November 1986

Cross recessed head thread cutting screws
Dimensions, requirements, testing

DIN 7516

Gewinde-Schneidschrauben; Kreuzschlitzschrauben; Maße, Anforderungen, Prüfung

Supersedes August 1971 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

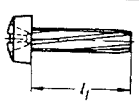
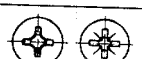
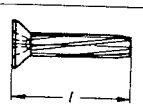
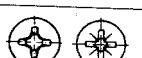
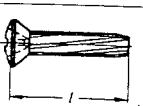
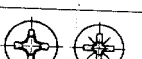
1 Scope and field of application

This standard applies to heat-treated screws (cross recessed head screws) with an ISO metric thread as specified in DIN 13 Part 12, with cutting slots diagonal to the screw axis, and which are designed to cut, with an appropriately shaped thread end, their own mating thread during assembly. The head styles for screws covered in this standard are dealt with in the relevant specialized DIN Standards (see clause 2), whereas DIN 267 Part 1 specifies general requirements and DIN 267 Part 5 applies to acceptance inspection.

The screws specified in this standard are designed to cut their own mating thread without distortion or fracture, assuming that they are not overstressed. Therefore, the main criteria for assessing the mechanical and functional properties are the surface hardness, the minimum breaking torque, the minimum tensile breaking load, and the quality of the thread formed.

2 Dimensions, designation

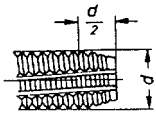
Table 1.

Style	Illustration	Cross recess as specified in DIN 7962	Other dimensions as in	Example of designation [1]
A		 Cross recess types H Z	DIN 7985	Screw DIN 7516 – A M 5 × 20 – St – H
D		 Cross recess types H Z	DIN 965	Screw DIN 7516 – D M 5 × 20 – St – H
E		 Cross recess types H Z	DIN 966	Screw DIN 7516 – E M 5 × 20 – St – H

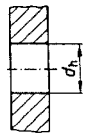
[1] If the designation does not include the symbol H or Z identifying the cross recesses, cross recess type H shall apply.

Continued on pages 2 to 4

Thread end



Thread core hole



The edge of the core hole on the insertion side shall be sharp-edged.

Table 2.

Thread size d	M 3	M 4	M 5	M 6	M 8
Nominal length, l[1]	Commercial length range[2]				
6	[3]				
8		[3]			
10			[3]		
12				[3]	
(14)					[3]
16					
(18)					
20					
(22)					
25					
30					
35					
40					
	Core hole diameter[4]				
d_h H11	2,7	3,6	4,5	5,5	7,4

[1] Use of the nominal lengths given in brackets should be avoided where possible.

[2] The range of standardized screws is indicated by stepped lines.

[3] Not intended for styles D and E.

[4] Designed for workpieces made from materials of medium strength. For thin-walled workpieces or workpieces made from soft materials, a smaller core hole diameter, for thick-walled workpieces or workpieces made from hard materials, a larger core hole diameter may be chosen, as appropriate. It is recommended that the selection be made on the basis of tests.

The depth of engagement should not exceed 2 d.

3 Requirements

3.1 General requirements

DIN 267 Part 1 shall apply with regard to the general requirements.

3.2 Design and dimensional accuracy

For the design and dimensional accuracy, ISO 4759 Part 1 or DIN 267 Part 2, product grade A, shall apply, unless other requirements have been specified in the relevant dimensional standards.

3.3 Material

Case hardening steel as specified in DIN 17 210 or quenched and tempered steel as specified in DIN 17 200 (symbolized by St) shall be used as the material for thread cutting screws, at the manufacturer's discretion.

See DIN 1654 Parts 3 and 4 for steels for other types of screws.

Other materials shall be particularly agreed upon.

3.4 Thread

The thread of thread cutting screws shall be such that the internal thread cut is capable of receiving a screw with ISO metric screw thread (coarse pitch thread) of tolerance quality 6h, as specified in DIN 13 Part 15.

The form and tolerance class of the thread cutting screw shall be selected by the manufacturer as appropriate.

3.5 Surface protection

DIN 267 Part 9 shall apply with regard to electroplated coatings. Other types of surface finish shall be subject to agreement.

