UDC 621.882.215.61.091.1

May 1985

Hexagon socket thin head cap screws

DIN 7984

Zylinderschrauben mit Innensechskant und niedrigem Kopf

Supersedes December 1970 edition.

In keeping with current practice in standards published by the International Organization for Standardization (ISO), a comma has been used throughout as the decimal marker.

Dimensions in mm

1 Field of application

This standard specifies product grade A hexagon socket thin head cap screws with ISO metric screw thread from size M3 up to and including size M24.

If, in special cases, the screws are to meet requirements other than those given in this standard, e.g. with regard to property class or material, these shall be selected in accordance with the appropriate standard. This also applies to the fine pitch thread conforming to DIN 13 Part 13 required in exceptional cases.

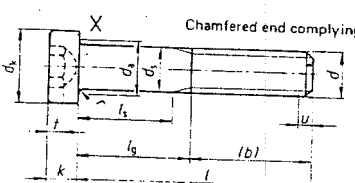
Owing to their head dimensions, screws complying with this standard are interchangeable with screws specified in DIN 84.

The critical cross section of screws covered by this standard can, as a consequence of the head geometry and the form of the wrench engagement, thus be located below the hexagon socket and not in the thread. This particularly applies for fine pitch thread screws and/or where tolerance positions are unfavourable (see also Explanatory notes). It is thus recommended that the screws should not be used for the transmission of high axial loads involving prestressing.

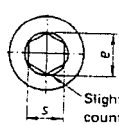
If a DIN 911 double offset screwdriver is used to tighten the screws by way of their socket, the design of the key only permits the application of prestressing loads corresponding to 70 % of the minimum yield point specified for property class 8.8 screws.

These screws may not be used in the form of screw assemblies with captive washers as specified in DIN 6900, as the corresponding components (e.g. washers) would require small radii below the screw head, which could seriously weaken the cross section in the zone below the hexagon socket and lead to screw failure.

2 Dimensions



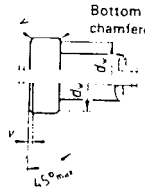
Chamfered end complying with DIN 78.



Slight rounding or countersink at the mouth of the socket permissible (no further than c).

d_a is applicable only for screws with unthreaded portion of shank.

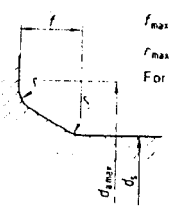
$u = 2P$ maximum; incomplete thread.



Bottom edge of the head may be rounded or chamfered to d_w and shall be deburred.

Top of head rounded or chamfered (pressing contour), at the manufacturer's discretion.

Detail X
Maximum underhead fillet



$f_{max} = 1{,}7\,r_{max}$

$r_{max} = \frac{d_{a\,max} - d_{s\,max}}{2}$

For r_{min}, see table.

Continued on pages 2 to 6

Thread size d		M3	M4	M5	M6	M8	M10
P [1]		0,5	0,7	0,8	1	1,25	1,5
b Thread length	[2]	12	14	16	18	22	26
	[3]	–	–	–	–	28	32
	[4]	–	–	–	–	–	–
d_k	max. = nominal dimension	5,5	7	8,5	10	13	16
	min	5,32	6,78	8,28	9,78	12,73	15,73
d_s	max.	3,6	4,7	5,7	6,8	9,2	11,2
d_s	max. = nominal dimension	3	4	5	6	8	10
	min	2,86	3,82	4,82	5,82	7,78	9,78
d_w	min	4,84	6,2	7,7	9,2	12,03	15,03
e [5]	min	2,3	2,87	3,44	4,58	5,72	8,01
f	max	0,51	0,6	0,6	0,68	1,02	1,02
k	max. = nominal dimension	2	2,8	3,5	4	5	6
	min	1,86	2,66	3,32	3,82	4,82	5,82
r	min	0,1	0,2	0,2	0,25	0,4	0,4
s	Nominal dimension	2	2,5	3	4	5	7
	min	2,02	2,52	3,02	4,02	5,02	7,025
	max	2,10	2,60	3,10	4,12	5,14	7,175
t	Nominal dimension	1,5	2,3	2,7	3	3,8	4,5
	min	1,38	2,18	2,58	2,88	3,65	4,35
	max	1,62	2,42	2,82	3,12	3,95	4,65
v	max	0,3	0,4	0,5	0,6	0,8	1

