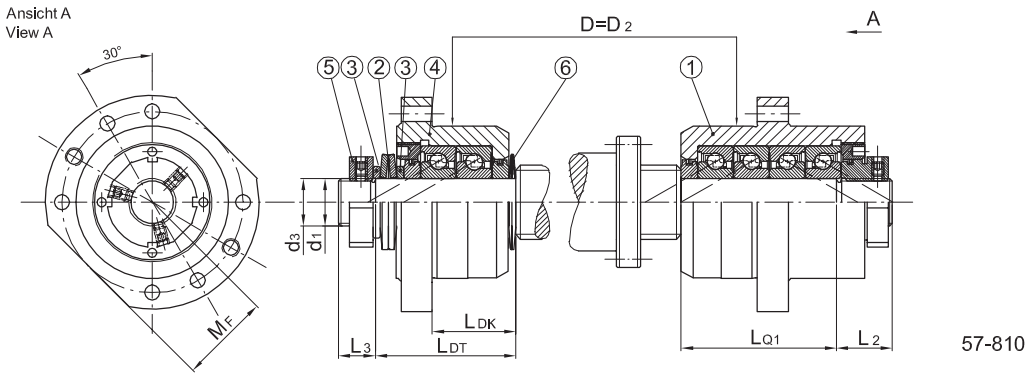
## 4.9 Criteria for Bearing Arrangements at Ball screws

**3) Spring-preloaded Fixed End Floating End Combinations**

Where a high operating speed leads to a high heat generation and expansion of the spindle, a fixed clamping at both ends is no longer useful. In this case it is better to clamp one end and to preload the other end by means of springs. The required preload can be set via the springs. By selecting an appropriate spring tension, the expansion due to heat is practically compensated without loss of preload and the stiffness of the spindle is kept on a constant level.

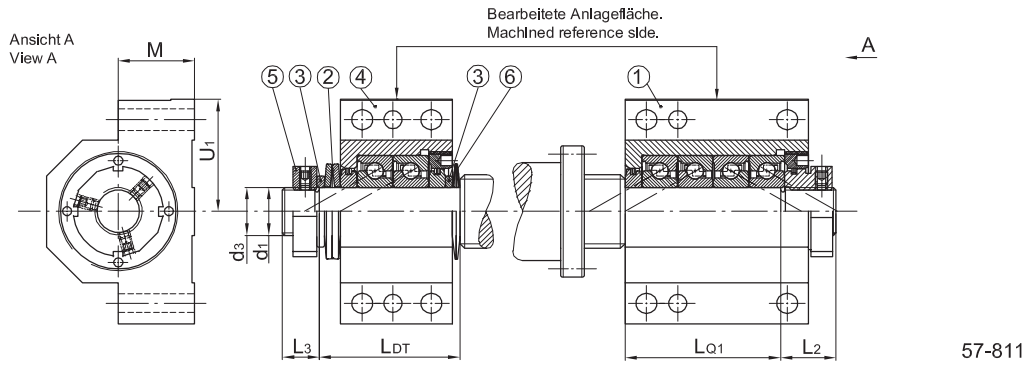
The two mounting examples with drawings for inquiry (see p. 33) are helpful in dealing with specific customer wishes.

The first example shows the combination of cartridge units, the second the combination of pillow block units. Of course, it is also easily possible to combine cartridge and pillow block units, because the final processing for the spindles is the same for both.




57-810

Ball screw supported at both ends with BSBU-M… QB + BSBU … DB … DT+PLS, can be stretched and preloaded via securable locknuts.




57-811

Ball screw supported at both ends with BSPB-M … QB + BSPB … D … DT+PLS,, can be stretched and preloaded via securable locknuts.

In addition to the arrangement with spring-preloaded end in DT arrangement, fixed end and if applicable, floating end QBT arrangements are possible, too (see p. 14).

**4) Combinations of fixed end bearing units with floating end bearing units, series BLPB and BLBU**

Whereas the stretching of the spindle and increasing the stiffness plays the most important role in case of fixed end bearing units and spring-preloaded units, preventing the spindle end from whirling around is the main objective here (see p. 23).

For combinations with series BSPB fixed end pillow block units, the pillow block units were designed with the same centre height and the same lateral stopping dimension. This permits the units to be adjoined to the same machined reference edge. The alignment is thus facilitated (see figure 57-601, 57-602, p. 24).

# 5. IBC Precision Locknuts and Labyrinth Seals

**Applications**
IBC Precision Locknuts are used for high-precision application owing to their high degree of accuracy. The no longer necessary retaining groove in the shafts (for the formerly used lock washers) facilitates production and assembly. The material cross section is maintained and the notch effect is not increased un-necessarily. Accuracy is increased by elimination of the imprecise lock washers (axial runout is reduced).

**Tolerances**
A high accuracy of the axial eccentricity according to IT3, ISO basic tolerances according to DIN 7151 (see p. 11), will be achieved by precision-machining the inner thread with its securing elements and the face in one operation. The face will be additionally compressed during machining. The securing elements, which are also profiled, bear on the thread flanks. The thread is manufactured with a tolerance of 4H according to DIN 13 T21-24. From M210x4 on, the tolerance is 6H.

**Design**
For compact applications (lightest weight), series MMR locknuts are used. The locknut in recessed locations which cannot be reached radially (housing bores) are secured using the axially accessible socket set screws on the MMA and MBA series nuts. This option requires a larger width because of the inner construction. From Ø 20 on, the MBA model is supplied. The permissible axial load corresponds to the MMR nut.
The same cross section as MBA is used for MMRB and thus permits larger loads and tightening torques. This is of interest in particular for preloading bearings supporting a high axial load (in ball screws, for instance).

**Nuts with Labyrinth Seal**
The MMRBS and MBAS series additionally have a set of laminar rings made out of spring steel, which may create a compact labyrinth seal in conjunction with the housing where limited space is available. The intermediate space of the labyrinth area must be filled with grease before and after mounting.
The cross section of the series MMRS nuts with similar properties as MMRBS nuts were designed to match the series BS 60° Super Precision Angular Contact Thrust Ball Bearings and the MD Seal Nuts (see page 24, 28 and 29). These are available in the standard sizes as well as in special sizes (different cross section) or made from stainless steel or with ATCoating.

**Abutment and Fillet Dimensions**
The recommended tolerance of the counter thread of the shaft is “medium” 6g, 6h or “fine” 4h for higher accuracy requirements (machine tools).

