INTERNATIONAL STANDARD

**ISO 3408-2**

Second edition
2021-05

# Ball screws —

## Part 2: Nominal diameters, leads, nut dimensions and mounting bolts — Metric series

*Vis à billes —*

*Partie 2: Diamètres et pas hélicoïdaux nominaux et dimensions des écrous et boulons de montage — Série métrique*



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# Foreword

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The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

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This document was prepared by Technical Committee ISO/TC 39, *Machine tools*, in collaboration with Technical Committee ISO/TC 4, *Rolling bearings*, Subcommittee SC 11, *Linear motion rolling bearings.*

This second edition cancels and replaces the first edition (ISO 3408-2:1991), which has been technically revised.

The main changes compared to the previous edition are as follows:

— the technical state of the art has been substantially reviewed;

— three series of ball screws reflecting different international standards have been defined;

— dimensions reflecting current market situations have been added; and

— different types of flanges reflecting state of the art have been defined.

A list of all parts in the ISO 3408 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.



# Ball screws —

# Part 2: Nominal diameters, leads, nut dimensions and mounting bolts — Metric series

## 1 Scope

This document specifies the nominal diameters and nominal leads, mounting dimensions for ball screw nuts and mounting bolts for metric ball screws. It also gives preferred combinations of nominal diameter and nominal lead and a general plan which includes the additional combinations to be used when it becomes necessary to deviate from the preferred combinations.

## 2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 3408-1, *Ball screws — Part 1: Vocabulary and designation*

## 3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 3408-1 apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

— IEC Electropedia: available at http://www.electropedia.org/

## 4 Symbols

| Symbol | Description | Units |
|---|---|---|
| $d_0$ | Nominal diameter | mm |
| $D_1$ | Ball screw nut outer diameter | mm |
| $D_4$ | Mounting bolt pitch circle diameter | mm |
| $D_5$ | Flange mounting bolt diameter | mm |
| $D_6$ | Flange outer diameter | mm |
| $D_7$ | Screw head counter bore diameter | mm |
| $F_{a\,max}$ | Axial load at the opening limit of the nut flange | kN |
| $L_1$ | Centring diameter length | mm |

| | | |
|---|---|---|
| $L_3$ | Collar length | mm |
| $L_7$ | Flange length | mm |
| $L_8$ | Flat flange width | mm |
| $L_9$ | Counter bore depth | mm |
| $L_{10}$ | Lubrication port thread length | mm |
| $P_{ho}$ | Nominal lead | mm |
| $Q$ | Thread for lubrication port | |
| $T_a$ | Tightening torque of one bolt | Nm |

## 5 Nominal diameters, nominal leads and their combinations

Nominal diameters, nominal leads and their combinations are shown in Table 1. Preferred combination of nominal diameter and lead are highlighted in grey and bold.

**Table 1 — Nominal diameters, nominal leads and their combinations**

| Nominal diameter $d_0$ [mm] | Nominal lead $P_{ho}$ [mm] | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 1 | 1,5 | 2 | 2,5 | 3 | 4 | 5 | 6 | 8 | 10 | 12 | 15 | 16 | 20 | 25 | 30 | 32 | 40 | 50 |
| 4 | **1** | | | | | | | | | | | | | | | | | | |
| 5 | **1** | 1,5 | | | | | | | | | | | | | | | | | |
| 6 | **1** | 1,5 | **2** | 2,5 | | | | | | | | | | | | | | | |
| 8 | **1** | 1,5 | **2** | 2,5 | 3 | 4 | **5** | 6 | 8 | **10** | 12 | | | | | | | | |
| 10 | **1** | 1,5 | **2** | 2,5 | 3 | 4 | **5** | 6 | 8 | **10** | 12 | | | | | | | | |
| 12 | | | **2** | 2,5 | 3 | 4 | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | | | |
| 14 | | | **2** | 2,5 | 3 | 4 | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | | | |
| 16 | | | **2** | 2,5 | 3 | 4 | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | | | |
| 20 | | | | | 3 | 4 | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 25 | | | | | | 4 | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 28 | | | | | | 4 | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 32 | | | | | | 4 | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 36 | | | | | | 4 | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 40 | | | | | | | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 45 | | | | | | | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 50 | | | | | | | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 63 | | | | | | | **5** | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 80 | | | | | | | | 6 | 8 | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 100 | | | | | | | | | | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 125 | | | | | | | | | | **10** | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |
| 160 | | | | | | | | | | | 12 | 15 | 16 | **20** | 25 | 30 | 32 | **40** | 50 |

## 6 Mounting dimensions for ball screw nuts, type B6, B8 and B4, A6 and C6

There are three series of standardized ball screw nut dimensions. In Tables 2, 3 and 4, different types of ball screw nuts are shown. The following list shows these series of ball screws along with the corresponding figures and dimension tables.

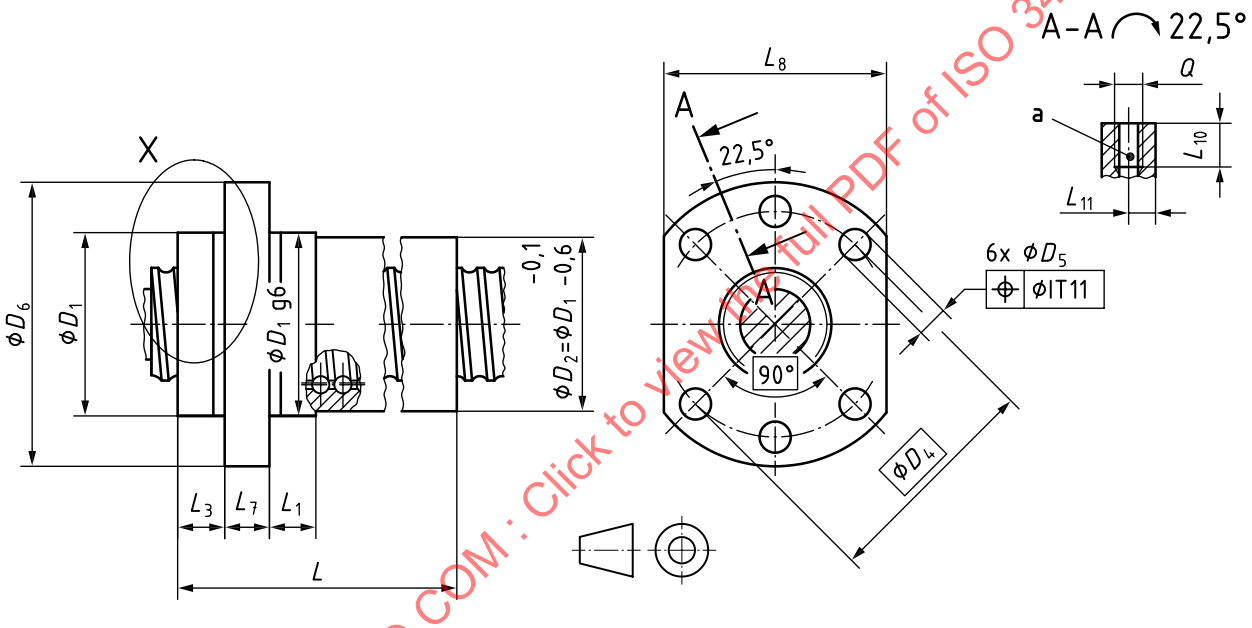
— Series 1 (internal recirculation): depicted in Figure 1 to 3; dimensions are shown in Table 2;

— Series 2 (internal recirculation): depicted in Figure 3 to 5; dimensions are shown in Table 3;

— Series 3 (external recirculation): depicted in Figure 3 to 5; dimensions are shown in Table 4.

Further design detail alternatives are given in Figure 6.

NOTE The character B in the type description, e.g. B4, represents the flange type and is based on the previous definition, where A represents round type, B two flats and C one flat flange type. The corresponding numbers represent the number of mounting holes on the flange (e.g. two flats flange type with 4 holes would be B4).




