
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*



STANDARDSISO.COM : Click to view the full PDF of ISO 3408-2:2021



COPYRIGHT PROTECTED DOCUMENT

© ISO 2021

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents		Page
Foreword		iv
1	Scope	1
2	Normative references	1
3	Terms and definitions	1
4	Symbols	1
5	Nominal diameters, nominal leads and their combinations	2
6	Mounting dimensions for ball screw nuts, type B6, B8 and B4, A6 and C6	4
Bibliography		18

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

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).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

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
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
25						4	5	6	8	10	12	15	16	20	25	30
28						4	5	6	8	10	12	15	16	20	25	30
32						4	5	6	8	10	12	15	16	20	25	30
36						4	5	6	8	10	12	15	16	20	25	30
40							5	6	8	10	12	15	16	20	25	30
45							5	6	8	10	12	15	16	20	25	30
50							5	6	8	10	12	15	16	20	25	30
63							5	6	8	10	12	15	16	20	25	30
80								6	8	10	12	15	16	20	25	30
100										10	12	15	16	20	25	30
125										10	12	15	16	20	25	30
160											12	15	16	20	25	30

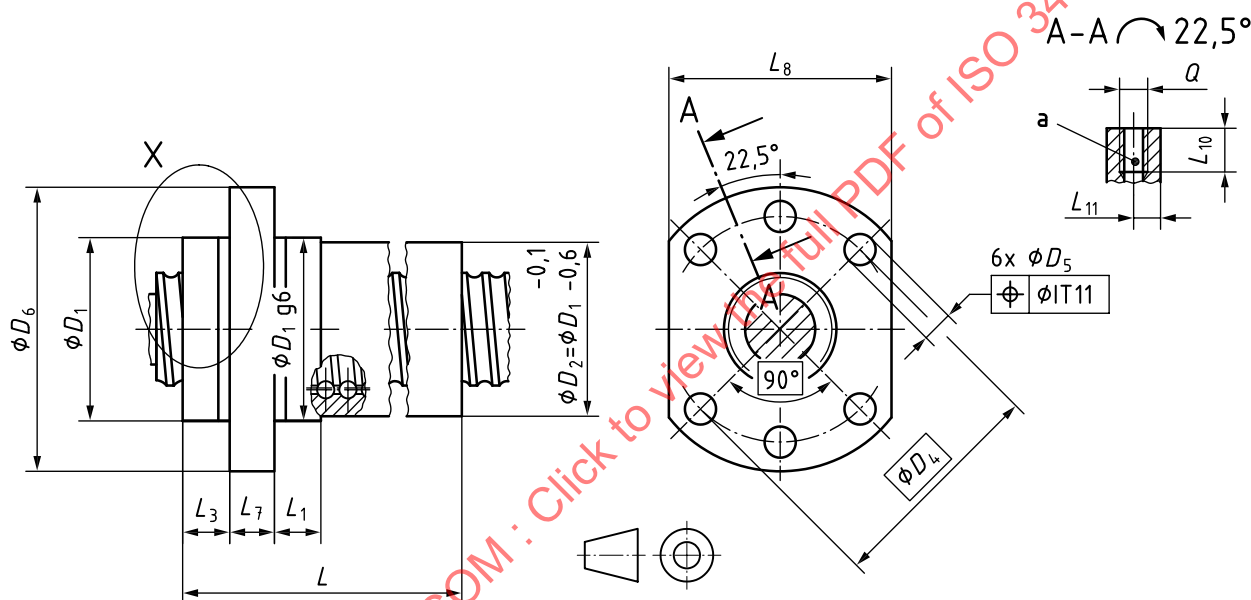
6 Mounting dimensions for ball screw nuts, type B6, B8 and B4, A6 and C6

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).

