

SCREWS AND STUDS (REV. 2) ISO 898-1: 2009

The symbol of resistance class (e.g. 8.8) is composed of two numbers. The first one represents tensile strength divided by 100
 e.g. R 800 N/mm²: 100 = 8, the second one represents ratio between yield and tensile strength multiplied by 10
 e.g. Rp 0.2 640 N/mm²: 800 N/mm² = 0.8 x 10 = 8

RESISTANCE CLASS	MATERIAL AND HEAT TREATMENT	CHEMICAL COMPOSITION					TEMPERING TEMPERATURE MIN. °C
		C%		P%	S%	B% ^b	
		min	max	max	max	max	
4.6 ^d	Carbon steel or carbon steel with additives	-	0.55	0.05	0.06	Not specified	-
4.8 ^d		-	0.55	0.05	0.06		-
5.6		0.13	0.55	0.05	0.06		-
5.8 ^d		-	0.55	0.05	0.06		-
6.8 ^d		0.15	0.55	0.05	0.06		-
8.8 ^f	Carbon steel with additives (B, Mn, Cr) +QT	0.15 ^e	0.40	0.025	0.025	0.003	425
	Carbon steel +QT	0.25	0.55	0.025	0.025	0.003	425
	Alloyed steel +QT	0.20	0.55	0.025	0.025	0.003	425
9.8 ^f	Carbon steel with additives (B, Mn, Cr) +QT	0.15 ^e	0.40	0.025	0.025	0.003	425
	Carbon steel +QT	0.25	0.55	0.025	0.025	0.003	425
	Alloyed steel +QT	0.20	0.55	0.025	0.025	0.003	425
10.9 ^f	Carbon steel with additives (B, Mn, Cr) +QT	0.20 ^e	0.55	0.025	0.025	0.003	425
	Carbon steel +QT	0.25	0.55	0.025	0.025	0.003	425
	Alloyed steel +QT	0.20	0.55	0.025	0.025	0.003	425
12.9 ^f	Alloyed steel +QT	0.30	0.50	0.025	0.025	0.003	425
<u>12.9</u> ^f	Carbon steel with additives (B, Mn, Cr, Mo) +QT	0.28	0.50	0.025	0.025	0.003	380

+QT = quenched and tempered material

^b Boron content can reach 0,005% provided that non-effective boron is controlled by the addition of titanium or aluminium.

^d Free-cutting steel is accepted for these resistance classes if the following max values are respected: S% 0.34, P% 0.11, Pb% 0.35

^e Carbon boron-alloyed steel with carbon content lower than 0,25 % should have a min manganese content of 0,6 % for class 8.8 and of 0,7 % for classes 9.8 and 10.9

^f The materials belonging to these classes should have sufficient hardenability, so that to obtain a structure consisting of about 90 % of martensite in the "as-hardened" condition before tempering.

RESISTANCE CLASS	BOLTS AND SCREWS OBTAINED FROM	FOR Ø AND MECHANICAL PROPERTIES SEE	STEEL GRADES BY LUCEFIN GROUP
4.6	machining	EN 10025-2 / ASTM	S355J2 - A 105 - A350
4.8		EN 10087 EN 10084 / EN 10083-2	11SMn30 - 11SMnPb30 - C15E - C22E - C35B
5.6			35SPb20
5.8		EN 10087	36SMnPb14 - 46S20 - 46SPb20
6.8			23MnB5 - 30MnB5 - 41Cr4 - 34CrMo4 - 42CrMo4
8.8		EN 10263-4 EN 10083-3	27MnCrB5 - 30MnB45 - 38MnB5 - 42CrMo4
9.8			32CrB4 - 42CrMo4 - 39NiCrMo3 - 30CrNiMo8
10.9			30CrNiMo8 - 36NiCrMo16 - 51CrV4
12.9			30CrNiMo8 - 36NiCrMo16 - 51CrV4
<u>12.9</u>			

For classes 8.8 and 12.9, quenching and tempering heat treatment is required.
 The reported steel grades are usually used prior agreements between producer and consumer.

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		TENSILE STRENGTH Rm N / mm ²												
		400	500	600	700	800	900	1000	1100	1200	1300			
MIN. A% AFTER FAILURE	8											12.9 / 12.9		
	9								10.9					
	10							9.8						
	12			6.8		8.8								
			4.8	5.8										
	20			5.6										
	22		4.6											

NOTE m) on request, the value has to be agreed while placing the order.				RESISTANCE CLASSES (MECHANICAL PROPERTIES AT ROOM TEMPERATURE)									
				4.6	4.8	5.6	5.8	6.8	8.8		9.8	10.9	12.9
									d ≤ 16	d > 16	d ≤ 16		12.9
Tensile strength	Rm	N/mm ²	min	400	420	500	520	600	800	830	900	1040	1220
Yield strength	Re	N/mm ²	min	240	340	300	420	480	-	-	-	-	-
0,2% yield strength	Rp _{0.2}	N/mm ²	min	-	-	-	-	-	640	660	720	940	1100
Ultimate elongation	A	%	min	22	24	20	22	20	12	12	10	9	8
Reduction after breaking	Z	%	min	-	-	-	-	-	52	52	48	48	44
Impact strength ^{Kv}	Kv	J	min	-	-	27	-	-	27	27	27	27	m)
Brinell Hardness	HBW	-	min	114	124	147	152	181	238	242	276	304	366
Brinell Hardness	HBW	-	max	209	209	209	209	238	304	318	342	361	414
Vickers Hardness	HV ₁₀	-	min	120	130	155	160	190	250	255	290	320	385
Vickers Hardness	HV ₁₀	-	max	220	220	220	220	250	320	335	360	380	435

When connection parts are used at temperatures different from room temperature, users must be sure that mechanical and physical properties are adequate to the specific service conditions for e.g.

^{Kv} Kv at -20 °C for diameters > 16 mm must be agreed between manufacturer and purchaser.

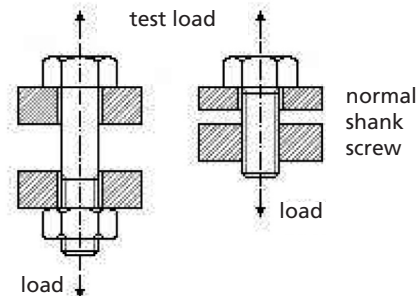
STEEL GRADES SUGGESTED BY LUCIFIN GROUP FOR CLASS 8.8

C45E	+QT	Ø < 24 mm
41Cr4	+QT	Ø > 24 e < 50 mm
42CrMo4	+QT	Ø > 50 e < 100 mm
39NiCrMo3	+QT	Ø > 100 mm

HIGH TEMPERATURE YIELD STRENGTH Rp_{0.2} N/mm²

CLASS	TEMPERATURE °C				
	+ 20	+ 100	+ 200	+ 250	+ 300
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

Values must be used only as a reference.
e.g. 100h at 300 °C can cause a permanent 25% reduction on the initial torqued screw load, with consequent yield strength decrease.



DECARBURIZATION ON THREADS SCREW

- G total decarburization
- 1 partial decarburization
- 2 base metal
- E non-decarburized area
- H1 thread depth
- 3 average diameter

TOTAL DECARBURIZATION MAX DEPTH FOR CLASSES

from 8.8 to 12.9 G = 0.015 mm