**Key**

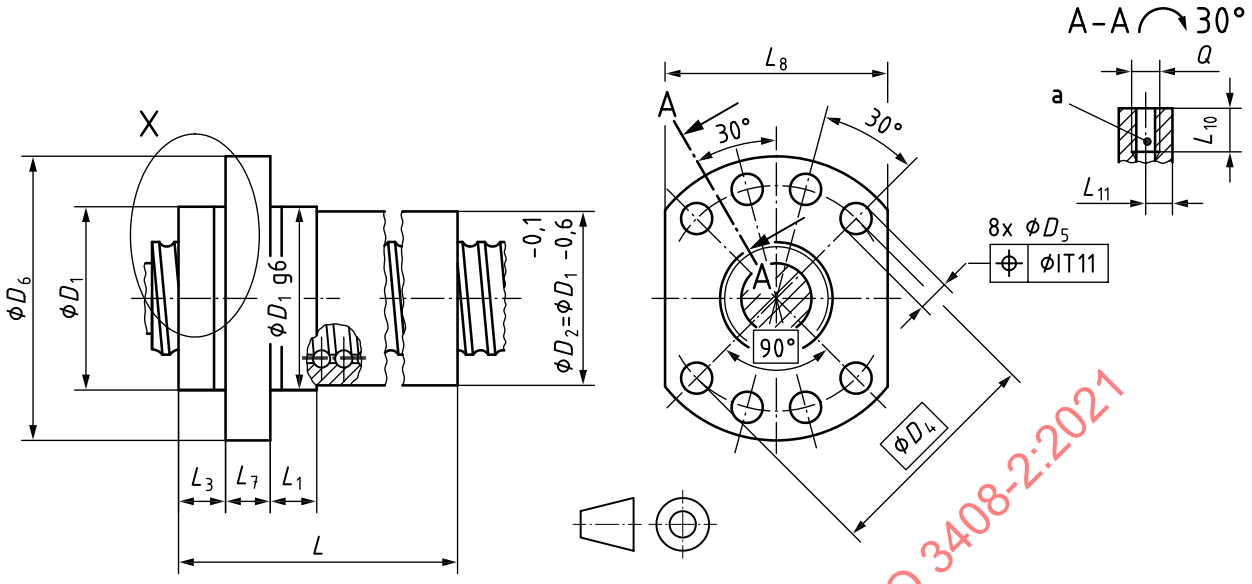
a If the position of the lubrication port is not sufficient, it can be sealed and replaced by a new axial hole on either side of the flange. Details need to be defined separately.

$L$ manufacturer-specific length of the ball screw nut

$L_{11}$ manufacturer-specific position of the thread for the lubrication port of the ball screw nut

NOTE See Figure 6 for detail X and all dimensions in Table 2.

**Figure 1 — Mounting dimensions for ball screw nuts, type B6**




**Key**

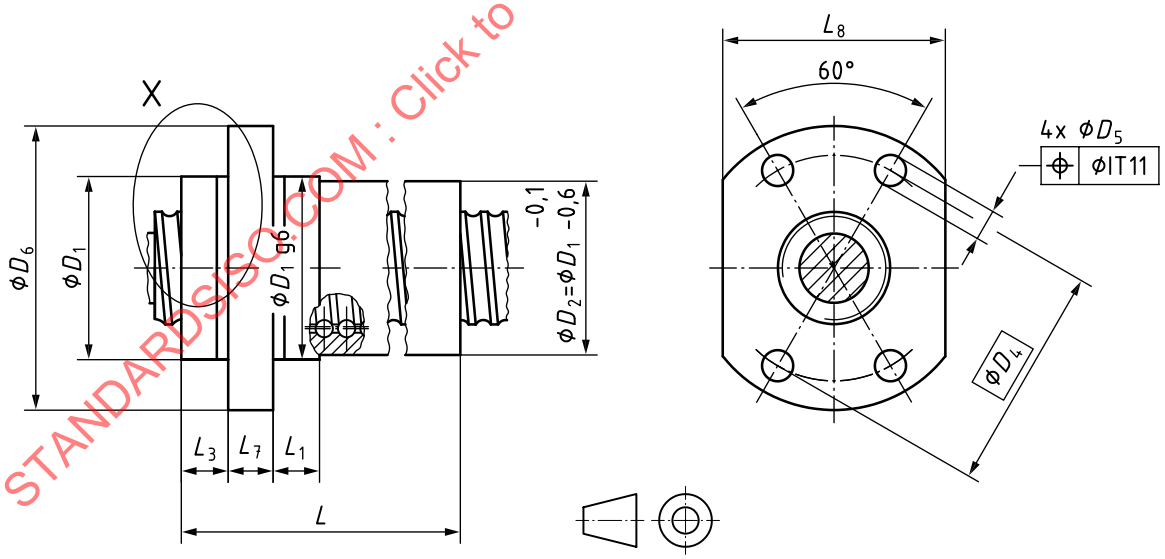
a If the position of the lubrication port is not sufficient, it can be sealed and replaced by a new axial hole on either side of the flange. Details need to be defined separately.

$L$ manufacturer-specific length of the ball screw nut

$L_{11}$ manufacturer-specific position of the thread for the lubrication port of the ball screw nut

NOTE See Figure 6 for detail X and all dimensions in Table 2.

**Figure 2 — Mounting dimensions for ball screw nuts, type B8**

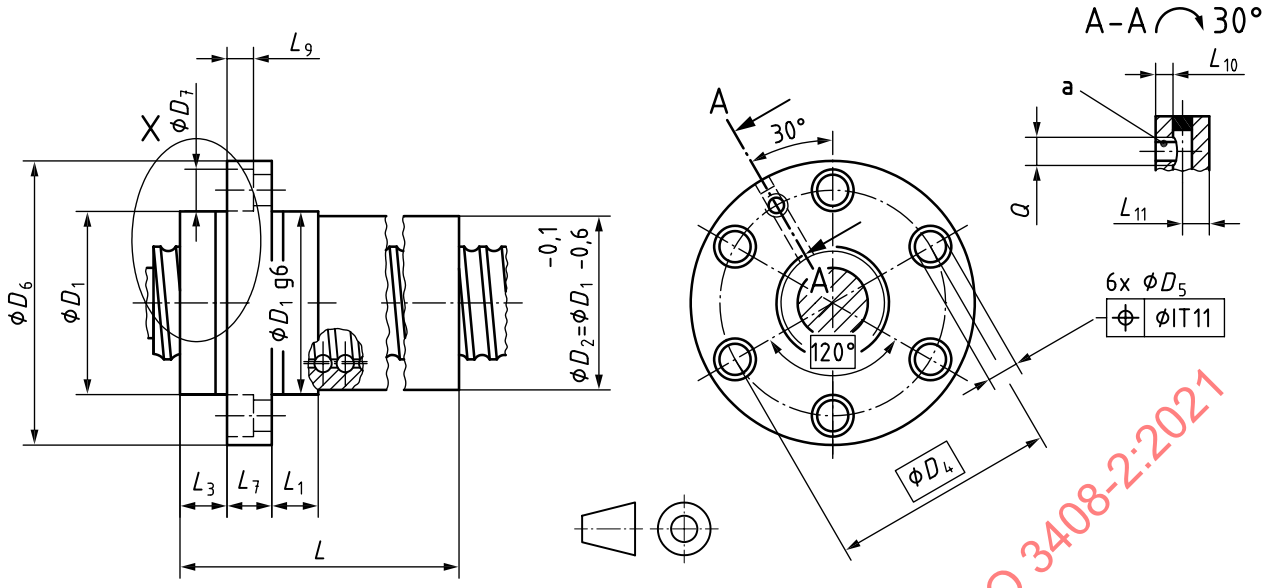



**Key**

$L$ manufacturer-specific length of the ball screw nut

NOTE See Figure 6 for detail X and all dimensions in Table 2, Table 3 and Table 4.

**Figure 3 — Mounting dimensions for ball screw nuts, type B4**




**Key**

a If the position of the lubrication port is not sufficient, it can be sealed and replaced by a new axial hole on either side of the flange. Details need to be defined separately.