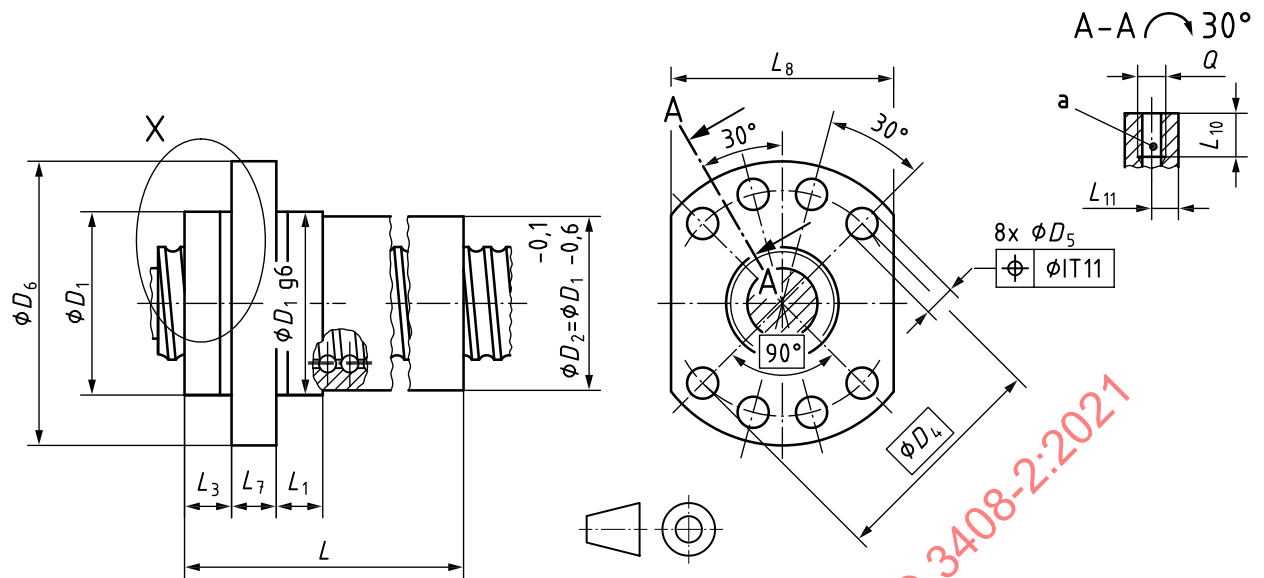


Key

- 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**

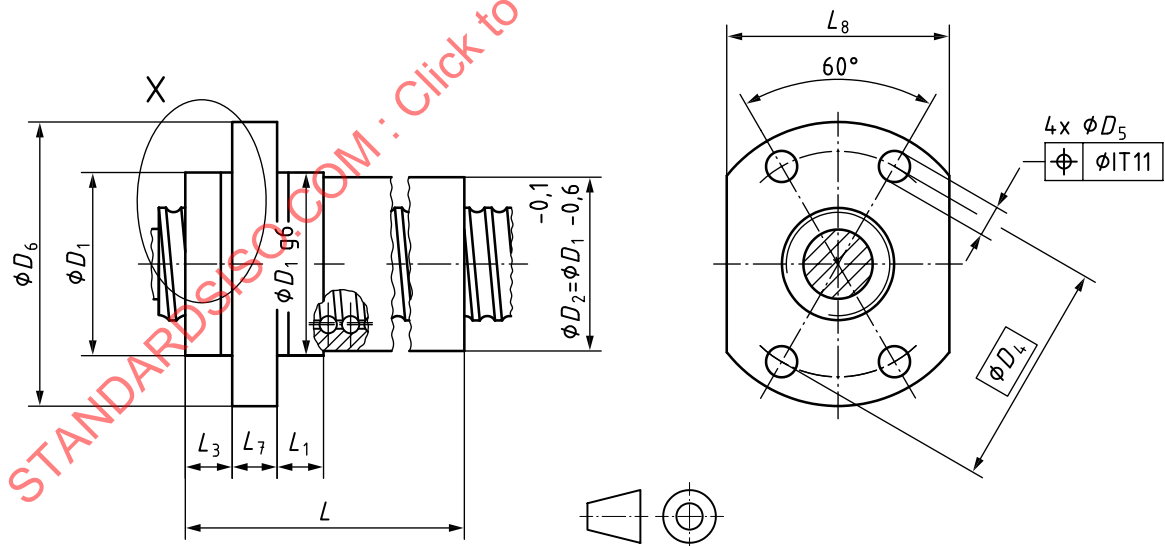
a If the position of the lubrication port is not sufficient, it can be sealed and replaced by a new axial hole on either side of the flange. Details need to be defined separately.