**Strength of the Nut Threads**
Threads up to M50: 1000 N/mm$^2$
Threads up to M55 – M85: 870 N/mm$^2$
Threads from M90 on: 700 N/mm$^2$

The permissible axial loads are applicable to bolt threads with a tensile strength of at least 700 N/mm$^2$. In case of dynamic load, 75 % of Fa is permissible.

**Mounting**
Nut to be screwed in with all locking devices in unchanged positions. Use spanners to tighten the locknuts with approx. double of the nominal torque (to avoid setting of the clamped parts), loosen and retighten them applying the nominal torque. The necessary tightening torque depends on the required preload $F_v$ [N] and can be determined approximately using the following equation:

$$M_D = 3 \cdot d_{\,Thread} \cdot F_v \cdot K_{Fv} \cdot 10^{-4}\ [Nm] \qquad [5.1]$$

$K_{Fv}$: bearing arrangement constant
For $F_v$ of the single bearings: for bs bearings see p. 9:

| | | | | | |
|---|---|---|---|---|---|
| <> | DB | 1 | <<>> | QBC | 2 |
| <<> | TBT | 1,36 | <<<<> | PBT | 1,71 |
| <<<> | QBT | 1,57 | <<<>>> | PBC | 2,42 |

$K_{Fv}$ = 1 for bearing units with $F_v$ preload for the unit, see p. 22.

(A single tightening with $M_D$ is sufficient for the heavily preloaded 60° super precision angular contact thrust ball bearings).

**Securing against loosening**
First tighten securing screw via hexagon socket set screw lightly until you notice resistance. Tighten second screw located opposite. If existing, tighten third screw (only in case of MMRB, MMRBS and MMRS) and fourth screw in model …Q. Retighten screws. For maximum tightening torques of the socket set screws, please refer to table.

| Socket set screws | Key size S [mm] | Tightening torque Max. $M_A$ [Nm] |
|---|---|---|
| M4 | 2 | 2 |
| M5 | 2,5 | 4 |
| M6 | 3 | 7 |
| M8 | 4 | 18 |
| M10 | 5 | 34 |
| M12 | 6 | 60 |

*Table 5.1: Maximum tightening torques of securing devices*

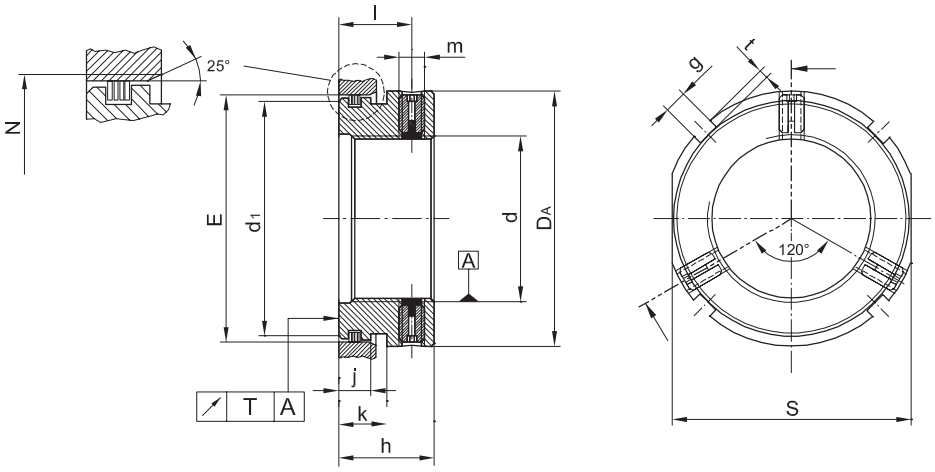
This results in high loosening torques to prevent unintended loosening even for spindles running clockwise and counter-clockwise intermittently.

**Disassembly**
Loosen securing elements first for disassembly. Since clamping does not deform the profiled securing elements made from hard bronze, the nut can be used repeatedly after loosening.

**Designations for IBC Precision Locknuts**

| | |
|---|---|
| MMR | narrow precision locknut with radial lock |
| MMRB | wide precision locknut with radial lock |
| MMA | precision locknut with axial lock via 2 cones meeting at an angle of 90° |
| MBA | precision locknut with axial lock via slotted segments, from Ø 20 on |
| MMRBS | the same as MMRB, but with laminar labyrinth seal |
| MBAS | the same as MBA, but with laminar labyrinth seal |
| MMRS | special locknut with radial lock, to match 60° Super Precision Angular Contact Thrust Ball Bearings BS and MD locknut |
| . . . . Q | 4 securing elements, unless standard |