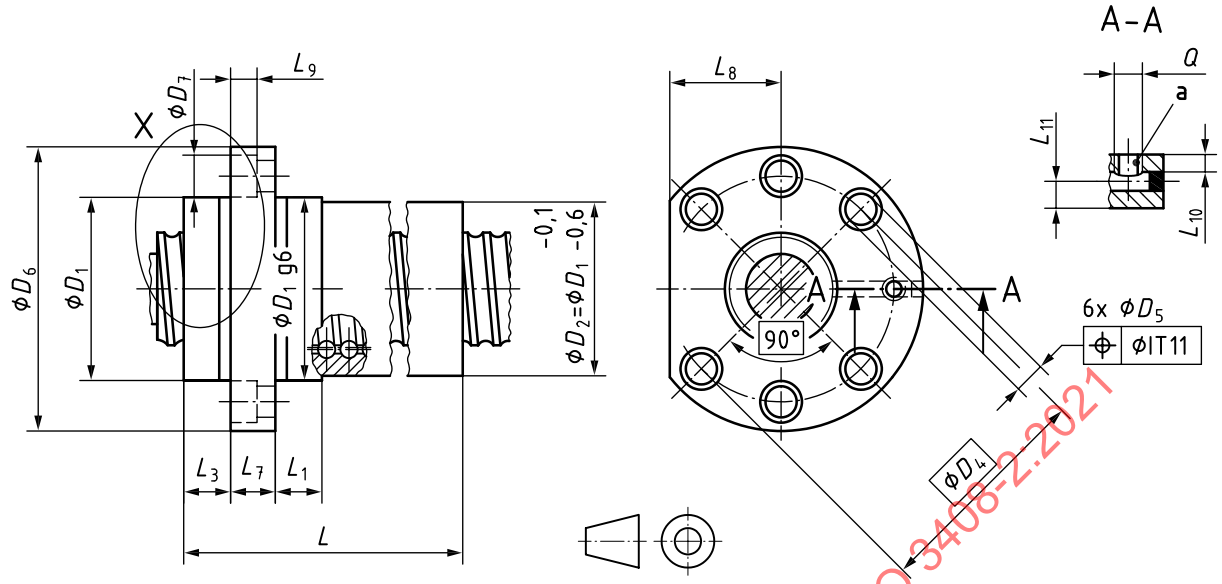
$L$ manufacturer-specific length of the ball screw nut

$L_{10}$ manufacturer-specific depth of the lubrication port

$L_{11}$ manufacturer-specific position of the thread for the lubrication port of the ball screw nut

NOTE See Figure 6 for detail X and all dimensions in Table 3 and 4.

**Figure 4 — Mounting dimensions for ball screw nuts, type A6**




**Key**

a If the position of the lubrication port is not sufficient, it can be sealed and replaced by a new axial hole on either side of the flange. Details need to be defined separately.

$L$ manufacturer-specific length of the ball screw nut

$L_{10}$ manufacturer-specific depth of the lubrication port

$L_{11}$ manufacturer-specific position of the thread for the lubrication port of the ball screw nut

NOTE See Figure 6 for detail X and all dimensions in Tables 3 and 4.

**Figure 5 — Mounting dimensions for ball screw nuts, type C6**

Detail X


**a) Collar without centring** **b) Collar with centring**

**Figure 6 — Alternatives for detail X (in Figures 1 to 5)**

## Table 2 — Mounting dimensions for ball screw nuts and mounting bolts – Series 1

| Nominal diameter $d_0$ mm | Nominal lead $P_{ho}$ mm | Ball screw nut outer diameter $D_1$ mm[b] | Mounting bolt pitch circle diameter $D_4$ mm | Ball screw nut flange type | Flange mounting bolts diameter $D_5$ mm | Flange outer diameter $D_6$ mm | Centring diameter length $L_1$ mm min. | Collar length $L_3$ mm max. | Flange length $L_7$ mm | Flat flange width $L_8$ mm | Lubrication port thread length $L_{10}$ mm min. | Thread for lubrication port $Q$ | Mounting bolts | Axial load at the opening limit of the nut flange $F_{a\,max}$[c] kN stat. | Tightening torque of one bolt $T_a$[c] Nm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | ≥1 | 11 | 17 | | 3,4 | 23 | 5 | 5 | 4 | 15 | – | – | M3 | 3,63 | 1,4 |
| 5 | ≥1 | 12 | 18 | | 3,4 | 24 | 5 | 5 | 4 | 15 | – | – | M3 | 3,63 | 1,4 |
| 6 | ≥1 | 12 | 18 | Figure 3 | 3,4 | 24 | 10 | 10 | 6 | 16 | – | – | M3 | 4,46 | 1,4 |
| 8 | ≥1 | 16 | 22 | Type B4 | 3,4 | 28 | 10 | 10 | 6 | 19 | – | – | M3 | 4,46 | 1,4 |
| 10 | ≥1 | 19 | 28 | | 4,5 | 36 | 10 | 12 | 6 | 23 | – | – | M4 | 8,16 | 3,1 |
| 12 | ≥2 | 24 | 32 | | 4,5 | 40 | 10 | 14 | 8 | 26 | – | – | M4 | 8,91 | 3,1 |
| 14 | ≥2 | 26 | 38 | | 5,5 | 48 | 10 | 10 | 10 | 40 | 8 | M6 × 1 | M5 | 23,6 | 6,3 |
| 16 | ≤5 | 28 | 38 | | 5,5 | 48 | 10 | 10 | 10 | 40 | 8 | M6 × 1 | M5 | 23,6 | 6,3 |
| 16 | >5 | 32 | 42 | | 5,5 | 52 | 10 | 15 | 10 | 40 | 8 | M6 × 1 | M5 | 23,6 | 6,3 |
| 20 | ≥1 | 36 | 47 | Figure 1 | 6,6 | 58 | 10 | 16 | 10 | 44 | 8 | M6 × 1 | M6 | 34,2 | 11 |
| 25 | ≤5 | 40 | 51 | Type B6 | 6,6 | 62 | 10 | 10 | 10 | 48 | 8 | M6 × 1 | M6 | 34,2 | 11 |
| 25 | >5 | 40 | 51 | | 6,6 | 62 | 10 | 17 | 10 | 48 | 8 | M6 × 1 | M6 | 34,2 | 12 |
| 28 | ≥4 | 46 | 65 | | 9 | 80 | 10 | 10 | 12 | 62 | 8 | M6 × 1 | M8 | 66,1 | 26 |
| 32 | ≤10 | 50 | 65 | | 9 | 80 | 10 | 10 | 12 | 62 | 8 | M6 × 1 | M8 | 66,1 | 26 |
| 32 | >10 | 56 | 71 | | 9 | 86 | 20 | 20 | 14 | 65 | 8 | M6 × 1 | M8 | 67,4 | 26 |
| 36 | ≥4 | 61 | 76 | | 9 | 91 | 10 | 17 | 14 | 68 | 10 | M8 × 1 | M8 | 89,9 | 26 |
| 40 | <10 | 63 | 78 | Figure 2 | 9 | 93 | 10 | 17 | 14 | 70 | 10 | M8 × 1 | M8 | 89,9 | 26 |
| 40 | ≥10 | 63 | 78 | Type B8 | 9 | 93 | 20 | 20 | 14 | 70 | 10 | M8 × 1 | M8 | 89,9 | 26 |
| 40 | >10[a] | 70 | 85 | | 9 | 100 | 25 | 25 | 14 | 75 | 10 | M8 × 1 | M8 | 89,9 | 26 |
| 45 | ≥5 | 70 | 88 | | 11 | 105 | 20 | 25 | 16 | 80 | 10 | M8 × 1 | M10 | 148 | 51 |

[a] Secondary sizes.

[b] Tolerances for $D_1$ for ball screw nut types B6, B8 and B4 (see Figures 1 to 3 and Figure 6).

[c] Basis of screw calculation: static load, concentric single-bolted joint, tapped thread joint (not through-bolt joint), opening of the nut flange at specified tensile force, only tensile force, no transverse force, calculated for hexagon socket head cap screws, property class 8.8, calculation is only valid for the specified bolt length, utilization factor of the yield point stress during tightening $\nu = 0{,}9$, load introduction factor $n$ according to VDI 2230 Nov. 2015; averaged for Table 2: $n = 0{,}34$, amount of embedding for $Rz < 10$ µm: $f_Z = f_{thread} + f_{head\ bearing\ area} + f_{interface} = 3{,}0$ µm + 2,5 µm + 1,5 µm = 7,0 µm, tightening factor $\alpha_A = 1{,}5$ for torque wrench; friction coefficient µg = 0,125; clamped part, bolt material and component with internal thread of steel $E = 210\,000$ N/mm$^2$. The following additional initial parameters were used for the screw calculation in Table 2: clamping length (clamped part) for Table 2: $l_k = L_7$; bolt length calculated from the clamping length and the length of thread engagement $l = l_k + 1{,}2 \cdot d$; diameter of through hole $D_{Ki} = D_5$; possible outside diameter of substitutional deformation cone $D_A$ outside = $D_6$ - $D_4$; possible inner diameter of substitutional deformation cone $D_{A\ inner} = D_4 - D_1$; diameter of substitutional deformation cone $D_A$ = MIN ($D_{A\ outside}$; $D_{A\ inner}$); length between basic solid and load introduction point $l_A = 0$, because the value is depending on the manufacturer; joint type SV4 according to VDI 2230 Nov. 2015 picture 22; clamp load is $F_{Kerf} = 0$ N when opening at the interface; number of bolts x at flange results from the types B4, B6, B8, A6, C6.