Nominal length	l min	l max	Shank lengths l_s and l_g											
			l_s min.	l_g max.	l_s min.	l_g max	l_s min.	l_g max	l_s min	l_g max	l_s min.	l_g max	l_s min.	l_g max
5	4,76	5,24	–	1,5										
6	5,76	6,24	–	1,5	–	2,1								
8	7,71	8,29	–	1,5	–	2,1	–	2,4						
10	9,71	10,29	–	1,5	–	2,1	–	2,4	–	3				
12	11,65	12,35	–	1,5	–	2,1	–	2,4	–	3	–	3,75		
(14)	13,65	14,35	–	1,5	–	2,1	–	2,4	–	3	–	3,75		
16	15,65	16,35	–	1,5	–	2,1	–	2,4	–	3	–	3,75	–	4,5
(18)	17,65	18,35	–	1,5	–	2,1	–	2,4	–	3	–	3,75	–	4,5
20	19,58	20,42	5,5	8	–	2,1	–	2,4	–	3	–	3,75	–	4,5
25	24,58	25,42			7,5	11	–	2,4	–	3	–	3,75	–	4,5
30	29,58	30,42					10	14	7	12	–	3,75	–	4,5
35	34,5	35,5							12	17	6,75	13	–	4,5
40	39,5	40,5							17	22	11,75	18	6,5	14
45	44,5	45,5									16,75	23	11,5	19
50	49,5	50,5									21,75	28	16,5	24
(55)	54,4	55,6									26,75	33	21,5	29
60	59,4	60,6									31,75	38	26,5	34
70	69,4	70,6											36,5	44

[1] P = pitch of thread (coarse pitch thread).
[2] For lengths $l \leq 125$ mm.
[3] For lengths $l > 125$ mm ≤ 200 mm.
[4] For lengths $l > 200$ mm.
[5] e min. = 1,14 X s min.

Thread size d			M 12	(M 14)	M 16	(M 18)	M 20	(M 22)	M 24
P [1]			1,75	2	2	2,5	2,5	2,5	3
b Thread length		[2]	30	34	38	42	46	50	54
		[3]	36	40	44	48	52	56	60
		[4]	–	–	57	61	65	69	73
d_k	max. = nominal dimension		18	21	24	27	30	33	36
		min	17,73	20,67	23,67	26,67	29,67	32,61	35,61
d_2		max	13,7	15,7	17,7	20,2	22,4	24,4	26,4
d_s	max. = nominal dimension		12	14	16	18	20	22	24
		min	11,73	13,73	15,73	17,73	19,67	21,67	23,67
d_w		min	17,03	19,83	22,83	25,83	28,83	31,61	34,61
e [5]		min	9,15	11,43	13,72	13,72	16	16	19,44
f		max	1,87	1,87	1,87	1,87	2,04	2,04	2,04
k	max. = nominal dimension		7	8	9	10	11	12	13
		min	6,78	7,78	8,78	9,78	10,73	11,73	12,73
r		min	0,6	0,6	0,6	0,6	0,8	0,8	0,8
s	Nominal dimension		8	10	12	12	14	14	17
		min	8,025	10,025	12,032	12,032	14,032	14,032	17,05
		max	8,175	10,175	12,212	12,212	14,212	14,212	17,23
t	Nominal dimension		5	5,3	5,5	6,5	7,5	8	8
		min	4,85	5,15	5,35	6,32	7,32	7,82	7,82
		max	5,15	5,45	5,65	6,68	7,68	8,18	8,18
v		max	1,2	1,4	1,6	1,8	2	2,2	2,4

Nominal length	l min	l max	Shank lengths l_s and l_g													
			l_s min.	l_g max.	l_s min.	l_g max.	l_s min.	l_g max.	l_s min	l_g max.	l_s min.	l_g max	l_s min.	l_g max.	l_s min	l_g max.
20	19,58	20,42	–	5,25												
25	24,58	25,42	–	5,25												
30	29,58	30,42	–	5,25	–	6	–	6								
35	34,5	35,5	–	5,25	–	6	–	6								
40	39,5	40,5	–	5,25	–	6	–	6	–	7,5	–	7,5				
45	44,5	45,5	–	5,25	–	6	–	6	–	7,5	–	7,5				
50	49,5	50,5	11,25	20	–	6	–	6	–	7,5	–	7,5	–	7,5	–	9
(55)	54,4	55,6	16,25	25	11	21	–	6	–	7,5	–	7,5	–	7,5	–	9
60	59,4	60,6	21,25	30	16	26	12	22	–	7,5	–	7,5	–	7,5	–	9
70	69,4	70,6	31,25	40	26	36	22	32	15,5	28	11,5	24	–	7,5	–	9
80	79,4	80,6	41,25	50	36	46	32	42	25,5	38	21,5	34	17,5	30	–	9
90	89,3	90,7							35,5	48	31,5	44	27,5	40	21	36
100	99,3	100,7							45,5	56	41,5	54	37,5	50	31	46

See page 2 for [1] to [5].