## 5.1 Labyrinth Locknuts MMRS



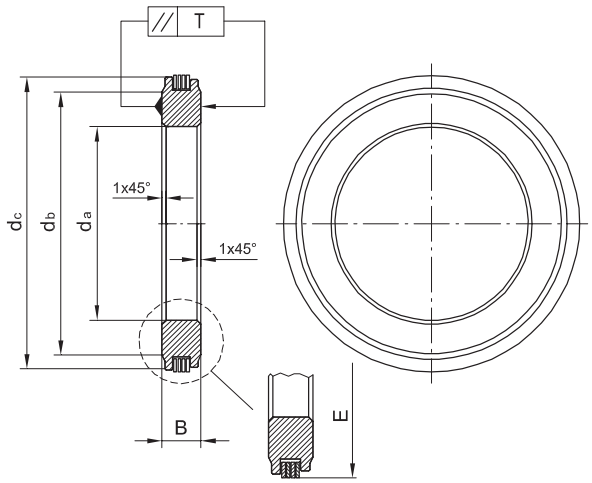

**MMRS..-..Q2** 58-001

| Thread | Designation | Dimensions | | | | | | | | | | | | Tightening torque set screws | Permissible axial load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | E | $D_A$ | h | g | t | $d_1$ | l | m | j | k | N | S | $M_S$ | $F_a$ |
| | | mm | | | | | | | | | | | | Nm | kN |
| **M 17 x 1** | **MMRS 17-36.Q2** | 36 | 38 | 20 | 5 | 2 | 32 | 15.5 | M 5 | 9 | 11 | 37.5 | 36 | 4 | 100 |
| **M 20 x 1** | **MMRS 20-36.Q2** | | | | | | | | | | | | | | 110 |
| **M 22 x 1** | **MMRS 22-36.Q2** | | | | | | | | | | | | | | 110 |
| **M 25 x 1.5** | **MMRS 25-50.Q2** | 50 | 58 | 25 | 6 | 2.5 | 46 | 19 | M 6 | 10 | 13 | 52 | 55 | 7 | 150 |
| **M 27 x 1.5** | **MMRS 27-50.Q2** | | | | | | | | | | | | | | |
| **M 30 x 1.5** | **MMRS 30-50.Q2** | | | | | | | | | | | | | | 180 |
| **M 30 x 1.5** | **MMRS 30-60.Q2** | 60 | 70 | 28 | | | 56 | 21 | M 8 | | | 63 | 65 | 18 | 180 |
| **M 35 x 1.5** | **MMRS 35-60.Q2** | | | | | | | | | | | | | | 190 |
| **M 40 x 1.5** | **MMRS 40-60.Q2** | | | | | | | | | | | | | | 210 |
| **M 45 x 1.5** | **MMRS 45-60.Q2** | | | | | | | | | | | | | | 260 |
| **M 35 x 1.5** | **MMRS 35-76.Q2** | 76 | 80 | 30 | 7 | 3 | 72 | 23 | | | 15 | 79.5 | 75 | | 290 |
| **M 40 x 1.5** | **MMRS 40-76.Q2** | | | | | | | | | | | | | | 340 |
| **M 45 x 1.5** | **MMRS 45-76.Q2** | | | | | | | | | | | | | | 400 |
| **M 50 x 1.5** | **MMRS 50-76.Q2** | | | | | | | | | | | | | | 420 |
| **M 55 x 2** | **MMRS 55-76.Q2** | | | | | | | | | | | | | | 450 |
| **M 55 x 2** | **MMRS 55-99.Q2** | 99 | 105 | | 8 | 3.5 | 95 | | | | | 103 | 95 | | 450 |
| **M 60 x 2** | **MMRS 60-99.Q2** | | | | | | | | | | | | | | 480 |
| **M 65 x 2** | **MMRS 65-99.Q2** | | | | | | | | | | | | | | 480 |
| **M 75 x 2** | **MMRS 75-99.Q2** | | | | | | | | | | | | | | 510 |
| **M 100 x 2** | **MMRS 100-132.Q2** | 132 | 140 | 35 | 12 | 5 | 128 | 27 | M 10 | 12 | 19 | 137.3 | 135 | 34 | 710 |
| **M 125 x 2** | **MMRS 125-162.Q2** | 162 | 175 | | | | 158 | | | | | 165 | 165 | | 800 |

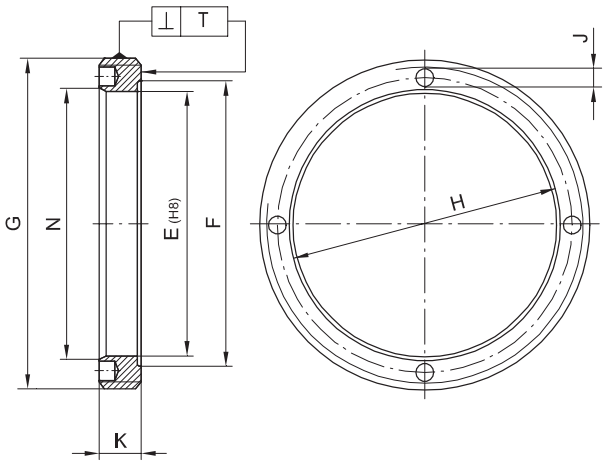
Axial runout according to IT3, DIN 7151

The Labyrinth Locknut with the mounted laminar spring-steel rings and the matching housing or a seal nut is forming a non-contact seal (see p. 29).
Whereas the Labyrinth Locknut turns with the shaft, the spring-steel rings are standing still, being preloaded radially to the outside by the housing. The free space has to be filled with the same grease as used for the bearings. The sealing area of the Labyrinth Locknut is already lubricated with BearLub GH62 grease, which has proven its quality in the lubrication of Ball Screw Support Bearings. Two additional engineer's wrenches flats located opposite each other facilitate the assembly. This locknut is used in particular with 60° Super Precision Angular Contact Thrust Ball Bearings (and in bearing units).

