UDC 621.882.2.082.8 : 621.882.082.1 : 620.1 December 1984

Thread rolling screws
for ISO metric thread
Dimensions Requirements Testing

DIN 7500 Part 1

Gewindefurchende Schrauben für metrisches ISO-Gewinde; Maße, Anforderungen, Prüfung

Supersedes October 1978 edition of DIN 7500.

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. Scope and field of application

This standard covers thread rolling, heat-treated screws which form a thread capable of taking a screw with an ISO metric thread. The existing DIN Standards (see clause 2) shall apply for the styles of head of thread rolling screws. For the screws specified in this standard, the general data given in DIN 267 Part 1 and the technical delivery conditions covering acceptance inspection as specified in DIN 267 Part 5 shall apply.

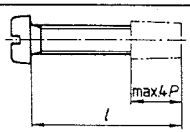
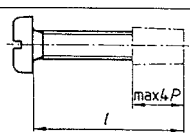
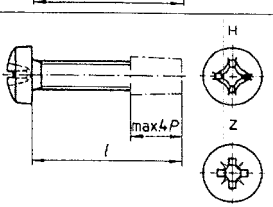
This standard specifies the dimensions and designation of thread rolling screws and is meant to prevent the screw thread from becoming deformed upon screwing or when exposed to stress at a later point, and from fracturing under normal stress conditions. Therefore, the main characteristics for assessing the mechanical and functional properties of a thread rolling screw are

- the surface hardness;
- the minimum breaking torque;
- the minimum tensile breaking load;
- the thread formed.

2 Dimensions, designation

Table 1. **Styles and designations**

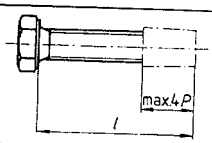
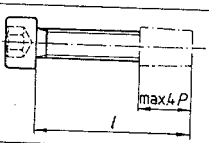
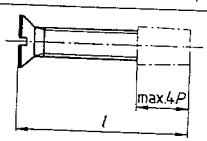
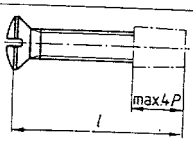
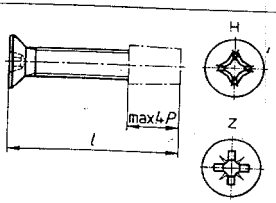
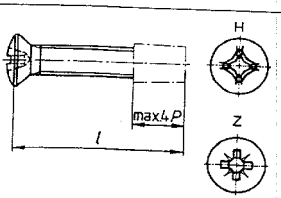
The shape of the screw end in the area outlined [ ] shall be at the manufacturer's discretion (see subclause 3.3).

Style	Illustration	Other dimensions as specified in	Size range for rolling	Example of designation
A		DIN 84	M 2 to M 10	Screw DIN 7500 – A M 6 × 20 – St
B		DIN 85	M 3 to M 6	Screw DIN 7500 – B M 6 × 20 – St
C		DIN 7985	M 2 to M 10	Screw DIN 7500 – C M 6 × 20 – St – Z [1]

[1] If the designation does not include the symbol H or Z identifying the cross recess, cross recess type H shall apply.

Continued on pages 2 to 6

Table 1. (continued)

Style	Illustration	Other dimensions as specified in	Size range for rolling	Example of designation
D		DIN 933	M 2 to M 10	Screw DIN 7500 – D M 6 × 20 – St
E		DIN 912	M 2 to M 10	Screw DIN 7500 – E M 6 × 20 – St
K		DIN 963	M 2 to M 10	Screw DIN 7500 – K M 6 × 20 – St
L		DIN 964	M 2 to M 10	Screw DIN 7500 – L M 6 × 20 – St
M		DIN 965	M 2 to M 10	Screw DIN 7500 – M M 6 × 20 – St – Z [1]
N		DIN 966	M 2 to M 10	Screw DIN 7500 – N M 6 × 20 – St – Z [1]

For [1], see page 1.

Table 2. **Usual length range for thread rolling screws**

Thread size	M 2	M 2,5	M 3	M 3,5	M 4	M 5	M 6	M 8	M 10
P	0,4	0,45	0,5	0,6	0,7	0,8	1	1,25	1,5
Rolling range max.	1,6	1,8	2	2,4	2,8	3,2	4	5	6
l	Usual length range								
3	*)								
4		*)	*)						
5			*)	*)					
6				*)	*)				
8						*)	*)		
10								*)	
12								*)	*)
(14)									*)
16									*)
(18)									
20									
(22)									
25									
(29)									
30									
35									
40									
45									
50									
55									
60									
70									
80									

Lengths in brackets shall be avoided as far as possible.
The usual commercial sizes are included between the stepped lines.
*) Not for types K to N.