The commercial nominal lengths are designated by giving the shank lengths.

The thread sizes and intermediate lengths given in brackets shall be avoided where possible.

Nominal lengths above 100 mm shall be graded by steps of 10 mm and those above 200 mm by steps of 20 mm.

Screws with nominal lengths above the dashed stepped line shall be threaded up to the head (the maximum distance between the last full form thread to the head bearing surface, l_g, is 3 P). The l_g and l_s values for bolts with nominal lengths below the dashed stepped line shall be determined in accordance with the following equations:

l_g max. = l (nominal length) – b (nominal length); l_s min. = l_g max. – 5 P.

3 Technical delivery conditions

Material		Steel	Stainless steel	Nonferrous metal
General requirements		As specified in DIN 267 Part 1.		
Thread	Tolerance class	6 g		
	Standard	DIN 13 Part 12 and Part 15		
Mechanical properties	Property class (material)	8.8	A2-70; M 20: A2-50	CuZn = copper-zinc alloy [2]
		Other property classes or materials subject to agreement.		
	Standard	ISO 898 Part 1 [1]	DIN 267 Part 11	DIN 267 Part 18
Permissible dimensional deviations and deviations of form	Product grade	A		
	Standard	ISO 4759 Part 1		
Surface finish		(Thermally or chemically) blackened.	Bright.	Bright.
		DIN 267 Part 2 shall apply with regard to the surface roughness. DIN 267 Part 19 shall apply with regard to the permissible surface discontinuities. DIN 267 Part 9 shall apply with regard to electroplating. If a different kind of electroplating or a different kind of surface protection is desired, this shall be agreed upon at the time of ordering.		
Acceptance inspection		DIN 267 Part 5 shall apply with regard to acceptance inspection.		

[1] The acceptance inspection shall include hardness testing of property class 8.8 screws, with hardness values of HV 250 to 320 for sizes up to and including M 16, and HV 255 to 335 for sizes greater than M 16 (see Explanatory notes).

[2] Preferably CU2 or CU3, at the manufacturer's discretion.

4 Designation

Designation of an M 12 hexagon socket head cap screw of nominal length l = 60 mm and assigned to property class 8.8[1]:

Hexagon socket head cap screw DIN 7984 – M 12 × 60 – 8.8

DIN 962 shall apply with regard to the designation of types and designs with additional information to be given on ordering.

The DIN 4000 – 2 – 1 tabular layout of article characteristics shall apply for screws covered by this standard.

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[1] If no property class is specified in the documents available, property class 8.8 shall apply.

5 Masses

Thread size *d*	M 3	M 4	M 5	M 6	M 8	M 10	M 12	(M 14)	M 16	(M 18)	M 20	(M 22)	M 24
Nominal length *l*	Mass (7,85 kg/dm³), in kg per 1000 units ≈												
5	0,48												
6	0,52	0,96											
8	0,6	1,12	2,26										
10	0,69	1,28	2,5	3,59									
12	0,78	1,44	2,74	3,94	8,05								
14	0,86	1,6	2,98	4,29	8,65								
16	0,97	1,76	3,22	4,64	9,25	14,4							
18	1,1	1,95	3,46	4,99	9,85	15,4							
20	1,2	2,15	3,77	5,34	10,5	16,4	24,1						
25		2,64	4,54	6,45	12	19	27,7						
30			5,31	7,56	14	21,6	31,3	46,5	62,1				
35				8,67	16	24,7	34,9	51,4	68,8				
40				9,78	18	27,8	39,3	56,3	75,5	99	130		
45					20	30,9	43,7	62,3	82,2	107	140		
50					22	34	48,1	68,3	89,6	115	150	188	223
55					24	37,1	52,5	74,3	97	125	160	201	238
60					26	40,2	56,9	80,3	104	135	172	214	253
70						46,4	65,8	92,4	119	155	197	244	288
80							74,7	105	134	175	222	274	324
90										195	247	304	359
100										215	272	334	395

The values of mass specified for the commercial sizes are for guidance only.