## 5.2 Labyrinth Seals S — Seal Nuts MD




**S..-...Q2** 58-002

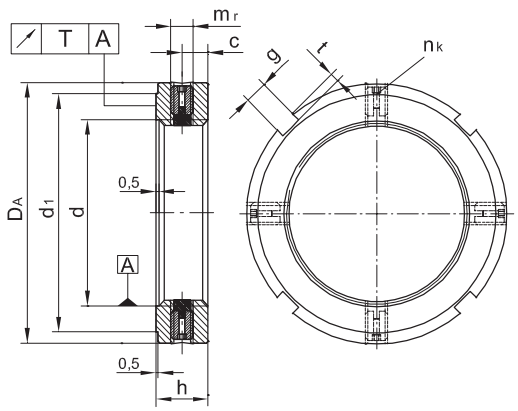



**MD..-...Q5** 58-003

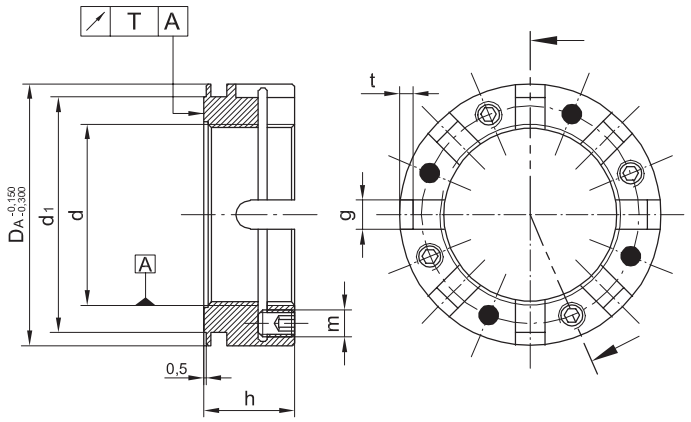
| Designation | Dimensions | | | | Designation | Dimensions | | | | | | | Permissible axial load |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | $d_a$ | $d_b$ | $d_c$ | B | | E | F | G | H | J | K | N | $F_a$ |
| | mm | | | | | mm | | | | | | | kN |
| **S 12-26.Q2** | 12 | 21 | 25.6 | 7 | **MD 40-26.Q5** | 26 | 28 | M 40 x 1.5 | 31 | 4.3 | 9 | 27 | 45 |
| **S 15-26.Q2** | 15 | | | | | | | | | | | | |
| **S 17-36.Q2** | 17 | 26 | 35.6 | | **MD 50-36.Q5** | 36 | 41 | M 50 x 1.5 | 42.5 | | 10 | 37.5 | 65 |
| **S 20-36.Q2** | 20 | | | | | | | | | | | | |
| **S 25-40.Q2** | 25 | 32 | 39.7 | | **MD 55-40.Q5** | 40 | 45 | M 55 x 1.5 | 47 | | | 42 | 77 |
| **S 25-50.Q2** | | 41 | 49.6 | 10 | **MD 70-50.Q5** | 50 | 56 | M 70 x 1.5 | 59.5 | | 12 | 52 | 100 |
| **S 30-50.Q2** | 30 | | | | | | | | | | | | |
| **S 30-60.Q2** | | 46 | 59.6 | | **MD 80-60.Q5** | 60 | 65 | M 80 x 1.5 | 72 | | | 63 | 130 |
| **S 35-60.Q2** | 35 | | | | | | | | | | | | |
| **S 35-76.Q2** | | 66 | 75.6 | 12 | **MD 110-76.Q5** | 76 | 92 | M 110 x 2 | 90 | 6.3 | 14 | 79.5 | 190 |
| **S 40-60.Q2** | 40 | 50 | 59.6 | 10 | **MD 80-60.Q5** | 60 | 65 | M 80 x 1.5 | 72 | 4.3 | 12 | 63 | 130 |
| **S 40-76-10.Q2** | | 66 | 75.6 | | **MD 95-76.Q5** | 76 | 82 | M 95 x 2 | 84.5 | 6.3 | | 79.5 | 150 |
| **S 40-76-12.Q2** | | | | 12 | **MD 110-76.Q5** | | 92 | M 110 x 2 | 90 | | 14 | | 190 |
| **S 45-60.Q2** | 45 | 55 | 59.6 | 10 | **MD 80-60.Q5** | 60 | 65 | M 80 x 1.5 | 72 | 4.3 | 12 | 63 | 130 |
| **S 45-66.Q2** | | | 65.6 | | **MD 85-66.Q5** | 66 | 72 | M 85 x 1.5 | 76 | | | 69 | 130 |
| **S 45-76.Q2** | | 66 | 75.6 | 12 | **MD 110-76.Q5** | 76 | 92 | M 110 x 2 | 90 | 6.3 | 14 | 79.5 | 190 |
| **S 50-76-10.Q2** | 50 | 68 | | 10 | **MD 95-76.Q5** | | 82 | M 95 x 2 | 84.5 | | 12 | | 150 |
| **S 50-76-12.Q2** | | | | 12 | **MD 110-76.Q5** | | 92 | M 110 x 2 | 90 | | 14 | | 190 |
| **S 55-76.Q2** | 55 | | | 10 | **MD 95-76.Q5** | | 82 | M 95 x 2 | 84.5 | | 12 | | 150 |
| **S 55-99.Q2** | | 86 | 98.6 | 12 | **MD 130-99.Q5** | 99 | 110 | M 130 x 2 | 110 | | 14 | 103 | 220 |
| **S 60-99.Q2** | 60 | | | | | | | | | | | | |
| **S 75-99.Q2** | 75 | | | 10 | **MD 120-99.Q5** | | 101 | M 120 x 2 | | | | | 210 |
| **S 100-132.Q2** | 100 | 114 | 131.6 | 14 | **MD 160-132.Q5** | 132 | 134 | M 160 x 3 | 148 | | 18 | 137.3 | 340 |
| **S 110-132.Q2** | 110 | 120 | 131.7 | | | | | | | | | | |
| **S 127-162.Q2** | 127 | 144 | 161.6 | 14.5 | **MD 190-162.Q5** | 162 | 167 | M 190 x 3 | 176 | | | 166 | 440 |

The non-contact series S sealing elements consist of a ground parallel steel ring with a radial outside groove. A set of laminar spring-steel rings is assembled into the groove, surrounded by a grease pack (GH62).
These are pressed into the bore of the matching series MD seal nut or into a housing bore via a chamfer and are thus fixed.
The spacer (support ring) of the labyrinth seal located on the shaft thus turns without touching the opposite lamella. A grease pack in the groove prevents the axial contact of the lamella with the walls. The Labyrinth Seals have proven to be of advantage adjoining bearings preloaded via these seals (Angular Contact Ball Bearings and 60° Super Precision Angular Contact Ball Bearings).
The Seal Nuts MD with outside thread can also be used separately to clamp outer bearing rings or other machine parts. They need to be secured by glue. An external radial lock is also possible.
Further sizes are available on inquiry.