NOTE Screw calculation is based on the given parameters and is calculated without a safety factor. For a detailed calculation method, see VDI 2230.

**Table 2** *(continued)*

| Nominal diameter $d_0$ mm | Nominal lead $P_{ho}$ mm | Ball screw nut outer diameter $D_1$ mm[b] | Mounting bolt pitch circle diameter $D_4$ mm | Ball screw nut flange type | Flange mounting bolts diameter $D_5$ mm | Flange outer diameter $D_6$ mm | Centring diameter length $L_1$ mm min. | Collar length $L_3$ mm max. | Flange length $L_7$ mm | Flat flange width $L_8$ mm | Lubrication port thread length $L_{10}$ mm min. | Thread for lubrication port $Q$ | Mounting bolts | Axial load at the opening limit of the nut flange $F_{a\,max}$[c] kN stat. | Tightening torque of one bolt $T_a$[c] Nm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 50 | ≤10 | 75 | 93 | | 11 | 110 | 10 | 17 | 16 | 85 | 10 | M8 × 1 | M10 | 148 | 51 |
| 50 | >10 | 75 | 93 | | 11 | 110 | 20 | 20 | 16 | 85 | 10 | M8 × 1 | M10 | 148 | 51 |
| 50 | >10[a] | 82 | 100 | | 11 | 118 | 25 | 25 | 16 | 92 | 10 | M8 × 1 | M10 | 147 | 51 |
| 63 | ≤10 | 90 | 108 | | 11 | 125 | 10 | 17 | 18 | 95 | 10 | M8 × 1 | M10 | 150 | 51 |
| 63 | >10 | 95 | 115 | | 13,5 | 135 | 25 | 30 | 20 | 100 | 10 | M8 × 1 | M12 | 226 | 87 |
| 63 | >10[a] | 105 | 125 | | 13,5 | 145 | 25 | 30 | 20 | 110 | 10 | M8 × 1 | M12 | 226 | 87 |
| 80 | ≤10 | 105 | 125 | | 13,5 | 145 | 12 | 17 | 20 | 110 | 10 | M8 × 1 | M12 | 226 | 87 |
| 80 | >10 | 125 | 145 | | 13,5 | 165 | 25 | 30 | 25 | 130 | 10 | M8 × 1 | M12 | 230 | 87 |
| 80 | >10[a] | 135 | 155 | Figure 2 | 13,5 | 175 | 25 | 40 | 25 | 140 | 10 | M8 × 1 | M12 | 230 | 87 |
| 100 | ≤10 | 125 | 145 | Type B8 | 13,5 | 165 | 10 | 17 | 22 | 130 | 10 | M8 × 1 | M12 | 227 | 87 |
| 100 | >10 | 150 | 176 | | 17,5 | 202 | 25 | 30 | 30 | 155 | 10 | M8 × 1 | M16 | 440 | 210 |
| 100 | >10[a] | 160 | 186 | | 17,5 | 212 | 40 | 40 | 30 | 165 | 10 | M8 × 1 | M16 | 440 | 210 |
| 125 | ≤10 | 150 | 176 | | 17,5 | 202 | 10 | 17 | 25 | 155 | 10 | M8 × 1 | M16 | 434 | 210 |
| 125 | >10 | 170 | 196 | | 17,5 | 222 | 25 | 30 | 30 | 175 | 10 | M8 × 1 | M16 | 440 | 210 |
| 125 | >10[a] | 200 | 233 | | 22 | 265 | 40 | 45 | 30 | 205 | 10 | M8 × 1 | M20 | 714 | 430 |
| 160 | ≤10 | 185 | 212 | | 17,5 | 240 | 10 | 17 | 30 | 190 | 10 | M8 × 1 | M16 | 437 | 210 |
| 160 | >10 | 210 | 243 | | 22 | 275 | 25 | 30 | 40 | 215 | 10 | M8 × 1 | M20 | 728 | 430 |
| 160 | >10[a] | 260 | 300 | | 22 | 340 | 40 | 50 | 40 | 265 | 10 | M8 × 1 | M20 | 707 | 430 |

[a] Secondary sizes.

[b] Tolerances for $D_1$ for ball screw nut types B6, B8 and B4 (see Figures 1 to 3 and Figure 6).

[c] Basis of screw calculation: static load, concentric single-bolted joint, tapped thread joint (not through-bolt joint), opening of the nut flange at specified tensile force, only tensile force, no transverse force, calculated for hexagon socket head cap screws, property class 8.8, calculation is only valid for the specified bolt length, utilization factor of the yield point stress during tightening ν = 0,9, load introduction factor $n$ according to VDI 2230 Nov. 2015; averaged for Table 2: $n$ = 0,34, amount of embedding for $Rz$ < 10 µm: $f_Z = f_{thread} + f_{head\ bearing\ area} + f_{interface}$ = 3,0 µm + 2,5 µm + 1,5 µm = 7,0 µm, tightening factor $\alpha_A$ = 1,5 for torque wrench; friction coefficient µg = 0,125; clamped part, bolt material and component with internal thread of steel $E$ = 210 000 N/mm². The following additional initial parameters were used for the screw calculation in Table 2: clamping length (clamped part) for Table 2: $l_k = L_7$; bolt length calculated from the clamping length and the length of thread engagement $l = l_k + 1{,}2 \cdot d$; diameter of through hole $D_{Ki} = D_5$; possible outside diameter of substitutional deformation cone $D_A$ outside = $D_6$ - $D_4$; possible inner diameter of substitutional deformation cone $D_{A\ inner} = D_4 - D_1$; diameter of substitutional deformation cone $D_A$ = MIN ($D_{A\ outside}$; $D_{A\ inner}$); length between basic solid and load introduction point $l_A$ = 0, because the value is depending on the manufacturer; joint type SV4 according to VDI 2230 Nov. 2015 picture 22; clamp load is $F_{Kerf}$ = 0 N when opening at the interface; number of bolts x at flange results from the types B4, B6, B8, A6, C6.

NOTE Screw calculation is based on the given parameters and is calculated without a safety factor. For a detailed calculation method, see VDI 2230.