3.6 Metallurgical properties

3.6.1 Surface hardness

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

3.6.2 Case depth

The values given in table 3 shall apply for the case depth.

Table 3. **Case depth**

Screw size	Case depth (Eht 450)	
	Minimum	Maximum
M 3	0,05	0,18
M 4 and M 5	0,10	0,25
M 6 and M 8	0,15	0,28

3.6.3 Core hardness

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

3.6.4 Microstructure

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

3.7 Mechanical properties

3.7.1 Suitability for cutting the mating thread

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

3.7.2 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 45.

3.7.3 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 made 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 above the surface of 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	Diameter of hole of test plate (tolerance class H9)	Maximum cutting torque, in N m
M 3	3	2,7	0,9
M 4	4	3,6	2,1
M 5	5	4,5	4,2
M 6	6	5,5	7,2
M 8	8	7,4	17

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 rate at which the screw is driven into the plate shall not exceed 30 revolutions per minute, the cutting torque shall not exceed the values given in table 4.

Where necessary, the lubricant to be used during the drive test shall be agreed upon.

Note. If thread cutting screws are plated by the purchaser, any complaints made to the screw manufacturer need be accepted only if screwing tests carried out on unplated screws of the same lot 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 than 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.

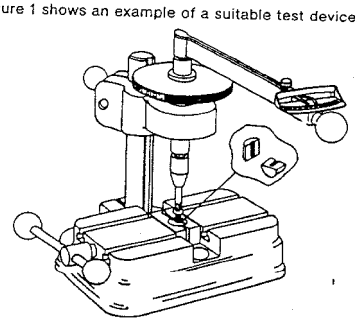


Table 5. Minimum breaking torque

Screw size	Minimum breaking torque, in Nm
M3	1,5
M4	3,4
M5	7,1
M6	12
M8	28

Table 6. **Minimum tensile forces**

Screw size	Minimum tensile force, in N
M3	4 000
M4	7 000
M5	11 400
M6	16 000
M8	29 000

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 reached before failure occurs.

Standards referred to

DIN	13 Part 12	ISO metric screw threads; 1 mm to 300 mm diameter coarse and fine pitch threads; selected diameters and pitches
DIN	13 Part 15	ISO metric screw threads; fundamental deviations and tolerances for screw threads of 1 mm and larger
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	965	Cross recessed countersunk flat head screws
DIN	966	Cross recessed raised countersunk (oval) head screws
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 steels for quenching and tempering
DIN	7513	Hexagon head and slotted head thread cutting screws; dimensions, requirements, testing
DIN	7962	Cross recesses for screw (modified version of ISO 4757)
DIN	7985	Cross recessed raised cheese head screws
DIN	17 200	Steels for quenching and tempering; technical delivery conditions
DIN	17 210	Case hardening steels; quality specifications
DIN	50 133	Testing of metallic materials; Vickers hardness test; HV 0,2 to HV 100
DIN	50 190 Part 1	Hardness depth of heat-treated components; determination of case depth
ISO	4759 Part 1	Fasteners; tolerances for bolts, screws and nuts with thread diameters between 1,6 mm and 150 mm product grades A, B and C

Previous editions

DIN 7516: 08.59, 08.71.

Amendments

The following amendments have been made to the August 1971 edition.

a) Style B as specified in DIN 7987 and style C as specified in DIN 7988 have been deleted.

b) Technical delivery conditions covering general and mechanical requirements and testing have been included.

c) The type Z cross recess (Pozidriv cross recess) as specified in DIN 7962 has been included.

d) Content and form of this standard have been harmonized with DIN 7500 Part 1 and DIN 7504.

Explanatory notes

As is already the case in other standards on cross recessed head screws, this standard now includes, in addition to the Phillip cross recess (as specified in DIN 7962 Part 1, August 1959 edition), a different type of cross recess known by its brand nam 'Pozidriv', which is now widely used. In future, the two types are to be distingulshed as follows:

Phillips: cross recess type H;

Pozidriv: cross recess type Z.

As 'Phillips' and 'Pozidriv' are proprietary brand names, they have not been referred to directly in the present standar (cf. also DIN 7972).

The inclusion of a further cross recess type does not necessitate altering existing documentation.

International Patent Classification

F 16 B 23/00 F 16 B 25/00 G 01 N 3/00