## 5.3 Precision Locknuts MMR, MMRB, MMRBS, MBA, MBAS




**MMR..** 58-004

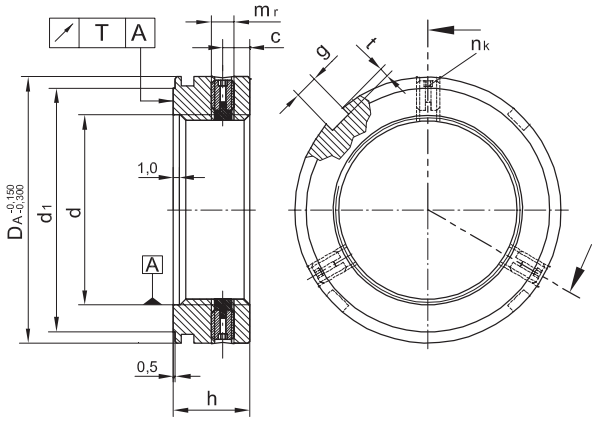



**MBA..** 58-005

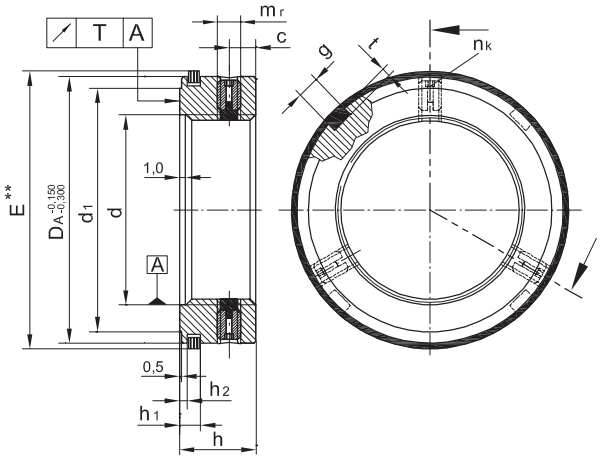
| Thread | Designation | | Dimensions | | | | | | | | | | | Max. tightening torque set screws | | Permissible axial load MMR / MMRB | MMA / MBA |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tolerance 4H | Radial locking system | Axial locking system | $D_A$ | h | g | t | $d_1$ | c | $m_a$ | $m_r$ | $h_1$ | $h_2$ | E* | $M_S$ rad. | $M_S$ ax. | $F_a$ | |
| | | | mm | | | | | | | | | | | Nm | | kN | |
| **M 6 x 0.5** | **MMR 6** | | 16 | 8 | 3 | 2 | 12 | 4 | – | M 4 | | – | – | 2 | – | 16 | |
| **M 8 x 0.75** | **MMR 8** | | | | | | | | | | | | | | | 17 | |
| **M 10 x 0.75** | **MMR 10** | | 18 | | | | 14 | | | | | | | | | 22 | |
| **M 12 x 1** | **MMR 12** | | 22 | | | | 18 | | | | | | | | | 26 | |
| **M 15 x 1** | **MMR 15** | | 25 | | | | 21 | | | | | | | | | 33 | |
| **M 17 x 1** | **MMR 17** | | 28 | 10 | 4 | | 23 | 5 | | M 5 | | | | 4 | | 49 | |
| | | **MMA 17 **** | | 16 | | | | | M 4 | | | | | | 2 | 70 | 70 |
| **M 20 x 1** | **MMR 20** | | 32 | 10 | | | 27 | | | | | | | | | 55 | |
| | **MMRB 20** | **MBA 20** | | 16 | | | | | | | 4.4 | 2.9 | 32 | | | 110 | 110 |
| **M 20 x 1.5** | **MMR 20 x 1.5** | | | 10 | | | | | | | | | | | | 70 | |
| | **MMRB 20 x 1.5** | **MBA 20 x 1.5** | | 16 | | | | | | | | | 32 | | | 110 | 110 |
| **M 25 x 1.5** | **MMR 25** | | 38 | 12 | 5 | | 33 | 6 | | M 6 | | | | 7 | | 87 | |
| | **MMRB 25** | **MBA 25** | | 18 | | | | | | | | | 38 | | | 130 | 130 |
| **M 30 x 1.5** | **MMR 30** | | 45 | 12 | | | 40 | | | | 5.2 | 3.2 | | | | 110 | |
| | **MMRB 30** | **MBA 30** | | 18 | | | | | M 6 | | | | 45 | | 7 | 150 | 150 |
| **M 35 x 1.5** | **MMR 35** | | 52 | 12 | | | 47 | | | | | | | | | 120 | |
| | **MMRB 35** | **MBA 35** | | 18 | | | | | | | | | 52 | | | 170 | 120 |
| **M 40 x 1.5** | **MMR 40** | | 58 | 14 | 6 | 2.5 | 52 | 7 | | | | | | | | 150 | |
| | **MMRB 40** | **MBA 40** | | 20 | | | | | | | | | 58 | | | 210 | 150 |
| **M 45 x 1.5** | **MMR 45** | | 65 | 14 | | | 59 | | | | 6 | 3.6 | | | | 170 | |
| | **MMRB 45** | **MBA 45** | | 20 | | | | | | | | | 65 | | | 240 | 170 |
| **M 50 x 1.5** | **MMR 50** | | 70 | 14 | | | 64 | | | | | | | | | 180 | |
| | **MMRB 50** | **MBA 50** | | 20 | | | | | | | | | 70 | | | 260 | 180 |
| **M 55 x 2** | **MMR 55** | | 75 | 16 | 7 | 3 | 68 | 8 | | M 8 | | | | 18 | 18 | 250 | |
| | **MMRB 55** | **MBA 55** | | 22 | | | | | M 8 | | | | 75 | | | 340 | 250 |
| **M 60 x 2** | **MMR 60** | | 80 | 16 | | | 73 | | | | | | | | | 270 | |
| | **MMRB 60** | **MBA 60** | | 22 | | | | | | | | | 80 | | | 360 | 270 |
| **M 65 x 2** | **MMR 65** | | 85 | 16 | | | 78 | | | | | | | | | 290 | |
| | **MMRB 65** | **MBA 65** | | 22 | | | | | | | | | 85 | | | 400 | 290 |
| **M 70 x 2** | **MMR 70** | | 92 | 18 | 8 | 3.5 | 85 | 9 | | | | | | | | 350 | |
| | **MMRB 70** | **MBA 70** | | 24 | | | | | | | | | 92 | | | 470 | 350 |
| **M 75 x 2** | **MMR 75** | | 98 | 18 | | | 90 | | | | | | | | | 370 | |
| | **MMRB 75** | **MBA 75** | | 24 | | | | | | | | | 98 | | | 500 | 370 |
| **M 80 x 2** | **MMR 80** | | 105 | 18 | | | 95 | | | | 7.3 | 4.3 | | | | 390 | |
| | **MMRB 80** | **MBA 80** | | 24 | | | | | | | | | 105 | | | 520 | 390 |
| **M 85 x 2** | **MMR 85** | | 110 | 18 | | | 102 | | | M 10 | | | | 34 | 34 | 400 | |
| | **MMRB 85** | **MBA 85** | | 24 | | | | | M 10 | | | | 110 | | | 540 | 400 |

E* see page 31 MMRBS ** Securing: 2 cones at 90°, different threads and pitch on request:
MMR 16 x 1,5 Q; MMR 33 x 1,5 Q; MMR 42 x 1,5 Q; MMR 60 x 1,5; MMR 65 x 1,5 Q; MMR 145 x 2 Q.