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.

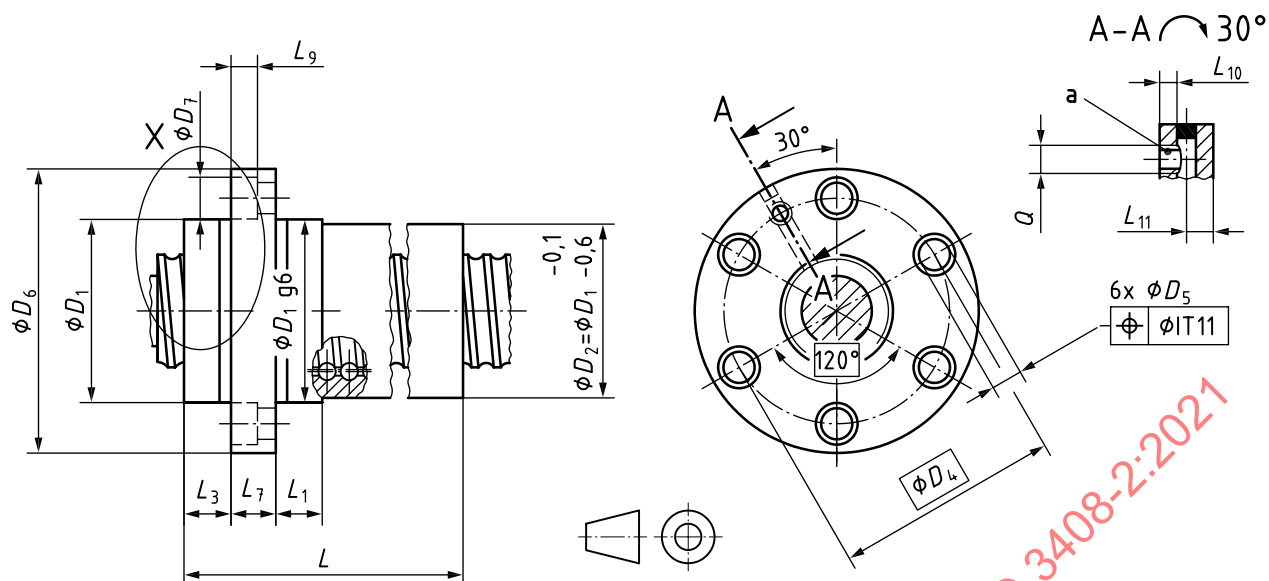
Figure 2 — Mounting dimensions for ball screw nuts, type B8

**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.

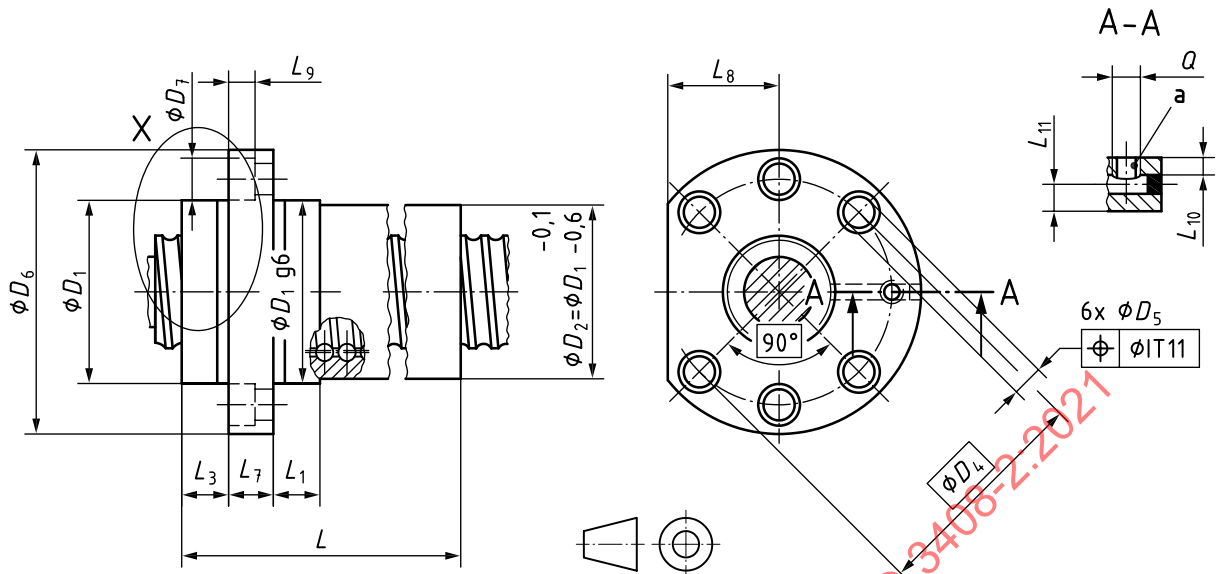
L manufacturer-specific length of the ball screw nut