## Table 3 — Mounting dimensions for ball screw nuts and mounting bolts – Series 2

| Nominal diameter $d_0$ mm | Nominal lead $P_{ho}$ mm | Ball screw nut outer diameter $D_1$ mm [a] | Mounting bolt pitch circle diameter $D_4$ mm | Ball screw nut flange type | Flange mounting bolts diameter $D_5$ mm | Flange outer diameter $D_6$ mm | Screw head counter bore diameter $D_7$ mm | Centring diameter length $L_1$ mm min. | Collar length $L_3$ mm max. | Flange length $L_7$ mm | Flat flange width $L_8$ mm | Counter bore depth $L_9$ mm | Thread for lubrication port $Q$ | Mounting bolts | Axial load at the opening limit of the nut flange $F_{a\,max}$ [b] kN stat. | Tightening torque of one bolt $T_a$ [b] Nm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1 | 9 | 14 | Figure 3 Type B4 | 2,9 | 19 | – | 5 | – | 3 | 13 | – | – | M2,6 | 2,98 | 0,8 |
| 5 | ≥1 ≤1,5 | 10 | 15 | | 2,9 | 20 | – | 5 | – | 3 | 14 | – | – | M2,6 | 2,98 | 0,8 |
| 6 | 1 | 11 | 17 | | 3,4 | 23 | – | 5 | – | 4 | 15 | – | – | M3 | 3,39 | 1,4 |
| 6 | 1,5 | 12 | 18 | | 3,4 | 24 | – | 5 | – | 4 | 16 | – | – | M3 | 3,55 | 1,4 |
| 6 | 2 | 13 | 19 | | 3,4 | 25 | – | 5 | – | 4 | 16 | – | – | M3 | 3,58 | 1,4 |
| 8 | 1 | 14 | 21 | | 3,4 | 27 | – | 5 | – | 4 | 19 | – | – | M3 | 3,39 | 1,4 |
| 8 | 1,5 | 15 | 22 | | 3,4 | 28 | – | 5 | – | 4 | 19 | – | – | M3 | 3,39 | 1,4 |
| 8 | ≥2 ≤2,5 | 16 | 23 | | 3,4 | 29 | – | 5 | – | 4 | 19 | – | – | M3 | 7,27 | 1,4 |
| 8 | ≥8 ≤12 | 18 | 25 | | 3,4 | 31 | – | 5 | 8 | 4 | 20 | – | – | M3 | 7,27 | 1,4 |
| 10 | 1 | 16 | 23 | | 3,4 | 29 | – | 10 | – | 4 | 20 | – | – | M3 | 7,27 | 1,4 |
| 10 | 1,5 | 17 | 26 | | 4,5 | 34 | – | 10 | – | 5 | 22 | – | – | M4 | 7,27 | 3,1 |
| 10 | 2 | 18 | 27 | | 4,5 | 35 | – | 10 | – | 5 | 22 | – | – | M4 | 7,27 | 3,1 |
| 10 | 2,5 | 19 | 28 | | 4,5 | 36 | – | 10 | – | 5 | 23 | – | – | M4 | 7,27 | 3,1 |
| 10 | ≥8 ≤12 | 23 | 32 | | 4,5 | 40 | – | 10 | 8 | 5 | 25 | – | – | M4 | 7,27 | 3,1 |
| 12 | 2 | 20 | 29 | | 4,5 | 37 | – | 10 | – | 5 | 24 | – | – | M4 | 7,27 | 3,1 |
| 12 | 2,5 | 21 | 30 | | 4,5 | 38 | – | 10 | – | 5 | 25 | – | – | M4 | 7,27 | 3,1 |
| 12 | 3 | 22 | 31 | | 4,5 | 39 | – | 10 | – | 5 | 25 | – | – | M4 | 13,9 | 3,1 |
| 12 | ≥10 ≤30 | 28 | 37 | | 4,5 | 45 | – | 10 | 10 | 5 | 28 | – | – | M4 | 13,9 | 3,1 |

[a] Tolerances for $D_1$ for ball screw nut types B4, A6 and C6 (see Figures 3, 4, 5 and Figure 6).

[b] Basis of screw calculation: static load, concentric single-bolted joint, tapped thread joint (not through-bolt joint), opening of the nut flange at specified tensile force, only tensile force, no transverse force, calculated for hexagon socket head cap screws, property class 8.8, calculation is only valid for the specified bolt length, utilization factor of the yield point stress during tightening $\nu = 0{,}9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 3: $n = 0{,}25$, amount of embedding for $Rz < 10$ µm: $f_Z = f_{thread} + f_{head\ bearing\ area} + f_{interface} = 3{,}0$ µm + 2,5 µm + 1,5 µm = 7,0 µm, tightening factor $\alpha_A = 1{,}5$ for torque wrench; friction coefficient $\mu_g = 0{,}125$; clamped part, bolt material and component with internal thread of steel $E = 210\,000$ N/mm$^2$. The following additional initial parameters were used for the screw calculation in Table 3: clamping length (clamped part) for Table 3: $l_k = L_7 - L_9$; bolt length calculated from the clamping length and the length of thread engagement $l = l_k + 1{,}2 \cdot d$; diameter of through hole $D_{Ki} = D_5$; possible outside diameter of substitutional deformation cone $D_A$ outside $= D_6 - D_4$; possible inner diameter of substitutional deformation cone $D_{A\ inner} = D_4 - D_1$; diameter of substitutional deformation cone $D_A$ = MIN ($D_{A\ outside}$; $D_{A\ inner}$); length between basic solid and load introduction point $l_A = 0$, because the value is depending on the manufacturer; joint type SV4 according to VDI 2230 Nov. 2015 picture 22; clamp load is $F_{Kerf} = 0$ N when opening at the interface; number of bolts x at flange results from the types B4, B6, B8, A6, C6.

NOTE Screw calculation is based on the given parameters and is calculated without a safety factor. For a detailed calculation method, see VDI 2230.

**Table 3** *(continued)*

| Nominal diameter<br>$d_0$<br>mm | Nominal lead<br>$P_{ho}$<br>mm | Ball screw nut outer diameter<br>$D_1$<br>mm [a] | Mounting bolt pitch circle diameter<br>$D_4$<br>mm | Ball screw nut flange type | Flange mounting bolts diameter<br>$D_5$<br>mm | Flange outer diameter<br>$D_6$<br>mm | Screw head counter bore diameter<br>$D_7$<br>mm | Centring diameter length<br>$L_1$<br>mm<br>min. | Collar length<br>$L_3$<br>mm<br>max. | Flange length<br>$L_7$<br>mm | Flat flange width<br>$L_8$<br>mm | Counter bore depth<br>$L_9$<br>mm | Thread for lubrication port<br>$Q$ | Mounting bolts | Axial load at the opening limit of the nut flange<br>$F_{a\,max}$ [b]<br>kN<br>stat. | Tightening torque of one bolt<br>$T_a$ [b]<br>Nm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 14 | ≥2 ≤2,5 | 22 | 32 | | 5,5 | 41 | – | 10 | – | 6 | 26 | – | – | M5 | 13,9 | 6,3 |
| 14 | 3 | 24 | 34 | | 5,5 | 43 | – | 10 | – | 6 | 28 | – | – | M5 | 13,9 | 6,3 |
| 14 | 4 | 26 | 36 | Figure 3 | 5,5 | 45 | – | 10 | – | 6 | 28 | – | – | M5 | 13,9 | 6,3 |
| 16 | ≥2 ≤2,5 | 25 | 35 | Type B4 | 5,5 | 44 | – | 10 | – | 6 | 28 | – | – | M5 | 13,9 | 6,3 |
| 16 | 3 | 26 | 36 | | 5,5 | 45 | – | 10 | – | 6 | 28 | – | – | M5 | 13,9 | 6,3 |
| 16 | ≥4, ≤5 | 28 | 38 | | 5,5 | 47 | – | 10 | – | 6 | 30 | – | – | M5 | 20,1 | 6,3 |
| 16 | ≥10 ≤30 | 34 | 45 | | 5,5 | 58 | 9,5 | 10 | 11 | 11 | 22 | 5,5 | M6×1 | M5 | 20,1 | 6,3 |
| 20 | 4 | 32 | 44 | | 5,5 | 56 | 9,5 | 10 | – | 11 | 22 | 5,5 | M6×1 | M5 | 19,6 | 6,3 |
| 20 | ≥5, ≤6 | 35 | 46 | | 5,5 | 58 | 9,5 | 10 | – | 11 | 22,5 | 5,5 | M6×1 | M5 | 20,1 | 6,3 |
| 20 | ≥15 ≤40 | 40 | 53 | | 6,6 | 67 | 11 | 10 | 13 | 12 | 26 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 25 | ≥5 ≤6 | 40 | 51 | | 5,5 | 63 | 9,5 | 10 | – | 11 | 24 | 5,5 | M6×1 | M5 | 20,1 | 6,3 |
| 25 | ≥8 ≤10 | 42 | 55 | Figure 4, 5 | 6,6 | 69 | 11 | 10 | – | 12 | 26 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 25 | ≥20 ≤32 | 47 | 60 | Type A6, C6 | 6,6 | 74 | 11 | 10 | 13 | 12 | 28 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 25 | ≥40 ≤50 | 50 | 64 | | 6,6 | 78 | 11 | 10 | 16 | 12 | 30 | 6,5 | M6×1 | M6 | 28,9 | 11 |
| 28 | ≥5 ≤10 | 45 | 58 | | 6,6 | 72 | 11 | 10 | – | 12 | 28 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 32 | ≥5 ≤6 | 48 | 61 | | 6,6 | 75 | 11 | 10 | – | 12 | 29 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 32 | 8 | 50 | 66 | | 9 | 84 | 14 | 10 | – | 15 | 32 | 8,5 | M6×1 | M8 | 59,5 | 26 |
| 32 | 10 | 54 | 70 | | 9 | 88 | 14 | 10 | – | 15 | 34 | 8,5 | M6×1 | M8 | 59,5 | 26 |
| 32 | ≥12 ≤16 | 62 | 75 | | 9 | 93 | 14 | 20 | – | 15 | 36 | 8,5 | M6×1 | M8 | 60,2 | 26 |

[a] Tolerances for $D_1$ for ball screw nut types B4, A6 and C6 (see Figures 3, 4, 5 and Figure 6).

