

EN ISO 898-1 (2013)

MECHANICAL PROPERTIES OF BOLTS SCREWS AND STUDS (extract)

7 Mechanical and physical properties

The bolts, screws and studs of the specified property classes shall, at ambient temperature²⁾, meet all the applicable mechanical and physical properties in accordance with Tables 3 to 7, regardless of which tests are performed during manufacturing or final inspection.

Clause 8 sets forth the applicability of test methods for verifying that fasteners of different types and dimensions fulfill the properties in accordance with Table 3 and Tables 4 to 7.

NOTE 1: Even if the steel properties of the fasteners meet all relevant requirements specified in Tables 2 and 3, some types of fasteners have reduced loadability due to dimensional reasons (see 8.2, 9.4 and 9.5)

NOTE 2: Although a great number of property classes are specified in this part of ISO 898, this does not mean that all classes are appropriate for all fasteners. Further guidance for application of the specific property classes is given in the relevant product standards. For non-standard fasteners, it is advisable to follow as closely as possible the choice already made for similar standard fasteners.

Table 3 - Mechanical and physical properties of bolts, screws and studs

n.	Mechanical or physical property	4.6	4.8	5.6	5.8	6.8	8.8		9.8	10.9	12.9		
							$d_s \leq 16 \text{ mm}^a$	$d_s > 16 \text{ mm}^b$	$d_s \leq 16 \text{ mm}$				
1	Tensile Strength, R_m , MPa	nom. ^c	400		500		600		800		900	1000	1200
		min.	400	420	500	520	600	800	830	900	1040	1220	
2	Lower yield strength, R_{eL}^d , MPa	nom. ^c	240	-	300	-	-	-	-	-	-	-	
		min.	240	-	300	-	-	-	-	-	-	-	
3	Stress at 0,2% non-proportional elongation, $R_{p0,2}$, MPa	nom. ^c	-	-	-	-	-	640	640	720	900	1080	
		min.	-	-	-	-	-	640	660	720	940	1100	
4	Stress at 0,0048 d non-proportional elongation for full-size fasteners, R_{pf} , MPa	nom. ^c	-	320	-	400	480	-	-	-	-	-	
		min.	-	340 ^e	-	420 ^e	480 ^e	-	-	-	-	-	
5	Stress under proof load, S_p^f , MPa	nom.	225	310	280	380	440	580	600	650	830	970	
		Proof strength ratio $\frac{S_{p,nom} R_{eL, min}}{S_{p,nom} R_{p0,2min}}$ $\frac{S_{p,nom} R_{pf, min}}{S_{p,nom} R_{pf, min}}$	0,94	0,91	0,93	0,90	0,92	0,91	0,91	0,90	0,88	0,88	
6	Percentage elongation after fracture for machined test pieces, A_f , %	min.	22	-	20	-	-	12	12	10	9	8	
7	Percentage reduction of area after fracture for machined test pieces, Z , %	min.	-				52		48		44		
8	Elongation after fracture for full-size fasteners, A_f (see also Annex C)	min.	-	0,24	-	0,22	0,20	-	-	-	-	-	
9	Head soundness	No fracture											

Table 3 (continued)

n.	Mechanical or physical properties		4.6	4.8	5.6	5.8	6.8	8.8		9.8	10.9	12.9
								$d \leq 16 \text{ mm}^a$	$d > 16 \text{ mm}^b$	$d \leq 16 \text{ mm}$		
10	Vickers hardness, HV $F \geq 98 \text{ N}$	min.	120	130	155	160	190	250	255	290	320	385
		max.	220 ^g				250	320	335	360	380	435
11	Brinnell hardness, HBW $F = 30 D^2$	min.	114	124	147	152	181	245	250	286	316	380
		max.	209 ^g				238	316	331	355	375	429
12	Rockwell hardness, HRB	min.	67	71	79	82	89	-				
		max.	95,0 ^g				99,5	-				
	Rockwell hardness, HRC	min.	-				22	23	28	32	39	
		max.	-				32	34	37	39	44	
13	Surface hardness, HV 0,3	max.	-				-			390	435	
14	Non-carburization, HV 0,3	max.	-				h					
15	Height of non-decarburized thread zone, E , mm	min.	-				$\frac{1}{2} H_1$			$\frac{2}{3} H_1$	$\frac{3}{4} H_1$	
	Depth of complete decarburization in the thread, G , mm	max.	-				0,015					
16	Reduction of hardness after retempering, HV	max.	-				20					
17	Breaking torque, M_B , Nm	min.	-				in accordance with ISO 898-7					
18	Impact strength, K_V ^{i,j} , J	min.	-	27	-		27				K	
19	Surface integrity in accordance with		ISO 6157-1 ^l									ISO 6157-3
a	Values do not apply to structural bolting.											
b	For structural bolting $d \geq M12$.											
c	Nominal values are specified only for the purpose of the designation system for property classes. See Clause 5.											
d	In cases where the lower yield strength R_{eL} cannot be determined, it is permissible to measure the stress at 0,2% non-proportional elongation $R_{p0,2}$.											
e	For the property classes 4.8, 5.8 and 6.8, the values for $R_{pf,min}$ are under investigation. The values at the time of publication of this part of ISO 898 are given for calculation of the proof stress ratio only. They are not test values.											
f	Proof loads are specified in Tables 5 and 7.											
g	Hardness determined at the end of a fastener shall be 250 HV, 238 HB or 99,5 HRB maximum.											
h	Surface hardness shall not be more than 30 Vickers points above the measured base metal hardness of the fastener when determination of both surface hardness and base metal hardness are carried out with HV 0,3 (see 9.11).											
i	Values are determined at a test temperature of -20°C (see 9.14).											
j	Applies to $d \geq 16 \text{ mm}$.											
k	Value for K_V is under investigation.											
l	Instead of ISO 6157-1, ISO 6157-3 may apply by agreement between the manufacturer and the purchaser.											