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.

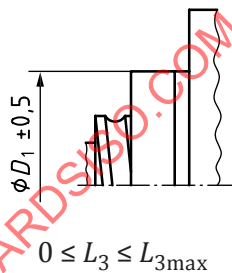
Figure 4 — Mounting dimensions for ball screw nuts, type A6

**Key**

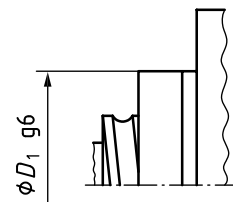
- ^a If the position of the lubrication port is not sufficient, it can be sealed and replaced by a new axial hole on either side of the flange. Details need to be defined separately.
- L manufacturer-specific length of the ball screw nut
- L_{10} manufacturer-specific depth of the lubrication port
- 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	Figure 3 Type B4	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		3,4	24	10	10	6	16	—	—	M3	4,46	1,4
8	≥1	16	22		3,4	28	10	10	6	19	—	—	M3	4,46	1,4
10	≥1	19	28	Figure 1 Type B6	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	Figure 2 Type B8	5,5	52	10	15	10	40	8	M6 × 1	M5	23,6	6,3
20	≥1	36	47		6,6	58	10	16	10	44	8	M6 × 1	M6	34,2	11
25	≤5	40	51		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	Secondary sizes.	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	Tolerances for D_1 for ball screw nut types B6, B8 and B4 (see Figures 1 to 3 and Figure 6).	9	93	10	17	14	70	10	M8 × 1	M8	89,9	26
40	≥10	63	78		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-bolt 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 $v = 0,9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 2: $n = 0,34$, amount of embedding for $Rz < 10 \mu\text{m}$: $f_z = f_{\text{thread}} + f_{\text{head bearing area}} + f_{\text{interface}} = 3,0 \mu\text{m} + 2,5 \mu\text{m} + 1,5 \mu\text{m} = 7,0 \mu\text{m}$, 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 $E = 210\,000 \text{ N/mm}^2$. 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 $D_{K1} = D_5$; possible outside diameter of substitutional deformation cone D_6 ; outside D_6 ; possible inner diameter of substitutional deformation cone $D_{A\text{inner}} = D_4 - D_1$; diameter of substitutional deformation cone $D_A = \text{MIN}(D_{A\text{outside}}, D_{A\text{inner}})$; 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 $F_{\text{kerf}} = 0 \text{ N}$ 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	Nominal lead	Ball screw nut outer diameter	Mounting bolt pitch circle diameter	Ball screw nut flange type	Flange mounting bolts diameter	Flange outer diameter	Centring diameter length	Collar length	Flange length	Flat flange width	Lubrication port thread length	Thread for lubrication port	Mounting bolts	Axial load at the opening limit of the nut flange	Tightening torque of one bolt
d_0 mm	P_{ho} mm	D_1 mm ^b	D_4 mm		D_5 mm	D_6 mm	L_1 mm min.	L_3 mm max.	L_7 mm	L_8 mm	L_{10} mm min.	Q		$F_{a\max}^c$ kN stat.	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		13,5	175	25	40	25	140	10	M8 × 1	M12	230	87
100	≤10	125	145	Figure 2 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 $v = 0,9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 2: $n = 0,34$, amount of embedding for $Rz < 10 \mu m$: $f_z = f_{thread} + f_{head\ bearing\ area} + f_{interface} = 3,0 \mu m + 2,5 \mu m + 1,5 \mu m = 7,0 \mu m$, 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 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 $D_{kl} = D_5$; possible outside diameter of substitutional deformation cone $D_{o\ outside} = D_6 \cdot D_7$; possible inner diameter of substitutional deformation cone $D_{i\ inner} = D_4 \cdot D_5$; 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	Nominal lead	Ball screw nut outer diameter	Mounting bolt pitch circle diameter	Ball screw nut flange type	Flange mounting bolts diameter	Flange outer diameter	Screw head counter bore diameter	Centring diameter length	Collar length	Flange length	Flat flange width	Counter bore depth	Thread for lubrication port	Mounting bolts	Axial load at the opening limit of the nut flange	Tightening torque of one bolt
d_0 mm	P_{ho} mm	D_1 mm ^a	D_4 mm		D_5 mm	D_6 mm	D_7 mm	L_1 mm min.	L_3 mm max.	L_7 mm	L_8 mm	L_9 mm	Q		$F_{a\max}^b$ kN stat.	T^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 $v = 0,9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 3: $n = 0,25$, amount of embedding for $Rz < 10 \mu m$: $f_z = f_{\text{thread}} + f_{\text{head bearing area}} + f_{\text{interface}} = 3,0 \mu m + 2,5 \mu m + 1,5 \mu m = 7,0 \mu m$, tightening factor $\alpha_A = 1,5$ for torque wrench; friction coefficient $\mu_s = 0,125$; clamped part, bolt material and component with internal thread of steel $E = 210\,000 \text{ N/mm}^2$. 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 $D_{k1} = D_5$; possible outside diameter of substitutional deformation cone $D_{A\text{ outside}} = D_6 - D_4$; possible inner diameter of substitutional deformation cone $D_{A\text{ inner}} = D_4 - D_1$; diameter of substitutional deformation cone $D_A = \text{MIN}(D_{A\text{ outside}}, D_{A\text{ inner}})$; 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 $F_{\text{kerf}} = 0 \text{ N}$ 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	Nominal lead	Ball screw nut outer diameter	Mounting bolt pitch circle diameter	Ball screw nut flange type	Flange mounting bolts diameter	Flange outer diameter	Screw head counter bore diameter	Centring diameter length	Collar length	Flange length	Flat flange width	Counter bore depth	Thread for lubrication port	Mounting bolts	Axial load at the opening limit of the nut flange	Tightening torque of one bolt
d_0 mm	P_{ho} mm	D_1 mm ^a	D_4 mm		D_5 mm	D_6 mm	D_7 mm	L_1 mm min.	L_3 mm max.	L_7 mm	L_8 mm	L_9 mm	Q		$F_{a\max}^b$ kN stat.	T^b Nm
14	$\geq 2 \leq 2,5$	22	32	Figure 3 Type B4	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		5,5	45	—	10	—	6	28	—	—	M5	13,9	6,3
16	$\geq 2 \leq 2,5$	25	35		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	$\geq 4, \leq 5$	28	38	Figure 4, 5 Type A6, C6	5,5	47	—	10	—	6	30	—	—	M5	20,1	6,3
16	$\geq 10 \leq 30$	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	$\geq 5, \leq 6$	35	46		5,5	58	9,5	10	—	11	22,5	5,5	M6×1	M5	20,1	6,3
20	$\geq 15 \leq 40$	40	53		6,6	67	11	10	13	12	26	6,5	M6×1	M6	29,7	11
25	$\geq 5 \leq 6$	40	51	Figure 4, 5 Type A6, C6	5,5	63	9,5	10	—	11	24	5,5	M6×1	M5	20,1	6,3
25	$\geq 8 \leq 10$	42	55		6,6	69	11	10	—	12	26	6,5	M6×1	M6	29,7	11
25	$\geq 20 \leq 32$	47	60		6,6	74	11	10	13	12	28	6,5	M6×1	M6	29,7	11
25	$\geq 40 \leq 50$	50	64		6,6	78	11	10	16	12	30	6,5	M6×1	M6	28,9	11
28	$\geq 5 \leq 10$	45	58		6,6	72	11	10	—	12	28	6,5	M6×1	M6	29,7	11
32	$\geq 5 \leq 6$	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	$\geq 12 \leq 16$	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 G).