# Precision Locknuts MMR, MMRB, MMRBS, MBA, MBAS




**MMRB...** 58-006




**MMRBS...** 58-007

| Thread | Designation | | Dimensions | | | | | | | | | | | Max. tightening torque set screws | Permissible axial load MMR MMRB | MMA MBAS |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Tolerance 4H | Radial locking system | Axial locking system | $D_A$ | h | g | t | $d_1$ | c | $m_r$ $m_a$ | $n_K$ | $h_1$ | $h_2$ | E* | $M_S$ | $F_a$ | |
| | | | mm | | | | | | | | | | | Nm | kN | |
| **M 90 x 2** | **MMR 90** | | 120 | 20 | 10 | 4 | 108 | 9 | M 10 | 4 | 7.3 | 4.3 | | 34 | 470 | |
| | **MMRB 90** | **MBA 90** | | 26 | | | | | | | | | 120 | | 610 | 470 |
| **M 95 x 2** | **MMR 95** | | 125 | 20 | | | 113 | | | | | | | | 490 | |
| | **MMRB 95** | **MBA 95** | | 26 | | | | | | | | | 125 | | 640 | 490 |
| **M 100 x 2** | **MMR 100** | | 130 | 20 | | | 120 | | | | | | | | 510 | |
| | **MMRB 100** | **MBA 100** | | 26 | | | | | | | | | 130 | | 660 | 510 |
| **M 105 x 2** | **MMR 105** | | 140 | 22 | 12 | 5 | 126 | | | | | | | | 560 | |
| | **MMRB 105** | **MBA 105** | | 28 | | | | | | | | | 140 | | 700 | 560 |
| **M 110 x 2** | **MMR 110** | | 145 | 22 | | | 133 | | | | | | | | 600 | |
| | **MMRB 110** | **MBA 110** | | 28 | | | | | | | | | 145 | | 770 | 600 |
| **M 115 x 2** | **MMR 115** | | 150 | 22 | | | 137 | | | | 7.5 | 4.4 | | | 660 | |
| | **MMRB 115** | **MBA 115** | | 28 | | | | | | | | | 150 | | 820 | 660 |
| **M 120 x 2** | **MMR 120** | | 155 | 24 | | | 138 | | | | | | | | 710 | |
| | **MMRB 120** | **MBA 120** | | 30 | | | | | | | | | 155 | | 890 | 710 |
| **M 125 x 2** | **MMR 125** | | 160 | 24 | | | 148 | | | | | | | | 740 | |
| | **MMRB 125** | **MBA 125** | | 30 | | | | | | | | | 160 | | 920 | 740 |
| **M 130 x 2** | **MMR 130** | | 165 | 24 | | | 149 | | | | | | | | 760 | |
| | **MMRB 130** | **MBA 130** | | 30 | | | | | | | | | 165 | | 950 | 760 |
| **M 140 x 2** | **MMR 140** | | 180 | 26 | 14 | 6 | 160 | 10 | M 12 | | | | | 60 | 880 | |
| | **MMRB 140** | **MBA 140** | | 32 | | | | | | | | | 180 | | 1080 | 880 |
| **M 150 x 2** | **MMR 150** | | 195 | 26 | | | 171 | | | | | | | | 930 | |
| | **MMRB 150** | **MBA 150** | | 32 | | | | | | | | | 195 | | 1040 | 930 |
| **M 160 x 3** | **MMRB 160** | **MBA 160** | 205 | 34 | 16 | 7 | 182 | | | | 8.3 | 5.3 | 205 | | 1360 | 1020 |
| **M 170 x 3** | **MMRB 170** | **MBA 170** | 220 | | | | 198 | | | | | | 220 | | 1430 | 1075 |
| **M 180 x 3** | **MMRB 180** | **MBA 180** | 230 | 36 | 18 | 8 | 203 | | | | | | 230 | | 1600 | 1200 |
| **M 190 x 3** | **MMRB 190** | **MBA 190** | 240 | | | | 214 | | | | | | 240 | | 1670 | 1250 |
| **M 200 x 3** | **MMRB 200** | **MBA 200** | 250 | 38 | | | 226 | | | | | | 250 | | 1850 | 1390 |
| **M 210 x 4** | **MMRB 210** | | 270 | 40 | 20 | 10 | 238 | 14 | M 14 | | 10 | 6.4 | 270 | 85 | 2000 | |
| **M 220 x 4** | **MMRB 220** | | 280 | | | | 250 | | | | | | 280 | | 2250 | |
| **M 240 x 4** | **MMRB 240** | | 300 | 44 | | | 270 | | | | | | 300 | | 2300 | |
| **M 260 x 4** | **MMRB 260** | | 310 | | | | 290 | | | | | | 310 | | 2500 | |
| **M 280 x 4** | **MMRB 280** | | 330 | 50 | 24 | | 310 | | | | 11 | 6.6 | 330 | | 2850 | |
| **M 300 x 5** | **MMRB 300** | | 360 | | | | 336 | | | | | | 360 | | 3100 | |

Face runout T acc. to IT3, DIN 7151; *above Ø 200 : 6H

$N_K$: no. of socket set screws (locking system)

MBAS, MMRBS = MBA, MMRB + Laminar spring steel rings (labyrinth seal)

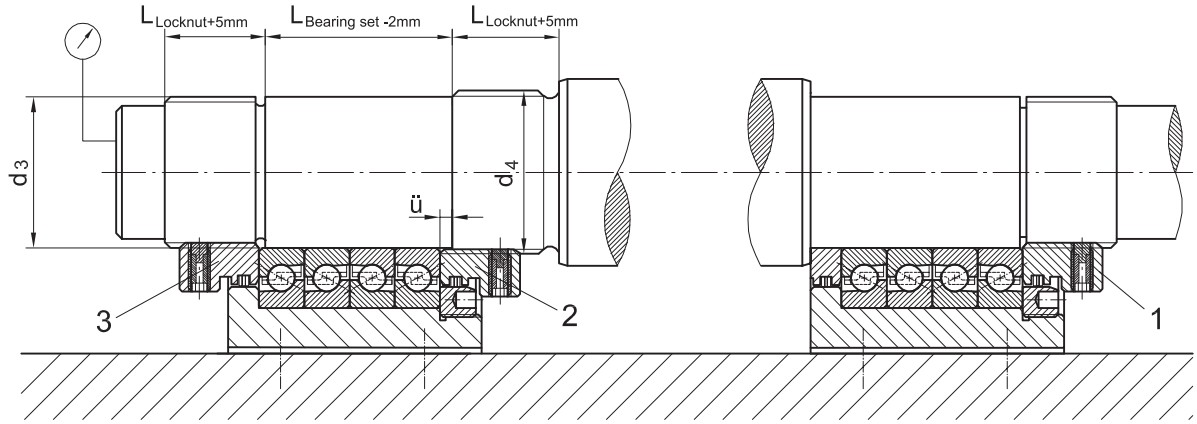
E* = Bore diameter of counterpart = $D_{AO}{}^{+0,1}$ … and a 25° chamfer for the sealing (see also MMRS), where the feeding diameter is 4 % larger than $D_a$.

