FABORY

STANDARD
ISO : 898-1
EN : 20898-1
DIN : —

MECHANICAL PROPERTIES

of steel bolts, screws and studs

info

1 Scope and field of application

The property classes and their mechanical properties apply to bolts, screws and studs, with metric (ISO) thread, with nominal thread diameter d 39 mm, made of carbon steel or alloy steel and when tested at room temperature.
They do not apply to set screws and similar (see ISO 898-5) or to specific requirements such as weldability, corrosion resistance (see ISO 3506 on page 15-40-1 and seq), ability to withstand temperatures above + 300°C or below - 50°C (see DIN 267 Part 13 on pages 15-5-3 and 4).
The designation system may be used for sizes (e.g. d > 39 mm), provided that all mechanical requirements of the property classes are met.

2 Designation system of property classes

The property class symbols, indicating the most important mechanical properties, consist of two figures, one on either side of a dot. For example, 10.9. The first figure indicates 1/100 of the nominal tensile strength in N/mm² (See R_m in the table).
So property class 10.9 has a tensile strength of 10 x 100 = 1000 N/mm².
The second figure indicates 10 times the ratio between lower yield stress R_{el} (or proof stress $R_{p0,2}$) and nominal tensile strength R_m (yield stress ratio).
So at property class 10.9 the second figure 9 = 10 x $\frac{900}{1000}$
The multiplication of these two figures will give 1/10 of the yield stress in N/mm², so 10 x 9 = 1/10 x 900 N/mm² .

3 Mechanical properties of bolts, screws and studs

	mechanical property		property class										
			3.6	4.6	4.8	5.6	5.8	6.8	8.8 [1] d≤16 mm	8.8 [1] d>16 mm [3]	9.8 [2]	10.9	12.9
1	tensile strength	nom.	300	400		500		600	800	800	900	1000	1200
2	R_m [4] N/mm²	min.	330	400	420	500	520	600	800	830	900	1040	1220
3	Vickers hardness HV F ≥ 98N	min.	95	120	130	155	160	190	250	255	290	320	385
		max.	250						320	335	360	380	435
4	Brinell hardness HB F = 30 D²	min.	90	114	124	147	152	181	238	242	276	304	366
		max.	238						304	318	342	361	414
5	Rockwell hardness	min. HRB	52	67	71	79	82	89	-	-	-	-	-
		min. HRC	-	-	-	-	-	-	22	23	28	32	39
		max. HRB	99,5						-	-	-	-	-
		max. HRC							32	34	37	39	44
6	Surface hardness HV 0,3	max.							5)				
7	Lower yield stress R_{el} [6] N/mm²	nom.	180	240	320	300	400	480	-	-	-	-	-
		min.	190	240	340	300	420	480	-	-	-	-	-
8	Proof stress	nom.				-			640	640	720	900	1080
	$R_{p0,2}$ N/mm²	min.				-			640	660	720	940	1100
	Stress under proofing	S_p/R_{el} or $S_p/R_{p0,2}$	0,94	0,94	0,91	0,93	0,90	0,92	0,91	0,91	0,90	0,88	0,88
	load, S_p	N/mm²	180	225	310	280	380	440	580	600	650	830	970
10	Elongation after fracture A in %	min.	25	22	14	20	10	8	12	12	10	9	8
11	Strength under wedge loading		The values for full size bolts and screws (not studs) shall not be smaller than the minimum values for tensile strength shown in 5.2										
12	Impact strength, J	min.				25			30	30	25	20	15
13	Head soundness		no fracture										
	Minimum height of non-decarburized thread zone, E					-			½ H_1			⅔ H_1	¾ H_1
14	Maximum depth of complete decarburization, G					-			0,015				

1) For class 8.8 in diameter d 16 mm there is an increased risk of nut stripping in the case of inadvertent over-tightening inducing a load in excess of proofing load. Reference to ISO 898-2 is recommended.
2) For structural bolting the limit is 12 mm.
3) Applies only to nominal thread diameter d 16 mm.
4) Min. tensile properties apply to products of nominal length l 2,5 d. Min. hardness applies to products of l < 2,5 d and other products, which cannot be tensile-tested (e.g. due to head configuration).
5) Surface hardness shall not be more than 30 Vickers points above the measured core hardness on the product when readings of both surface and core are carried out at HV 0,3. For class 10.9 max. surface hardness = 390 HV.
6) In cases where the lower yield stress R_{el} cannot be determined, it is permissible to measure the proof stress $R_{p0,2}$.

Guide for properties at elevated temperatures
(No integral part of the standard)

	+20°C	+100°C	+200°C	+250°C	+300°C
Property class	Lower yield stress, R_{el} or proof stress $R_{p0,2}$ N/mm²				
5.6	300	270	230	215	195
8.8	640	590	540	510	480
10.9	940	875	790	745	705
12.9	1100	1020	925	875	825

4 Marking of bolts, screws and studs

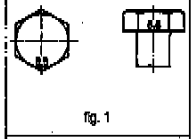

fig. 1

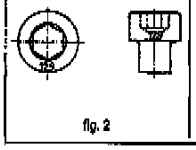

fig. 2

- Marking of all property classes is obligatory for hexagon bolts and screws with nominal diameters d 5 mm, preferably on top of the head (fig. 1).
- Marking of property classes 8.8 is obligatory for hexagon socket head cap screws with nominal diameter d 5 mm, preferably on the top of the head (fig. 2).
- When low carbon martensitic steels are used for class 10.9, the symbol 10.9 shall be underlined: 10.9. (See also page 15-10-5).
- Studs shall be marked for property classes 8.8 and with nominal diameter d 5 mm. For studs with interference fit, the marking shall be at the nut end (fig. 3). Alternative identification with symbols (fig. 4) is permissable.
- Left-hand thread shall be marked for nominal diameters d 5 mm with the symbol shown in figure 5 either on the top of the head or the point.
  Alternative marking, as shown in fig. 6 may be used for hexagon bolts and screws.
- The trade (identification) marking of the manufacturer is mandatory on all products which are marked with property classes.
- For other types of bolts and screws the same marking system shall be used. For special components marking will be as agreed between the interested parties.

fig. 3

Property class	8.8	9.8	10.9	12.9
Identification symbol	○	+	□	

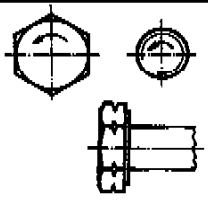
fig. 4
fig. 5
fig. 6