^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 $v = 0,9$; load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 3: $\eta = 0,25$; amount of embedding for $Rz < 10 \mu\text{m}$: $f_z = f_{\text{head bearing area}} + f_{\text{interface}} = 3,0 \mu\text{m} + 2,5 \mu\text{m} + 1,5 \mu\text{m} = 7,0 \mu\text{m}$; tightening factor $\alpha_A = 1,5$ for torque wrench; friction coefficient $\mu_A = 0,125$; clamped part, bolt material and component with internal thread of steel $E = 210\,000 \text{ N/mm}^2$. 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 $D_{K1} = D_5$; possible outside diameter of substitutional deformation cone D_6 ; outside = $D_6 - D_5$; possible inner diameter of substitutional deformation cone $D_{A\text{ inner}} = D_4 - D_1$; diameter of substitutional deformation cone $D_A = \text{MIN}(D_{A\text{ outside}}, D_{A\text{ inner}})$; 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 $F_{\text{kerf}} = 0 \text{ N}$ 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	Nominal lead	Ball screw nut outer diameter	Mounting bolt pitch circle diameter	Ball screw nut flange type	Flange mounting bolts diameter	Flange outer diameter	Screw head counter bore diameter	Centring diameter length	Collar length	Flange length	Flat flange width	Counter bore depth	Thread for lubrication port	Mounting bolts	Axial load at the opening limit of the nut flange	Tightening torque of one bolt
d_0 mm	p_{ho} mm	D_1 mm ^a	D_4 mm	Figure 4, 5 Type A6, C6	D_5 mm	D_6 mm	D_7 mm	L_1 mm min.	L_3 mm max.	L_7 mm	L_8 mm	L_9 mm	Q		$F_{a\max}^b$ kN stat.	T_a^b 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		9	96	14	10	—	15	37	8,5	Rc1/8	M8	59,4	26
45	8	65	82		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 $v = 0,9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 3: $n = 0,25$, amount of embedding for $R_z < 10 \mu\text{m}$: $f_z = f_{z\text{head}} + f_{z\text{bearing area}} + f_{z\text{interface}} = 3,0 \mu\text{m} + 2,5 \mu\text{m} + 1,5 \mu\text{m} = 7,0 \mu\text{m}$, tightening factor $\alpha = 1,5$ for torque wrench; friction coefficient $\mu_e = 0,125$; clamped part, bolt material and component with internal thread of steel $E = 210\,000 \text{ N/mm}^2$. 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 $D_{K1} = D_5$; possible outside diameter of substitutional deformation cone D_A outside = $D_6 - D_9$; possible inner diameter of substitutional deformation cone $D_{A\text{inner}} = D_4 - D_1$; diameter of substitutional deformation cone $D_A = \text{MIN}(D_{A\text{outside}}, D_{A\text{inner}})$; 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 $F_{\text{kerf}} = 0 \text{ N}$ 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	Nominal lead	Ball screw nut outer diameter	Mounting bolt pitch circle diameter	Ball screw nut flange type	Flange mounting bolts diameter	Flange outer diameter	Screw head counter bore diameter	Centring diameter length	Collar length	Flange length	Flat flange width	Counter bore depth	Thread for lubrication port	Mounting bolts	Axial load at the opening limit of the nut flange	Tightening torque of one bolt	
d_0 mm	P_{ho} mm	D_1 mm ^a	D_4 mm	Figure 4, 5 Type A6, C6	D_5 mm	D_6 mm	D_7 mm	L_1 mm min.	L_3 mm max.	L_7 mm	L_8 mm	L_9 mm	Q		$F_{a\max}^b$ kN stat.	T_a^b Nm	
