

Grades

from screws, nuts and grub screws

The different materials (steel and stainless steel) have different strength classes. In addition, there are differences in the strength classes of the steel screws, nuts and grub screws.

The listing of material codes is based on ISO 898-1 (for screws), ISO 898-2 (for nuts) and ISO 898-5 (for grub screws).

Strength values for screws

The strength values (grade) for steel screws are expressed by two digits separated by a dot.

The first digit corresponds to one hundredth of the tensile strength R_m in N/mm^2 . The tensile strength indicates the tensile stress at which the screw breaks.

Example of a screw with grade 10.9:

Tensile strength $R_m = \text{first digit} * 100 = 10 N/mm^2 * 100 = 1,000 N/mm^2$

From the second digit, the yield strength R_e or the yield point or equivalent yield strength $R_p 0.2$ of the screw can be determined. The yield strength R_e and the yield point $R_p 0.2$ indicate the maximum stress before the screw deforms plastically. With plastic deformation, the screw is permanently deformed (as compared to elastic deformation where the screw returns to its original shape after the tension is released). The second digit specifies 10 times the ratio between the yield strength R_e or the equivalent yield point $R_p 0.2$ and the tensile strength R_m .

Example of a screw with grade 10.9:

Yield strength $R_e = \text{Tensile strength } R_m \times \text{second digit} \times 0.1 = 1,000 N/mm^2 \times 9 \times 0.1 = 900 N/mm^2$

The elongation at break A indicates the percentage of plastic deformation at break.

Material properties	Grade					
	4.6	5.8	6.8	8.8	10.9	12.9
Tensile strength R_m in N/mm^2	400	500	600	800	1000	1200
Yield strength R_e or yield point $R_p 0.2$ in N/mm^2	240	400	480	640	900	1080
Elongation at fracture A in %	22	10	8	12	9	8

Strength value for nuts

In contrast to screws, the strength class for steel nuts is given by only one code value. This is the test stress S_p . It can be equated with the tensile strength R_m of the screw. Nuts with a two-digit number (e.g. 04) describe thin nuts.

Test stress S_p in N/mm^2		Grade				
over	to	04	6	8	10	12
	M4	380	600	800	1040	1140
M4	M7		670	855	1040	1140
M7	M10		680	870	1040	1140
M10	M16		700	880	1050	1170
M16	M39		720	920	1060	1200

Strength value for grub screws

The steel grub screws are designated with a digit and an H at the end. The digit here indicates a tenth of the Vickers hardness HV min. The H stands for hardness

Example of a grub screw with a grade 45H:

Vickers hardness = $45 \text{ HV} \times 10 = 450 \text{ HV}$

That corresponds to a tensile strength R_m of $1,455 \text{ N/mm}^2$.

Strength value for stainless steel

The stainless steel specifications are uniformly formatted for screws, nuts and grub screws.

The first letter indicates the steel structure.

Example for stainless steel A2-70:

The A stands for austenitic (F stands for ferritic).

The first number describes the steel group and the associated material characteristics.

Example for stainless steel A2-70:

With A2-70, the stainless steel is alloyed with chromium and nickel (different to A4 stainless steel which is alloyed with chromium, nickel and molybdenum).

The number after the hyphen indicates 0.1 times the tensile strength R_m .

Example for stainless steel A2-70:

Tensile strength $R_m = \text{number behind the hyphen} \times 10 = 70 \text{ N/mm}^2 \times 10 = 700 \text{ N/mm}^2$

Material properties	Grade			
	A2-50	A2-70	A4-50	A4-70
Tensile strength R_m in N/mm^2	400	500	600	800
Yield strength R_e or yield point $R_p 0.2$ in N/mm^2	240	400	480	640
Elongation at fracture A in %	22	10	8	12