## 5.4 Pretension of spindles with Precision Locknuts

### 5.4.1 Application with two Fixed End Bearings and Stretched Spindle

Two locknuts with integrated labyrinth seal are used at one end.
The interior nut should have a 2–5 mm larger thread diameter, e.g. MMRS 30-60.Q2 + MMRS 35-60.Q2 with a bearing support series BSPB-M 30Q50 or BSBU-M30QB98.

**Left-hand side of bearing (stretching side)** **Right-hand side of bearing**




58-601

$d_4 > d_3$ by one thread size (see MMRS on page 28)

(MMRS 25-36.Q2, MMRS 35-50.Q2 and other intermediate sizes are manufactured upon demand.
As an alternative, the series MMRB locknuts can be used next to the labyrinth seal).

**Spindle Stretching Procedure**

1) The right-hand unit is screwed and pinned, locknut 1 is preloaded with tightening torque $M_D$ acc. to page 27.
2) Tighten the base of the left-hand unit lightly.
3) Tighten locknuts 2 and 3 lightly first and then tighten them against each other and tighten locknut 3 with $M_D$.
4) Tighten screws in the base of the left-hand unit fully (ream and pin pre-drilled holes and pin).
5) Determine zero-value position at axial spindle reference surface via dial indicator. Then loosen locknut 2 a bit and carefully tighten locknut 3 until the dial of the indicator displays the setpoint stretching value. (For locknuts up to Ø 50, the pitch is 1.5 mm for 360° which corresponds e. g. to a stretch of 4.2 µm at an angle of rotation of 1°, from threat Ø 55 x 2 on, 5.6 µm correspond to 1° angle of rotation.)
6) Tighten locknut 2 with tightening torque $M_D$ against the bearing package and lock.

### 5.4.2 Stretching and preloading spring-preloaded spindles and bearing units

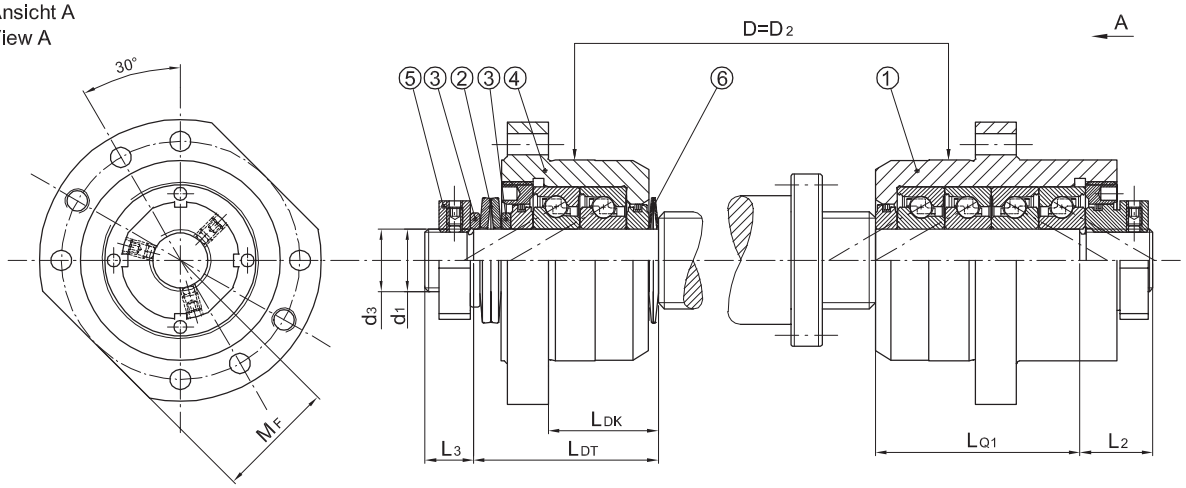
If larger expansion of the spindles due to heat is expected, the spindles and bearings are preloaded using separate MMRB locknuts. On the following page, two drawings for inquiry show the basic structure of these cartridge or pillow block units. Of course, a combination of these designs is possible.

The preload and thus the required stiffness are set via the spring path of the disc springs. When the drawing for inquiry is processed, details are discussed with the customer. For this purpose, the drawings may be copied and the required bearing units entered in accordance with the present catalogue.
At the floating end, the shaft $d_1$ has to be executed with a g4 or g5 seat.

# 6. Inquiry drawings for fixed bearings + spring preloaded construction groups

Beidseitig gelagerter Kugelgewindetrieb, federvorgespannt, mit sicherbaren Spannmuttern.
Ball screw supported at both ends, spring preloaded, with securable locknuts.

Ansicht A
View A




| d1 | d3 | D=D2 | L2 | L3 | LDT | LQ1 | MF | LDK |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | |

| Pos. | Bezeichnung / Designation | Menge / Quantity |
|---|---|---|
| 6 | Tellerfeder / Disc Spring | 2 Stück / Pieces |
| 5 | sicherbare Spannmutter / securable Locknut | 1 Stück / Piece |
| 4 | BSBU.....DB.....DT | 1 Stück / Piece |
| 3 | Distanzring / Spacer DS .....x.....x 4 | 2 Stück / Pieces |
| 2 | Tellerfeder / Disc Spring | 2 Stück / Pieces |
| 1 | BSBU-M.....QB..... | 1 Stück / Piece |

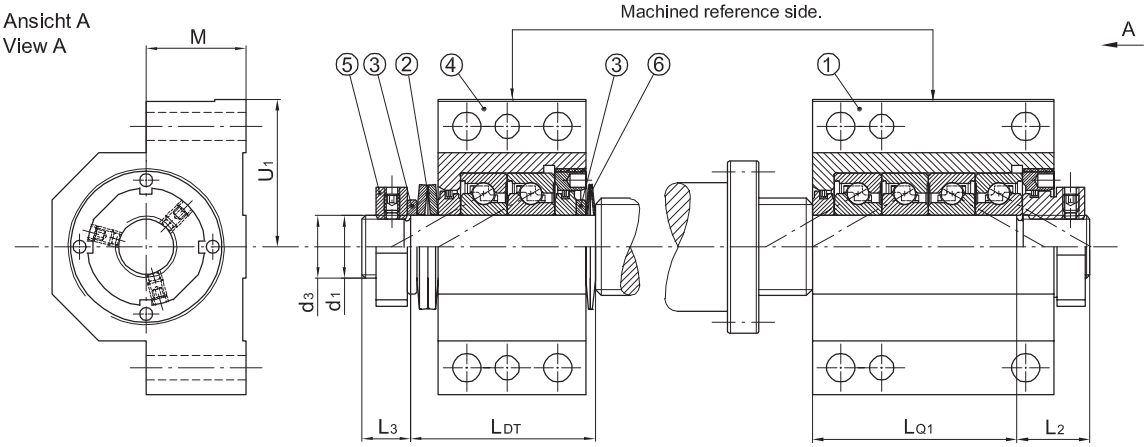
Techn. Daten siehe Katalog
Techn. data please see catalog