80	10	105	127		14	151	20	20	10	—	22	57	13	Rc1/8	M12	154	88
80	12	110	132		14	156	20	20	20	—	22	59	13	Rc1/8	M12	154	88
80	≥15 ≤20	115	143		18	173	26	26	40	—	28	66	17,5	Rc1/8	M16	299	220
100	10	125	147		14	171	20	20	20	—	22	64	13	Rc1/8	M12	154	88
100	12	130	158	18	188	26	26	20	—	28	71	17,5	Rc1/8	M16	488	220	
100	≥15 ≤20	135	169	22	205	32	32	40	—	32	79	21,5	Rc1/8	M20	488	430	
Tolerances for D_1 for ball screw nut types B4, A6 and C6 (see Figures 3, 4, 5 and Figure 6).																	
^a 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 $v = 0,9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 3: $n = 0,25$, amount of embedding for $Rz < 10\text{ }\mu\text{m}$: $f_z = f_{\text{thread}} + f_{\text{head bearing area}} + f_{\text{interface}} = 3,0\text{ }\mu\text{m} + 2,5\text{ }\mu\text{m} + 1,5\text{ }\mu\text{m} = 7,0\text{ }\mu\text{m}$, 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 $E = 210\,000\text{ N/mm}^2$. 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 $D_{Kl} = D_5$; possible outside diameter of substitutional deformation cone D_{Δ} outside $= D_6 - D_4$; possible inner diameter of substitutional deformation cone $D_{\Delta\text{inner}} = D_4 - D_1$; diameter of substitutional deformation cone $D_{\Delta} = \text{MIN}(D_{\Delta\text{inner}}, D_{\Delta\text{outside}})$; 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 $F_{\text{kerf}} = 0\text{ N}$ when opening at the interface; number of bolts x at flange results from the types B4, B6, B8, A6, C6.																	
^b 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	Nominal lead	Ball screw nut outer diameter	Mounting bolt pitch circle diameter	Ball screw nut flange type	Flange mounting bolts diameter	Flange outer diameter	Screw head counter bore diameter	Centring diameter length	Collar length	Flange length	Flat flange width	Counter bore depth	Thread for lubrication port	Mounting bolts	Axial load at the opening limit of the nut flange	Tightening torque of one bolt
d_0 mm	P_{ho} mm	D_1 mm ^a	D_4 mm		D_5 mm	D_6 mm	D_7 mm	L_1 mm min.	L_3 mm max.	L_7 mm	L_8 mm	L_9 mm	Q		$F_{a\max}^b$ kN stat.	T_a^b Nm
4	1	11	17	Figure 3 Type B4	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		4,5	42	—	5	—	5	26	—	—	M4	3,58	3,1
8	≥5 ≤8	24	34		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 $v = 0,9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 4: $n = 0,25$, amount of embedding for $Rz < 10 \mu m$: $f_{Rz} = f_{Rz}^{head} + f_{Rz}^{bearing} + f_{Rz}^{thread} = 3,0 \mu m + 2,5 \mu m + 1,5 \mu m = 7,0 \mu m$, tightening factor $\alpha_A = 1,5$ for torque wrench; friction coefficient $\mu_e = 0,125$; clamped part, bolt material and component with internal thread of steel $E = 210\,000 \text{ N/mm}^2$. 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 $D_{kl} = D_5$; possible outside diameter of substitutional deformation cone $D_{A\text{outside}} = D_6 - D_4$; possible inner diameter of substitutional deformation cone $D_{A\text{inner}} = D_4 - D_1$; diameter of substitutional deformation cone $D_A = \text{MIN}(D_{A\text{outside}}, D_{A\text{inner}})$; 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 $F_{\text{clerf}} = 0 \text{ N}$ 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	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	Collar length	L_3 mm	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	Tightening torque of one bolt	T_a^b Nm