[b] Basis of screw calculation: static load, concentric single-bolted joint, tapped thread joint (not through-bolt joint), opening of the nut flange at specified tensile force, only tensile force, no transverse force, calculated for hexagon socket head cap screws, property class 8.8, calculation is only valid for the specified bolt length, utilization factor of the yield point stress during tightening $\nu = 0,9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 3: $n = 0,25$, amount of embedding for $Rz < 10$ µm: $f_Z = f_{thread} + f_{head\ bearing\ area} + f_{interface} = 3,0$ µm + 2,5 µm + 1,5 µm = 7,0 µm, tightening factor $\alpha_A = 1,5$ for torque wrench; friction coefficient $\mu_g = 0,125$; clamped part, bolt material and component with internal thread of steel $E = 210\,000$ N/mm$^2$. The following additional initial parameters were used for the screw calculation in Table 3: clamping length (clamped part) for Table 3: $l_k = L_7 - L_9$; bolt length calculated from the clamping length and the length of thread engagement $l = l_k + 1,2 \cdot d$; diameter of through hole $D_{Ki} = D_5$; possible outside diameter of substitutional deformation cone $D_A$ outside = $D_6 - D_4$; possible inner diameter of substitutional deformation cone $D_{A\ inner} = D_4 - D_1$; diameter of substitutional deformation cone $D_A$ = MIN ($D_{A\ outside}$; $D_{A\ inner}$); length between basic solid and load introduction point $l_A = 0$, because the value is depending on the manufacturer; joint type SV4 according to VDI 2230 Nov. 2015 picture 22; clamp load is $F_{Kerf} = 0$ N when opening at the interface; number of bolts x at flange results from the types B4, B6, B8, A6, C6.

NOTE Screw calculation is based on the given parameters and is calculated without a safety factor. For a detailed calculation method, see VDI 2230.

**Table 3** *(continued)*

| Nominal diameter<br>$d_0$<br>mm | Nominal lead<br>$P_{ho}$<br>mm | Ball screw nut outer diameter<br>$D_1$<br>mm [a] | Mounting bolt pitch circle diameter<br>$D_4$<br>mm | Ball screw nut flange type | Flange mounting bolts diameter<br>$D_5$<br>mm | Flange outer diameter<br>$D_6$<br>mm | Screw head counter bore diameter<br>$D_7$<br>mm | Centring diameter length<br>$L_1$<br>mm<br>min. | Collar length<br>$L_3$<br>mm<br>max. | Flange length<br>$L_7$<br>mm | Flat flange width<br>$L_8$<br>mm | Counter bore depth<br>$L_9$<br>mm | Thread for lubrication port<br>$Q$ | Mounting bolts | Axial load at the opening limit of the nut flange<br>$F_{a\,max}$ [b]<br>kN<br>stat. | Tightening torque of one bolt<br>$T_a$ [b]<br>Nm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | ≥5 ≤6 | 52 | 68 | | 9 | 86 | 14 | 10 | – | 15 | 33 | 8,5 | M6×1 | M8 | 59,5 | 26 |
| 36 | 8 | 56 | 72 | | 9 | 90 | 14 | 10 | – | 15 | 35 | 8,5 | M6×1 | M8 | 59,5 | 26 |
| 36 | 10 | 58 | 78 | | 11 | 100 | 17,5 | 10 | – | 18 | 38 | 11 | M6×1 | M10 | 98,4 | 51 |
| 40 | ≥5 ≤6 | 56 | 72 | | 9 | 90 | 14 | 10 | – | 15 | 34 | 8,5 | Rc1/8 | M8 | 59,5 | 26 |
| 40 | 8 | 60 | 76 | | 9 | 94 | 14 | 10 | – | 15 | 36 | 8,5 | Rc1/8 | M8 | 59,5 | 26 |
| 40 | 10 | 62 | 82 | | 11 | 104 | 17,5 | 10 | – | 18 | 40 | 11 | Rc1/8 | M10 | 98,4 | 51 |
| 40 | ≥12 ≤16 | 74 | 92 | | 11 | 114 | 17,5 | 20 | – | 18 | 43 | 11 | Rc1/8 | M10 | 98,4 | 51 |
| 45 | ≥5 ≤6 | 61 | 78 | Figure 4, 5 | 9 | 96 | 14 | 10 | – | 15 | 37 | 8,5 | Rc1/8 | M8 | 59,4 | 26 |
| 45 | 8 | 65 | 82 | Type A6, C6 | 9 | 100 | 14 | 10 | – | 15 | 38 | 8,5 | Rc1/8 | M8 | 59,4 | 26 |
| 45 | 10 | 67 | 88 | | 11 | 110 | 17,5 | 10 | – | 18 | 43 | 11 | Rc1/8 | M10 | 98,3 | 51 |
| 50 | ≥5 ≤6 | 66 | 82 | | 9 | 100 | 14 | 10 | – | 15 | 38 | 8,5 | Rc1/8 | M8 | 59,5 | 26 |
| 50 | 8 | 70 | 90 | | 11 | 112 | 17,5 | 10 | – | 18 | 43 | 11 | Rc1/8 | M10 | 98,4 | 51 |
| 50 | 10 | 72 | 92 | | 11 | 114 | 17,5 | 10 | – | 18 | 44 | 11 | Rc1/8 | M10 | 98,4 | 51 |
| 50 | ≥12 ≤20 | 75 | 97 | | 14 | 121 | 20 | 20 | – | 22 | 47 | 13 | Rc1/8 | M12 | 154 | 88 |
| 63 | 6 | 80 | 100 | | 11 | 122 | 17,5 | 10 | – | 18 | 47 | 11 | Rc1/8 | M10 | 98,4 | 51 |
| 63 | 8 | 82 | 102 | | 11 | 124 | 17,5 | 10 | – | 18 | 47 | 11 | Rc1/8 | M10 | 98,4 | 51 |
| 63 | 10 | 85 | 107 | | 14 | 131 | 20 | 20 | – | 22 | 50 | 13 | Rc1/8 | M12 | 154 | 88 |
| 63 | 12 | 90 | 112 | | 14 | 136 | 20 | 20 | – | 22 | 52 | 13 | Rc1/8 | M12 | 154 | 88 |
| 63 | ≥15 ≤20 | 95 | 123 | | 18 | 153 | 26 | 20 | – | 28 | 59 | 17,5 | Rc1/8 | M16 | 299 | 220 |

[a] Tolerances for $D_1$ for ball screw nut types B4, A6 and C6 (see Figures 3, 4, 5 and Figure 6).

[b] Basis of screw calculation: static load, concentric single-bolted joint, tapped thread joint (not through-bolt joint), opening of the nut flange at specified tensile force, only tensile force, no transverse force, calculated for hexagon socket head cap screws, property class 8.8, calculation is only valid for the specified bolt length, utilization factor of the yield point stress during tightening $\nu = 0{,}9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 3: $n = 0{,}25$, amount of embedding for $Rz < 10$ µm: $f_Z = f_{thread} + f_{head\ bearing\ area} + f_{interface} = 3{,}0$ µm + 2,5 µm + 1,5 µm = 7,0 µm, tightening factor $\alpha_A = 1{,}5$ for torque wrench; friction coefficient $\mu_g = 0{,}125$; clamped part, bolt material and component with internal thread of steel $E = 210\,000$ N/mm$^2$. The following additional initial parameters were used for the screw calculation in Table 3: clamping length (clamped part) for Table 3: $l_k = L_7 - L_9$; bolt length calculated from the clamping length and the length of thread engagement $l = l_k + 1{,}2 \cdot d$; diameter of through hole $D_{Ki} = D_5$; possible outside diameter of substitutional deformation cone $D_A$ outside $= D_6 - D_4$; possible inner diameter of substitutional deformation cone $D_{A\ inner} = D_4 - D_1$; diameter of substitutional deformation cone $D_A$ = MIN ($D_{A\ outside}$; $D_{A\ inner}$); length between basic solid and load introduction point $l_A = 0$, because the value is depending on the manufacturer; joint type SV4 according to VDI 2230 Nov. 2015 picture 22; clamp load is $F_{Kerf} = 0$ N when opening at the interface; number of bolts x at flange results from the types B4, B6, B8, A6, C6.