| Schutzvermerk nach DIN 34 beachten | MABSTAB/SCALE | IBC WÄLZLAGER GMBH Wetzlar–Germany |
|---|---|---|
| Erstellt : Stendebach 03.03.05 | | Bezeichnung, Designation: BS–Lagerung (Schema) / BS–Support (Scheme) |
| Geprüft : | | BSBU-M..QB... + BSBU..DB...DT + PLS |
| | 050303 | Zeichnungsnr., Drawing no. 57-812 |

Beidseitig gelagerter Kugelgewindetrieb, federvorgespannt, mit sicherbaren Spannmuttern.
Ball screw supported at both ends, spring preloaded, with securable locknuts.

Bearbeitete Anlagefläche.
Machined reference side.

Ansicht A
View A




| d1 | d3 | L2 | L3 | LDT | LQ1 | M | U1 |
|---|---|---|---|---|---|---|---|
| | | | | | | | |

| Pos. | Bezeichnung / Designation | Menge / Quantity |
|---|---|---|
| 6 | Tellerfeder / Disc Spring | 2 Stück / Pieces |
| 5 | sicherbare Spannmutter / securable Locknut | 1 Stück / Piece |
| 4 | BSPB.....D.....DT | 1 Stück / Piece |
| 3 | Distanzring / Spacer DS .....x.....x 4 | 2 Stück / Pieces |
| 2 | Tellerfeder / Disc Spring | 2 Stück / Pieces |
| 1 | BSPB-M.....Q..... | 1 Stück / Piece |

Techn. Daten siehe Katalog
Techn. data please see catalog

| Schutzvermerk nach DIN 34 beachten | MABSTAB/SCALE | IBC WÄLZLAGER GMBH Wetzlar–Germany |
|---|---|---|
| Erstellt : Stendebach 03.03.05 | | Bezeichnung, Designation: BS–Lagerung (Schema) / BS–Support (Scheme) |
| Geprüft : | | BSPB-M..Q... + BSPB..D...DT + PLS |
| | 050303 | Zeichnungsnr., Drawing no. 57-813 |

# 7. Alphanumerical Product Table



# 8. Glossary

## 8.1 Material

### Bearing Rings and Balls

| Suffix | Material | Material-no. | (USA) | (JAPAN) | Hardness [HRC] |
|---|---|---|---|---|---|
| – | Bearing Steel 100Cr6 | 1.3505 | SAE 52100 | SUJ2 | 62±2 |

| | Chemical Composition in percentage of weight-% | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | C | Si | Mn | P | S | Cr | Ni | Cu |
| | 0.9-1.05 | 0.15-0.35 | 0.25-0.45 | 0.03 | 0.025 | 1.35-1.65 | 0.3 | 0.3 |

| | Ceramic Balls (pressed isostaticly) | Hardness |
|---|---|---|
| CB | $Si_3N_4$ | 1600 [HV] |

| | Thin chromium coated bearing parts | | |
|---|---|---|---|
| AC | Armoloy ATCoating | 99 | 75[HRC]/1200 [HV] |

### Additional Suffixed of ATCoated Bearings

| | |
|---|---|
| A11 | Inner and outer ring ATCoated |
| A15 | Inner and outer ring ATCoated<br>Rolling elements and cage as far as possible corrosion protected |
| A21, A26 | Inner ring ATCoated |

### Function of the ATCoating

1) Reduction of friction, lower heat generation

| Friction Partners | static friction coefficient (dry) [μo] | sliding friction coefficient (dry) [μ] |
|---|---|---|
| Stahl/Stahl | 0.3 | 0.2 |
| Stahl/ATC | 0.17 | 0.16 |
| ATC/ATC | 0.14 | 0.12 |

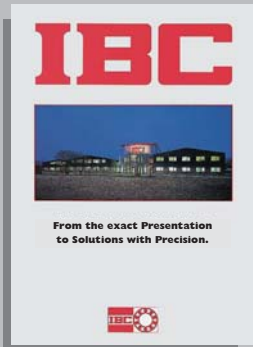
2) Lubricant film bonds better.
3) Separation of parts of same material; avoiding of cold welding by adhesion, avoiding of fretting corrosion. Securing of sliding property of bearing ring against shaft or housing (important for floating bearings).
4) Outer corrosion protection, chemical resistance against aggressive materials, tribocorrosion.
5) Wear protection by higher hardness of the rim zone 1200HV, 0.003 (75 HRC).

## 8.2 Grease

| Lubricant BearLub | Temperature range | Viscosity 40 °/100 °C |
|---|---|---|
| GH62: | – 30 °/160 °C | 150/18 $mm^2/s$ |
| GN21: | – 35 °/140 °C | 85/12,5 $mm^2/s$ |

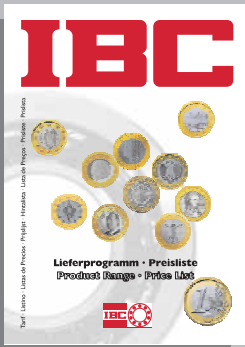
02/05

# More of IBC . . .




Company Profile


Product Range
T1-0-000 I / D (German)
T1-0-000 I / E (English)




Product Range
Pricelist


Angular Contact
Bearings 40°
T1-1-4044.0 / D (German)


Linear Bearings
T1-1-7001.2 / D (German)


Telescopic Rails
T1-1-7005.1 / D (German)


High Precision
Bearings
T1-1-5001.1 / D (German)


Super Precision Bearings
Service Catalog
T1-1-5003.1 / D (German)
T1-1-5003.1 / E (English)


ATCoated bearings
TI-1-5010.2 / D (German)

# IBC WÄLZLAGER GMBH

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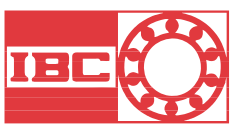


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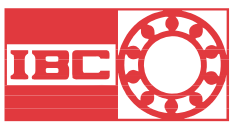


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