



Mechanical properties: Steel screws, bolts and studs

The mechanical properties of steel screws as well as their quality inspection and marking are set in ISO 898-1.

Designation system for the property classes

The most important mechanical properties for steel screws are given a two-number combination name – here's an example:

The first number gives 1/100 of the **minimum tensile strength** in N/mm² stress area.

Tensile strength $8 \times 100 = 800 \text{ N/mm}^2$.

← **8.8** →

The second number specifies the 10-fold ratio of the lower yield strength limit (R_{el} or $R_{p0.2}$) for nominal tensile strength R_m (yield strength ratio).

Multiplying the two numbers results in 1/10 **of the minimum yield strength** in N/mm².
 Stress at 0.2% non-proportional elongation $8 \times 8 \times 10 = 640 \text{ N/mm}^2$.

Table 1: Mechanical properties of screws, bolts and studs

Properties	Property classes	3.6	4.6	4.8	5.6	5.8	6.8	8.8		10.9	12.9
								M16	> M 16*		
Tensile strength ** Rm in N/mm ²	Nominal value	300	400		500		600	800		1000	1200
	min.	330	400	420	500	520	600	800	830	1040	1220
Yield stress ** Rel in N/mm ²	Nominal value	180	240	320	300	400	480	–	–	–	–
	min.	190	240	340	300	420	480	–	–	–	–
Stress at 0.2% non-proportional elongation ** Rp 0.2 in N/mm ²	Nominal value				–			640	640	900	1080
	min.				–			640	660	940	1100
Lower yield stress R_{el} / Stress at 0.2% non-proportional elongation at higher temperatures in N/mm ² (ISO 898-1 Issue 11/99, Tab. A1)	Continuous use at increased temperatures can lead to significant tensile relaxation.	+ 100 °C	–	–	–	270	–	–	590	875	1020
		+ 200 °C	–	–	–	230	–	–	540	790	925
		+ 250 °C	–	–	–	215	–	–	510	745	875
		+ 300 °C	–	–	–	195	–	–	480	705	825
Elongation after fracture A in % **	min.	25	22	–	20	–	–	12	–	9	8
Vickers hardness (HV) (F ≤ 98 N) **	HV min-max	95-220	120-220	130-220	155-220	160-220	190-250	250-320	255-335	320-380	385-435
	***	250	250	250	250	250	–	–	–	–	–
Brinell hardness (F = 30 D2) **	HB min-max	90-209	114-209	124-209	147-209	152-209	181-238	238-304	242-318	304-361	366-414
	***	238	238	238	238	238	–	–	–	–	–
Rockwell hHardness **	HRB min-max	52-95	67-95	71-95	79-95	82-95	89-99,5	–	–	–	–
	***	99.5	99.5	99.5	99.5	99.5	–	–	–	–	–
	HRC min-max	–	–	–	–	–	–	22-32	23-34	32-39	39-44

* construction steel bolts from M12

** values apply at room temperature approx. +20 °C

*** max. value at the screw end

Marking screws, bolts and studs

According to the standard, fasteners from a thread diameter of M5 onward are to be marked with the manufacturer's identification marks and the property class marking as follows*:

Hexagon and hexalobular head screws and bolts in all property classes. The marking shall be made preferably on the top of the head by indenting or embossing, or on the side of the head by indenting.

① ②

Hexagon and hexalobular socket head cap screws in all property classes. The marking shall be made preferably on the side of the head by indenting, or on the top of the head by indenting or embossing.

③ ④

Cup head square neck bolts in all property classes. The marking shall be made on the head by indenting or embossing.

⑤

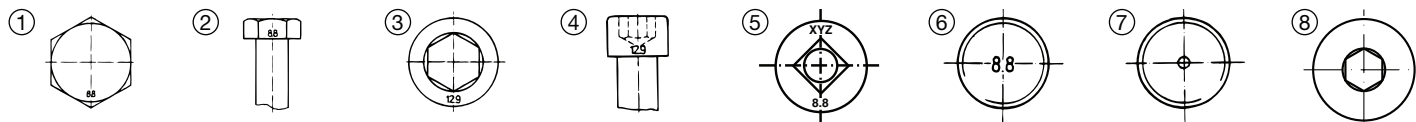


Studs of property classes 5.6, 8.8, 9.8, 10.9 and 12.9. The marking shall be on the unthreaded part of the stud. If this is not possible, marking of the property class shall be on the nut end, and the manufacturer's identification mark may be omitted. Alternative marking symbols are 5.6 = –, 8.8 = ○, for 10.9 = □ and for 12.9 = △

⑥ ⑦

Marking of fasteners which have reduced loadability like, hexagon socket head cap screws with low head for example (DIN 7984): Fasteners shall be marked with the property class, except that the marking symbol for property class shall be preceded by the digit "0" (e.g. "08.8"). The requirement to add a marking is regulated in the product standards. Other screws with reduced loadability are, for example, hexagon socket countersunk head screws acc. to ISO 10642.

⑧



* if there is a lack of space, a marking based on the clock system can be used (→ analogue Table 3)