Standards referred to

DIN	13 Part 12	ISO metric screw threads; coarse and fine pitch threads from 1 to 300 mm diameter; selection of diameters and pitches
DIN	13 Part 13	ISO metric screw threads; selected sizes for screws, bolts and nuts from 1 to 52 mm screw thread diameter and limits of size
DIN	13 Part 15	ISO metric screw threads; fundamental deviations and tolerances for screw threads of 1 mm diameter and larger
DIN	78	Thread ends and lengths of projection of bolt ends for ISO metric threads in accordance with DIN 13
DIN	84	Slotted cheese head screws
DIN	267 Part 1	Fasteners; technical delivery conditions; general requirements
DIN	267 Part 2	Fasteners; technical delivery conditions; types of finish and dimensional accuracy
DIN	267 Part 5	Fasteners; technical delivery conditions; acceptance inspection
DIN	267 Part 9	Fasteners; technical delivery conditions; electroplated components
DIN	267 Part 11	Fasteners; technical delivery conditions with addenda to ISO 3506; stainless and acid resistant steel components
DIN	267 Part 18	Fasteners; technical delivery conditions; nonferrous metal components

DIN 267 Part 19	Fasteners; technical delivery conditions; surface discontinuities on bolts
DIN 911	Hexagon socket screw keys
DIN 962	Bolts, screws, studs and nuts; designations, types and finishes
DIN 4000 Part 2	Tabular layout of article characteristics for bolts, screw and nuts
DIN 6900	Screw assemblies
ISO 898 Part 1	Mechanical properties of fasteners; bolts, srcews and studs
ISO 4759 Part 1	Tolerances for fasteners; bolts, screws and nuts with thread diameters ≥ 1,6 and ≤ 150 mm and product grades A, B and C

Previous editions

DIN 7984: 03.61, 12.67, 12.70

Amendments

The following amendments have been made in comparison with the December 1970 edition:

a) The content of the standard has been editorially revised and harmonized with DIN 912.

b) Shank lengths have been adopted (see Explanatory notes).

c) The head bearing surface has been dimensioned in detail (see Explanatory notes).

d) The technical delivery conditions have been supplemented and harmonized with the corresponding basic standards.

e) Maximum and minimum values have been adopted for the individual dimensions.

f) In the field of application attention has been drawn to the limited axial loadability of the screws.

g) Some of the values of depth of the hexagon socket, t, have been reduced for reasons of strength (see ISO 898 Part 1) and for reasons associated with manufacture.

h) The hardness test has been specified as the determining test for the acceptance inspection.

Explanatory notes

Re amendment a):

In respect of its dimensional specifications and its layout, Standard DIN 912, December 1983 edition, corresponds to International Standard ISO 4762 – 1977. The national amendments and/or supplements required have been identified. The same layout has been selected for the present standard and the other standards covering hexagon socket screws, DIN 6912 and DIN 7991, although no international standards comparable to these standards have yet been published.

Re amendment b):

As an addition to the previous specifications, dimensions have been specified for the shank lengths (l_s and l_g). l_g can be considered to represent the minimum grip length. Thread length b, which has remained unamended at $2 \times d + 6$ mm or $2 \times d + 12$ or 25 mm, is now only applicable as a reference dimension for calculating l_g and l_s. This dimension also covers the tolerances on nominal length l and the previous tolerances on thread length, i.e. the difference between l_g and l_s (= 5 P) covers both tolerances and the thread runout. A value corresponding to 3 P has been specified for dimension l_g of screws with a nominal length above the dashed stepped line, this value corresponds to dimension a_1 (distance between the last full form thread to the head), as specified in DIN 76 Part 1. The dashed line has been moved downwards slightly for some sizes, in order to prevent unnecessarily short unthreaded portions of shank. There is no risk to interchangeability as a consequence of the amended dimensioning.

Re amendment c):

The head bearing surface and the underhead fillet of the screw have been dimensioned in detail, by analogy with DIN 912. As a deviation from DIN 912, a minimum bearing surface diameter corresponding to d_w min. = d_k min. – IT 15 has been specified for sizes up to M 24, following proper high standard cold forming practice (see also Explanatory notes to DIN 912 in this respect).

Re amendment h):

As the critical cross section in these screws can lie between the hexagon socket and the threaded portion of the shank, the screws are not to be subjected to the wedge loading test (see ISO 898 Part 1, April 1979 edition, table 5). Furthermore, according to a revision agreed in October 1984 by Subcommittee SC 1 of Technical Committee ISO/TC 2, the hardness test has been made mandatory for acceptance inspection as specified in ISO 898 Part 1, table 3. In addition to revised hardness values, it has been specified that screws having a head which, as a function of its design, is (or could be) weaker than the threaded portion shall be accepted on the basis of hardness testing.

International Patent Classification

F 16 B 23/00