3 Requirements

3.1 Design and dimensional accuracy

For the design and dimensional accuracy of thread rolling screws, DIN 267 Part 2 or ISO 4759 Part 1, product grade A (previously design m) shall apply, unless special requirements are laid down in individual dimensional standards. As a deviation from these standards, tolerance class js 16 shall apply for the nominal lengths of thread rolling screws.

If thread rolling screws with an unthreaded portion of shaft are required, the thread length as specified in DIN 962 shall be included in the designation, e.g.:

Screw DIN 7500 – A M6 × 50 × 28 – St.

3.2 Material

Case hardening steel as specified in DIN 17210 or quenched and tempered steel as specified in DIN 17200 (both symbolized by "St") shall be used as the material for thread rolling screws, at the discretion of the manufacturer.

For steels for screws, see also DIN 1654 Part 1 to Part 5.

Other materials shall be particularly agreed upon.

DIN 267 Part 9 shall apply for electroplating.

3.3 Thread

The thread of thread rolling screws shall be such that the internal thread formed is capable of receiving a commer-

cial screw with ISO metric coarse screw thread of tolerance quality 6h, in accordance with the DIN 13 series of standards, and the screw shall be capable of being screwed manually using a screwdriver.

The form and arrangement of the rolling area of the thread shall be selected by the manufacturer as appropriate. The length of the rolling area shall be not greater than 4 *P*.

3.4 Metallurgical properties

3.4.1 Surface hardness

The surface hardness of thread-rolling screws after heat treatment shall be at least 450 HV 0,3.

3.4.2 Case depth

The values given in table 3 shall apply for hardness Eht 450.

Table 3. Case depth

Screw size	Case depth (Eht 450)	
	min.	max.
M 2 and M 2,5	0,04	0,12
M 3 and M 3,5	0,05	0,18
M 4 and M 5	0,10	0,25
M 6 and M 8	0,15	0,28
M 10	0,15	0,32

3.4.3 Core hardness

The core hardness after heat treatment shall be between 240 and 390 HV.

3.4.4 Microstructure

The structure after heat treatment shall not show any band of ferrite between the surface zone and core.

3.5 Mechanical properties

3.5.1 Suitability for forming the mating thread

The thread of the screw shall not undergo any plastic deformation when forming the mating thread by driving the screw into a test plate as specified in subclause 4.2.1.

3.5.2 Torsional strength

The values of minimum breaking torque obtained in the test specified in subclause 4.2.2 shall not be below the values given in table 5.

3.5.3 Tensile force

The values of minimum tensile force obtained in the test specified in subclause 4.2.3 shall not be below the values given in table 6.

4 Testing

4.1 Methods of testing the metallurgical properties

4.1.1 Surface hardness test

The Vickers hardness test of the surface shall be carried out in accordance with DIN 50 133. The indentation shall be made at a point as flat as possible, preferably on the screw head.

4.1.2 Determining the case depth

The case depth may be determined microscopically on a longitudinal section at the thread flank midpoint.

DIN 50 190 Part 1 shall apply for determining the case depth by means of hardness measurements.

4.1.3 Core hardness test

The core hardness shall be determined using the Vickers hardness test in accordance with DIN 50 133.

4.1.4 Microstructure test

The structure of the material shall be determined by metallographic examination.

4.2 Methods of testing the mechanical properties

4.2.1 Screwing test

The screw to be tested shall be driven into a test plate until one full thread of the screw projects through the plate.

The thickness of the test plate shall be as specified in table 4.

Table 4. Test plate

Screw size	Thickness of test plate	Hole diameter of test plate (tolerance class H9)
M 2	2	1,8
M 2,5	2,5	2,3
M 3	3	2,75
M 3,5	3,5	3,2
M 4	4	3,6
M 5	5	4,6
M 6	6	5,5
M 8	8	7,4
M 10	10	9,3

The Brinell hardness of the test plate shall be between 110 and 130 HB.

The carbon content of the test plate material shall not exceed 0,23%.

The core hole in the test plate may be drilled, or punched and redrilled, or reamed.

The contact force when driving the screw into the test plate shall not exceed 50 N for sizes up to M 5 and 100 N for sizes from M 6 onwards. The driving speed shall not exceed 30 revolutions per minute.

In case of doubt, the lubricant to be used during the drive test shall be agreed upon.

Note. If thread rolling screws are plated by the purchaser, any complaints made to the screw manufacturer need be accepted only if screwing tests carried out on screws of the same lot not subsequently plated, do not provide satisfactory results.

4.2.2 Torsional strength test

The screw to be tested shall be clamped in a split clamping device with mating thread or in an equivalent test

device in such a way that the clamped portion of the screw is not damaged. The screw shall project above the clamping device by not less two full threads, at least two full threads (not including the screw end) being held within the device or in the test device. In the case of short screws, the head shall not be supported and the full thread shall be clamped securely. The screw shall reach the minimum breaking torques as specified in table 5 before failure occurs.