NOTE Screw calculation is based on the given parameters and is calculated without a safety factor. For a detailed calculation method, see VDI 2230.

**Table 3** *(continued)*

| Nominal diameter<br>$d_0$<br>mm | Nominal lead<br>$P_{ho}$<br>mm | Ball screw nut outer diameter<br>$D_1$<br>mm [a] | Mounting bolt pitch circle diameter<br>$D_4$<br>mm | Ball screw nut flange type | Flange mounting bolts diameter<br>$D_5$<br>mm | Flange outer diameter<br>$D_6$<br>mm | Screw head counter bore diameter<br>$D_7$<br>mm | Centring diameter length<br>$L_1$<br>mm<br>min. | Collar length<br>$L_3$<br>mm<br>max. | Flange length<br>$L_7$<br>mm | Flat flange width<br>$L_8$<br>mm | Counter bore depth<br>$L_9$<br>mm | Thread for lubrication port<br>$Q$ | Mounting bolts | Axial load at the opening limit of the nut flange<br>$F_{a\,max}$ [b]<br>kN<br>stat. | Tightening torque of one bolt<br>$T_a$ [b]<br>Nm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 80 | 10 | 105 | 127 | Figure 4, 5 | 14 | 151 | 20 | 10 | — | 22 | 57 | 13 | Rc1/8 | M12 | 154 | 88 |
| 80 | 12 | 110 | 132 | Type A6, C6 | 14 | 156 | 20 | 20 | — | 22 | 59 | 13 | Rc1/8 | M12 | 154 | 88 |
| 80 | ≥15 ≤20 | 115 | 143 | | 18 | 173 | 26 | 40 | — | 28 | 66 | 17,5 | Rc1/8 | M16 | 299 | 220 |
| 100 | 10 | 125 | 147 | | 14 | 171 | 20 | 20 | — | 22 | 64 | 13 | Rc1/8 | M12 | 154 | 88 |
| 100 | 12 | 130 | 158 | | 18 | 188 | 26 | 20 | — | 28 | 71 | 17,5 | Rc1/8 | M16 | 488 | 220 |
| 100 | ≥15 ≤20 | 135 | 169 | | 22 | 205 | 32 | 40 | — | 32 | 79 | 21,5 | Rc1/8 | M20 | 488 | 430 |

[a] Tolerances for $D_1$ for ball screw nut types B4, A6 and C6 (see Figures 3, 4, 5 and Figure 6).

[b] Basis of screw calculation: static load, concentric single-bolted joint, tapped thread joint (not through-bolt joint), opening of the nut flange at specified tensile force, only tensile force, no transverse force, calculated for hexagon socket head cap screws, property class 8.8, calculation is only valid for the specified bolt length, utilization factor of the yield point stress during tightening $\nu = 0{,}9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 3: $n = 0{,}25$, amount of embedding for $Rz < 10$ µm: $f_Z = f_{thread} + f_{head\ bearing\ area} + f_{interface} = 3{,}0$ µm + 2,5 µm + 1,5 µm = 7,0 µm, tightening factor $\alpha_A = 1{,}5$ for torque wrench; friction coefficient $\mu_g = 0{,}125$; clamped part, bolt material and component with internal thread of steel $E = 210\,000$ N/mm$^2$. The following additional initial parameters were used for the screw calculation in Table 3: clamping length (clamped part) for Table 3: $l_k = L_7 - L_9$; bolt length calculated from the clamping length and the length of thread engagement $l = l_k + 1{,}2 \cdot d$; diameter of through hole $D_{Ki} = D_5$; possible outside diameter of substitutional deformation cone $D_A$ outside $= D_6 - D_4$; possible inner diameter of substitutional deformation cone $D_{A\ inner} = D_4 - D_1$; diameter of substitutional deformation cone $D_A = \text{MIN}\ (D_{A\ outside}; D_{A\ inner})$; length between basic solid and load introduction point $l_A = 0$, because the value is depending on the manufacturer; joint type SV4 according to VDI 2230 Nov. 2015 picture 22; clamp load is $F_{Kerf} = 0$ N when opening at the interface; number of bolts x at flange results from the types B4, B6, B8, A6, C6.

NOTE Screw calculation is based on the given parameters and is calculated without a safety factor. For a detailed calculation method, see VDI 2230.

## Table 4 — Mounting dimensions for ball screw nuts and mounting bolts – Series 3

| Nominal diameter<br>$d_0$<br>mm | Nominal lead<br>$P_{ho}$<br>mm | Ball screw nut outer diameter<br>$D_1$<br>mm [a] | Mounting bolt pitch circle diameter<br>$D_4$<br>mm | Ball screw nut flange type | Flange mounting bolts diameter<br>$D_5$<br>mm | Flange outer diameter<br>$D_6$<br>mm | Screw head counter bore diameter<br>$D_7$<br>mm | Centring diameter length<br>$L_1$<br>mm<br>min. | Collar length<br>$L_3$<br>mm<br>max. | Flange length<br>$L_7$<br>mm | Flat flange width<br>$L_8$<br>mm | Counter bore depth<br>$L_9$<br>mm | Thread for lubrication port<br>$Q$ | Mounting bolts | Axial load at the opening limit of the nut flange<br>$F_{a\,max}$ [b]<br>kN<br>stat. | Tightening torque of one bolt<br>$T_a$ [b]<br>Nm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 4 | 1 | 11 | 17 | | 3,4 | 23 | – | 5 | – | 4 | 15 | – | – | M3 | 0,87 | 1,4 |
| 5 | ≤1,5 | 12 | 18 | | 3,4 | 24 | – | 5 | – | 4 | 15 | – | – | M3 | 0,87 | 1,4 |
| 6 | 1 | 13 | 21 | | 3,4 | 29 | – | 5 | – | 4 | 17 | – | – | M3 | 3,58 | 1,4 |
| 6 | 1,5 | 14 | 22 | | 3,4 | 29 | – | 5 | – | 4 | 17 | – | – | M3 | 3,58 | 1,4 |
| 6 | ≥2 ≤2,5 | 15 | 23 | | 3,4 | 29 | – | 5 | – | 4 | 18 | – | – | M3 | 3,58 | 1,4 |
| 8 | ≤1,5 | 16 | 24 | | 3,4 | 32 | – | 5 | – | 4 | 18 | – | – | M3 | 3,58 | 1,4 |
| 8 | 2 | 20 | 30 | | 4,5 | 40 | – | 5 | – | 5 | 25 | – | – | M4 | 3,58 | 3,1 |
| 8 | ≥2,5 ≤4 | 22 | 32 | Figure 3 | 4,5 | 42 | – | 5 | – | 5 | 26 | – | – | M4 | 3,58 | 3,1 |
| 8 | ≥5 ≤8 | 24 | 34 | Type B4 | 4,5 | 44 | – | 5 | – | 5 | 27 | – | – | M4 | 3,58 | 3,1 |
| 10 | ≤1,5 | 19 | 30 | | 4,5 | 40 | – | 10 | – | 5 | 25 | – | – | M4 | 7,55 | 3,1 |
| 10 | ≥2 ≤2,5 | 24 | 34 | | 4,5 | 44 | – | 10 | – | 5 | 27 | – | – | M4 | 7,55 | 3,1 |
| 10 | ≥3 ≤10 | 26 | 36 | | 4,5 | 46 | – | 10 | – | 5 | 28 | – | – | M4 | 7,55 | 3,1 |
| 12 | ≤2,5 | 26 | 36 | | 4,5 | 46 | – | 10 | – | 5 | 28 | – | – | M4 | 7,55 | 3,1 |
| 12 | ≥3 ≤12 | 30 | 42 | | 5,5 | 51 | – | 10 | – | 6 | 32 | – | – | M5 | 7,55 | 6,3 |
| 14 | 2 | 26 | 37 | | 5,5 | 46 | – | 10 | – | 6 | 29 | – | – | M5 | 13,9 | 6,3 |
| 14 | 2,5 | 28 | 39 | | 5,5 | 48 | – | 10 | – | 6 | 30 | – | – | M5 | 13,9 | 6,3 |
| 14 | 3 | 30 | 42 | | 5,5 | 51 | – | 10 | – | 6 | 32 | – | – | M5 | 13,9 | 6,3 |
| 14 | ≥4 ≤8 | 34 | 45 | | 5,5 | 54 | – | 10 | – | 6 | 33 | – | – | M5 | 13,9 | 6,3 |

[a] Tolerances for $D_1$ for ball screw nut types B4, A6 and C6, see Figures 3, 4, 5 and Figure 6 - Alternatives for detail X.

