

MECHANICAL PROPERTIES OF BOLTS, SCREWS AND STUDS ACCORDING TO ISO 898/1-1978(E)

Sub-clause No.	Mechanical property	Property class												
		3.6	4.6	4.8	5.6	5.8	6.8	8.8	M16 ¹⁾	M16 ¹⁾	9.8 ²⁾	10.9	12.9	
5.1 and 5.2	Tensile strength, R_m , N/mm ²	nominal	300	400	500	600	800	800	900	1 000	1 200			
		min.	330	400	420	500	520	600	830	830	900	1 040	1 220	
5.3	Vickers hardness ³⁾ , HV, F · 98 N	min.	95	120	130	155	160	190	230	255	280	310	372	
		max.	220				250	300	336	360	382	434		
5.4	Brinell hardness ³⁾ , HB, F · 30 D ²	min.	90	114	124	147	152	181	219	242	266	295	353	
		max.	209				238	285	319	342	363	412		
5.5	Rockwell hardness ³⁾ , HR	min.	HRB	52	67	71	79	82	89	-	-	-	-	
			HRC	-	-	-	-	-	-	20	23	27	31	38
		max.	HRB	95				99	-	-	-	-	-	-
			HRC	-	-	-	-	-	30	34	36	39	44	
5.6	Surface hardness, HV 0.3	max.												
5.7	Yield stress ⁴⁾ , R_{eL} , N/mm ²	nominal	180	240	320	300	400	480						
		min.	190	240	340	300	420	480						
5.8	Stress at permanent set limit, $R_{p0.2}$, N/mm ²	nominal	-				640	640	720	900	1 080			
		min.	-				640	660	720	940	1 100			
5.9	Stress under proof load, S_p	S_p/R_{eL} or $R_{p0.2}$	0.94	0.94	0.91	0.94	0.91	0.91	0.91	0.91	0.88	0.88	0.88	
		N/mm ²	180	225	310	280	380	440	580	600	650	830	970	
5.10	Elongation after fracture, A_5 , %	min.	25	22	14	20	10	8	12	12	13	9	8	
5.11	Strength under wedge loading	The values for full size bolts and screws (not studs) should equal the minimum values for tensile strength shown in 5.2												
5.12	Impact strength, J	min.	25				30	30	25	20	15			
5.13	Head soundness	no fracture												
5.14	Minimum height of non-decarburized thread zone, f							$\frac{1}{2}M_1$	$\frac{2}{3}M_1$	$\frac{3}{4}M_1$				
	Maximum depth of complete decarburization, G	mm						0.015						

COMPARISON N/mm² to psi

PROPERTY CLASS	min. TENSILE STRENGTH Rm	
	In N/mm ²	In psi
4.6	400	58000
4.8	420	60900
5.6	500	72500
5.8	520	75400
8.8		
< M16	800	116000
> M16	830	120350
9.8	900	130500
10.9	1040	150800
12.9	1220	176900

(1 N/mm² = 145 psi)

- 1) For structural bolting - M12
- 2) Applies only to sizes up to 16 mm thread diameter.
- 3) Hardness values calculated on ISO/TC 17/SC6 N 357.
- 4) In a case where the yield stress, R_{eL} , cannot be determined, it is permissible to measure the stress at permanent set limit, $R_{p0.2}$.

MECHANICAL PROPERTIES OF NUTS (COARSE THREAD) ACCORDING TO ISO 898/2-1980 (E)

Nominal size (thread diameter) mm	Property class												
	04		05				4		5		6		
	Proof stress σ_p	Vickers hardness HV	Proof stress σ_p	Vickers hardness HV	Proof stress σ_p	Vickers hardness HV	Proof stress σ_p	Vickers hardness HV	Proof stress σ_p	Vickers hardness HV	Proof stress σ_p	Vickers hardness HV	
over	10	N/mm ²	min	max	N/mm ²	min	max	N/mm ²	min	max	N/mm ²	min	max
4	4							520			600		
4	7							580			670		
7	10	380	188	302	500	272	353	590	130		680	150	302
10	16							610		302	700		
16	29							510			720	170	
39	100							117	302		146	170	
											128	142	

Nominal size (thread diameter) mm	Property class												
	8		9				10		12				
	Proof stress σ_p	Vickers hardness HV	Proof stress σ_p	Vickers hardness HV	Proof stress σ_p	Vickers hardness HV	Proof stress σ_p	Vickers hardness HV	Proof stress σ_p	Vickers hardness HV	Proof stress σ_p	Vickers hardness HV	
over	10	N/mm ²	min	max	N/mm ²	min	max	N/mm ²	min	max	N/mm ²	min	max
4	4	800	170		900	270		1 040			1 150		
4	7	810			915			1 040			1 150		
7	10	830	188	302	940	188	302	1 040			1 160	295 ¹⁾	353
10	16	840			950			1 050	272	353	1 150		
16	29	920	233		920			1 060			1 200		
39	100		207	353									

- 1) Nuts style 1 (ISO 4032)
 - 2) Nuts style 2 (ISO 4033)
- NOTE Minimum hardness is mandatory only when nuts cannot be proof load tested, or of heat treated nuts. For all other nuts minimum hardness is provided for guidance only.
- Hardness values for nominal sizes (thread diameters) over 39 up to and including 100 mm are to be used for information and guidance only.