Figure 1 shows an example of a suitable test device.

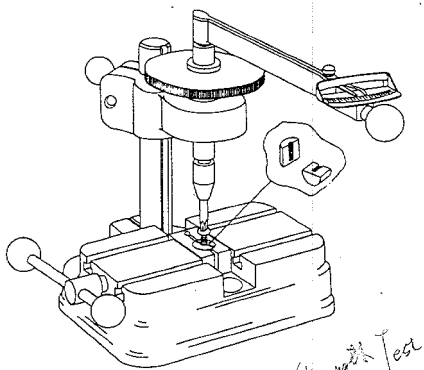


Figure 1.

Table 5. **Minimum breaking torque**

Screw size	Breaking torque N m min.
M 2	0,5
M 2,5	1
M 3	1,5
M 3,5	2,3
M 4	3,4
M 5	7,1
M 6	12
M 8	29
M 10	59

4.2.3 Tensile test

The screw to be tested as a finished component shall be clamped in a tensile testing machine and subjected to tensile stress. The minimum tensile force as specified in table 6 shall be attained before the screw breaks.

Table 6. **Minimum tensile force**

Screw size	Tensile force N min.
M 2	1650
M 2,5	2700
M 3	4000
M 3,5	5400
M 4	7000
M 5	11400
M 6	16000
M 8	29000
M 10	46000

4.2.4 Rolling torque test

When driving a screw into a test plate as specified in table 4, the values of maximum rolling torque given in table 7 shall not be exceeded.

Table 7. **Maximum rolling torques**

Screw size	Rolling torque N m max.
M 2	0,3
M 2,5	0,6
M 3	1
M 3,5	1,6
M 4	2,4
M 5	4,7
M 6	8
M 8	20
M 10	39

Standards referred to

Standards of the DIN 13 series on ISO metric screw threads

DIN	267 Part 1	Fasteners; technical delivery conditions, general requirements
DIN	267 Part 2	Fasteners; technical delivery conditions; design and dimensional accuracy
DIN	267 Part 5	Fasteners; technical delivery conditions; acceptance inspection
DIN	267 Part 9	Fasteners; technical delivery conditions; electroplated components
DIN	962	Bolts, screws, studs and nuts; designations, types and finishes
DIN	1654 Part 1	Cold heading and cold extruding steels; technical delivery conditions; general
DIN	1654 Part 2	Cold heading and cold extruding steels; technical delivery conditions for killed unalloyed steels not intended for heat treatment
DIN	1654 Part 3	Cold heading and cold extruding steels; technical delivery conditions for case hardening steels
DIN	1654 Part 4	Cold heading and cold extruding steels; technical delivery conditions for quenched and tempered steels
DIN	1654 Part 5	Cold heading and cold extruding steels; technical delivery conditions for stainless steels
DIN	7500 Part 2	Thread rolling screws for ISO metric thread; guideline values for hole diameters
DIN 17 200		Quenched and tempered steels; technical delivery conditions
DIN 17 210		Case hardening steels; quality specifications
DIN 50 133		Testing of metallic materials; Vickers hardness testing; range HV 0,2 to HV 100
DIN 50 190 Part 1		Hardness depth of heat-treated components; determination of the depth of case hardening
ISO	4759 Part 1	Fasteners; tolerances for bolts, screws and nuts with thread diameters between 1,6 and 150 mm; product grades A, B and C

Previous editions

DIN 7500: 10.78

Amendments

The following amendments have been made in comparison with the October 1978 edition of DIN 7500.

a) Types H and Z cross recesses as specified in DIN 7962 have been included.

b) The maximum core hardness has been reduced from 425 H to 390 H.

c) The content of the standard has been revised editorially and re-arranged as Part 1 and Part 2, the latter Part dealing with guideline values for hole diameters.

Explanatory notes

This standard covers screws specified as "thread forming" and which may be subdivided as follows.

a) **Thread cutting screws**
are screws which, when driven into a predrilled core hole, form their own mating thread for example with the aid of cutting slots, under chip extraction.

b) **Thread rolling screws**
are screws which, when driven into a predrilled core hole, form, for example by means of a suitable shape of the thread end, their mating thread without the removal of any material.

c) **Self drilling screws**
are screws which, when screwed, drill their own core hole by means of a suitable shape of the point and form the mating thread with the following portion of the thread, without chip extraction.

Note. The above-mentioned thread forming screws are not defined according to the type of thread (e.g. ISO metric thread or tapping thread).

International Patent Classification

F 16 B 25/00
F 21 D 9/22
G 01 M 13/00