[b] Basis of screw calculation: static load, concentric single-bolted joint, tapped thread joint (not through-bolt joint), opening of the nut flange at specified tensile force, only tensile force, no transverse force, calculated for hexagon socket head cap screws, property class 8.8, calculation is only valid for the specified bolt length, utilization factor of the yield point stress during tightening $\nu = 0{,}9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 4: $n = 0{,}25$, amount of embedding for $Rz < 10$ µm: $f_Z = f_{thread} + f_{head\ bearing\ area} + f_{interface} = 3{,}0$ µm + 2,5 µm + 1,5 µm = 7,0 µm, tightening factor $\alpha_A = 1{,}5$ for torque wrench; friction coefficient $\mu_g = 0{,}125$; clamped part, bolt material and component with internal thread of steel $E = 210\,000$ N/mm². The following additional initial parameters were used for the screw calculation in tables: clamping length (clamped part) for Table 4: $l_k = L_7 - L_9$; bolt length calculated from the clamping length and the length of thread engagement $l = l_k + 1{,}2 \cdot d$; diameter of through hole $D_{Ki} = D_5$; possible outside diameter of substitutional deformation cone $D_{A\ outside} = D_6 - D_4$; possible inner diameter of substitutional deformation cone $D_{A\ inner} = D_4 - D_1$; diameter of substitutional deformation cone $D_A$ = MIN ($D_{A\ outside}$; $D_{A\ inner}$); length between basic solid and load introduction point $l_A = 0$, because the value is depending on the manufacturer; joint type SV4 according to VDI 2230 Nov. 2015 picture 22; clamp load is $F_{Kerf} = 0$ N when opening at the interface; number of bolts x at flange results from the types B4, B6, B8, A6, C6.

NOTE Screw calculation is based on the given parameters and is calculated without a safety factor. For a detailed calculation method, see VDI 2230.

**Table 4** *(continued)*

| Nominal diameter<br>$d_0$<br>mm | Nominal lead<br>$P_{ho}$<br>mm | Ball screw nut outer diameter<br>$D_1$<br>mm [a] | Mounting bolt pitch circle diameter<br>$D_4$<br>mm | Ball screw nut flange type | Flange mounting bolts diameter<br>$D_5$<br>mm | Flange outer diameter<br>$D_6$<br>mm | Screw head counter bore diameter<br>$D_7$<br>mm | Centring diameter length<br>$L_1$<br>mm<br>min. | Collar length<br>$L_3$<br>mm<br>max. | Flange length<br>$L_7$<br>mm | Flat flange width<br>$L_8$<br>mm | Counter bore depth<br>$L_9$<br>mm | Thread for lubrication port<br>$Q$ | Mounting bolts | Axial load at the opening limit of the nut flange<br>$F_{a\,max}$ [b]<br>kN<br>stat. | Tightening torque of one bolt<br>$T_a$ [b]<br>Nm |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 16 | ≤2,5 | 28 | 39 | | 5,5 | 48 | – | 10 | – | 6 | 30 | – | – | M5 | 13,9 | 6,3 |
| 16 | 3 | 32 | 44 | | 5,5 | 53 | – | 10 | – | 6 | 33 | – | – | M5 | 13,9 | 6,3 |
| 16 | 4 | 36 | 47 | | 5,5 | 59 | 9,5 | 10 | – | 11 | 22,5 | 5,5 | M6×1 | M5 | 13,9 | 6,3 |
| 16 | ≥5 ≤16 | 40 | 51 | | 5,5 | 63 | 9,5 | 10 | – | 11 | 24 | 5,5 | M6×1 | M5 | 20,1 | 6,3 |
| 20 | 4 | 40 | 51 | | 5,5 | 63 | 9,5 | 10 | – | 11 | 24 | 5,5 | M6×1 | M5 | 20,1 | 6,3 |
| 20 | 5 | 44 | 55 | | 5,5 | 67 | 9,5 | 10 | – | 11 | 26 | 5,5 | M6×1 | M5 | 20,1 | 6,3 |
| 20 | ≥6 ≤20 | 48 | 61 | | 6,6 | 75 | 11 | 10 | – | 12 | 29 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 25 | 4 | 46 | 57 | Figure 4, 5 | 5,5 | 69 | 9,5 | 10 | – | 11 | 26 | 5,5 | M6×1 | M5 | 20,1 | 6,3 |
| 25 | 5 | 50 | 61 | Type A6, | 5,5 | 73 | 9,5 | 10 | – | 11 | 28 | 5,5 | M6×1 | M5 | 20,1 | 6,3 |
| 25 | 6 | 53 | 64 | C6 | 5,5 | 76 | 9,5 | 10 | – | 11 | 29 | 5,5 | M6×1 | M5 | 20,1 | 6,3 |
| 25 | ≥8 ≤12 | 58 | 71 | | 6,6 | 85 | 11 | 10 | – | 12 | 32 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 25 | ≥15 ≤25 | 62 | 75 | | 6,6 | 89 | 11 | 10 | – | 12 | 34 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 28 | 5 | 55 | 68 | | 6,6 | 82 | 11 | 10 | – | 12 | 31 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 28 | 6 | 58 | 71 | | 6,6 | 85 | 11 | 10 | – | 12 | 32 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 28 | 8 | 62 | 75 | | 6,6 | 89 | 11 | 10 | – | 12 | 34 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 28 | 10 | 65 | 82 | | 9 | 100 | 14 | 10 | – | 15 | 38 | 8,5 | M6×1 | M8 | 59,4 | 26 |
| 32 | 4 | 54 | 67 | | 6,6 | 81 | 11 | 10 | – | 12 | 31 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 32 | 5 | 58 | 71 | | 6,6 | 85 | 11 | 10 | – | 12 | 32 | 6,5 | M6×1 | M6 | 29,7 | 11 |
| 32 | 6 | 62 | 75 | | 6,6 | 89 | 11 | 10 | – | 12 | 34 | 6,5 | M6×1 | M6 | 29,7 | 11 |

[a] Tolerances for $D_1$ for ball screw nut types B4, A6 and C6, see Figures 3, 4, 5 and Figure 6 - Alternatives for detail X.

[b] Basis of screw calculation: static load, concentric single-bolted joint, tapped thread joint (not through-bolt joint), opening of the nut flange at specified tensile force, only tensile force, no transverse force, calculated for hexagon socket head cap screws, property class 8.8, calculation is only valid for the specified bolt length, utilization factor of the yield point stress during tightening $\nu = 0{,}9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 4: $n = 0{,}25$, amount of embedding for $Rz < 10$ µm: $f_Z = f_{thread} + f_{head\ bearing\ area} + f_{interface} = 3{,}0$ µm + 2,5 µm + 1,5 µm = 7,0 µm, tightening factor $\alpha_A = 1{,}5$ for torque wrench; friction coefficient $\mu_g = 0{,}125$; clamped part, bolt material and component with internal thread of steel $E = 210\,000$ N/mm$^2$. The following additional initial parameters were used for the screw calculation in tables: clamping length (clamped part) for Table 4: $l_k = L_7 - L_9$; bolt length calculated from the clamping length and the length of thread engagement $l = l_k + 1{,}2 \cdot d$; diameter of through hole $D_{Ki} = D_5$; possible outside diameter of substitutional deformation cone $D_{A\,outside} = D_6 - D_4$; possible inner diameter of substitutional deformation cone $D_{A\,inner} = D_4 - D_1$; diameter of substitutional deformation cone $D_A$ = MIN ($D_{A\,outside}$; $D_{A\,inner}$); length between basic solid and load introduction point $l_A = 0$, because the value is depending on the manufacturer; joint type SV4 according to VDI 2230 Nov. 2015 picture 22; clamp load is $F_{Kerf} = 0$ N when opening at the interface; number of bolts x at flange results from the types B4, B6, B8, A6, C6.

NOTE Screw calculation is based on the given parameters and is calculated without a safety factor. For a detailed calculation method, see VDI 2230.