16	16	≤2,5	28	39	28	39	5,5	Figure 4.5 Type A6, C6	—	48	—	10	—	6	30	—	M5	13,9	6,3	—	—	—	—	—	—	—	—	—	—	—	—
16	16	3	32	44	32	44	5,5		—	53	—	10	—	6	33	—	M5	13,9	6,3	—	—	—	—	—	—	—	—	—	—	—	—
16	16	4	36	47	36	47	5,5		9,5	59	—	10	—	11	22,5	—	M5	13,9	6,3	—	—	—	—	—	—	—	—	—	—	—	—
16	16	≥5 ≤16	40	51	40	51	5,5		9,5	63	—	10	—	11	24	—	M5	20,1	6,3	—	—	—	—	—	—	—	—	—	—	—	—
20	20	4	40	51	40	51	5,5	Figure 4.5 Type A6, C6	9,5	63	—	10	—	11	24	—	M5	20,1	6,3	—	—	—	—	—	—	—	—	—	—	—	—
20	20	5	44	55	44	55	5,5		11	67	—	10	—	11	26	—	M5	20,1	6,3	—	—	—	—	—	—	—	—	—	—	—	—
20	20	≥6 ≤20	48	61	48	61	6,6		11	75	—	10	—	12	29	—	M6	29,7	11	—	—	—	—	—	—	—	—	—	—	—	—
25	25	4	46	57	46	57	5,5		9,5	69	—	10	—	11	26	—	M5	20,1	6,3	—	—	—	—	—	—	—	—	—	—	—	—
25	25	5	50	61	50	61	5,5	Figure 4.5 Type A6, C6	9,5	73	—	10	—	11	28	—	M5	20,1	6,3	—	—	—	—	—	—	—	—	—	—	—	—
25	25	6	53	64	53	64	5,5		9,5	76	—	10	—	11	29	—	M5	20,1	6,3	—	—	—	—	—	—	—	—	—	—	—	—
25	25	≥8 ≤12	58	71	58	71	6,6		11	85	—	10	—	12	32	—	M6	29,7	11	—	—	—	—	—	—	—	—	—	—	—	—
25	25	≥15 ≤25	62	75	62	75	6,6		11	89	—	10	—	12	34	—	M6	29,7	11	—	—	—	—	—	—	—	—	—	—	—	—
28	28	5	55	68	55	68	6,6	Figure 4.5 Type A6, C6	11	82	—	10	—	12	31	—	M6	29,7	11	—	—	—	—	—	—	—	—	—	—	—	—
28	28	6	58	71	58	71	6,6		11	85	—	10	—	12	32	—	M6	29,7	11	—	—	—	—	—	—	—	—	—	—	—	—
28	28	8	62	75	62	75	6,6		11	89	—	10	—	12	34	—	M6	29,7	11	—	—	—	—	—	—	—	—	—	—	—	—
28	28	10	65	82	65	82	9		14	100	—	10	—	15	38	—	M8	59,4	26	—	—	—	—	—	—	—	—	—	—	—	—
32	32	4	54	67	54	67	6,6	Figure 4.5 Type A6, C6	11	81	—	10	—	12	31	—	M6	29,7	11	—	—	—	—	—	—	—	—	—	—	—	—
32	32	5	58	71	58	71	6,6		11	85	—	10	—	12	32	—	M6	29,7	11	—	—	—	—	—	—	—	—	—	—	—	—
32	32	6	62	75	62	75	6,6		11	89	—	10	—	12	34	—	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, tapered thread joint (not through-bolt joint), opening of the nut flange at specified tensile force, only tensile force, no transverse force, calculated for hexagonal 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 $v = 0,9$, load introduction factor n according to VDI 2230 Nov. 2015; averaged for Table 4: $n = 0,25$, amount of embedding for $Rz < 10 \mu m$: $f_{zr} = f_{thead} + f_{head bearing area} + f_{interface} = 3,0 \mu m + 2,5 \mu m + 1,5 \mu m = 7,0 \mu m$, tightening factor $\alpha_A = 1,5$ for torque wrench; friction coefficient $\mu_R = 0,125$; clamped part, bolt material and component with internal thread of steel $F = 210\,000 \text{ N/mm}^2$. The following additional parameters were used for the screw calculation in tables: clamping length (clamped part) for Table 4: $l_k = L_s - L_g$; bolt length calculated from the clamping length and the length of thread engagement $l = l_k + 1,2 \cdot d$; diameter of through hole $D_{Kl} = D_s$; possible outside diameter of substitutional deformation cone $D_{A, outside} = D_6 - D_i$; possible inner diameter of substitutional deformation cone $D_{A, inner} = D_4 - D_i$; 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 $F_{kerf} = 0 \text{ N}$ 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.