

Marking and mechanical requirements for nuts of steel

Table 25 Nuts in mm

(CLOCK MARKING)

Property class	04	05	4	5	6	8	9	10	12
Marking									
Example of marking									

Nuts should be manufactured from steel with the chemical composition according to table 5.

Table 5 Chemical composition

Property class			Chemical composition (check analysis), %			
			C max.	Mn min.	P max.	S max.
4 ¹⁾	5 ¹⁾	6 ¹⁾	—	0,50	—	0,060
8	9	04 ¹⁾	0,58	0,25	0,060	0,150
	10 ²⁾	05 ¹⁾	0,58	0,30	0,048	0,058
	12 ²⁾	—	0,58	0,45	0,048	0,058

1) Nuts in these property classes are possible to manufacture from free cutting steel if nothing else has been agreed between manufacturer and customer. In these cases the following max. proportions of sulphur, phosphorus and lead are allowed: Sulphur 0,34%, phosphorus 0,11% and lead 0,35%.

2) Alloy material can be added if it is necessary to achieve strength requirements.

Nuts with nominal heights $\geq 0,8 D$ (effective lengths of thread $\geq 0,6 D$)

Nuts with nominal heights $\geq 0,8 D$ (effective lengths of thread $\geq 0,6 D$) are designated by a number to indicate the maximum appropriate property class of bolts with which they may be mated.

It would therefore be desirable to design threaded connections so that their mode of failure would always be by shank fracture but, unfortunately, because of the many variables which govern stripping strength (nut and bolt material strengths, thread clearances, across-flats dimensions, etc.), nuts would have to be objectionably thick to guarantee this mode in all cases.

A bolt or screw of thread M5 to M39 assembled with a nut of the appropriate property class, in accordance with table 84, is intended to provide an assembly capable of being tightened to the bolt proof load without thread stripping occurring.

Nuts with nominal heights $\geq 0,5 D$ but $< 0,8 D$ (effective heights of thread) $\geq 0,4 D$ but $< 0,6 D$

Nuts with nominal heights $\geq 0,5 D$ but $< 0,8 D$ (effective height of thread $\geq 0,4 D$ but $< 0,6 D$) are designated by a combination of two numbers. A guide for minimum expected stripping strengths of the joints when these nuts are assembled with bolts of various property classes is shown in table 186.

Table 82 Heights of hexagon nuts

Thread	Width across flats mm	Nut height					
		Style 1			Style 2		
		min. mm	max. mm	m/D	min. mm	max. mm	m/D
M 5	8	4,4	4,7	0,94	4,8	5,1	1,02
M 6	10	4,9	5,2	0,87	5,4	5,7	0,95
M 7	11	6,14	6,5	0,93	6,84	7,2	1,03
M 8	13	6,44	6,8	0,85	7,14	7,5	0,94
M 10	16	8,04	8,4	0,84	8,94	9,3	0,93
M 12	18	10,37	10,8	0,90	11,57	12	1,00
M 14	21	12,1	12,8	0,91	13,4	14,1	1,01
M 16	24	14,1	14,8	0,92	15,7	16,4	1,02
M 18	27	15,1	15,8	0,88	16,9	17,6	0,98
M 20	30	16,9	18	0,90	19	20,3	1,02
M 22	34	18,1	19,4	0,88	20,5	21,8	0,93
M 24	36	20,2	21,5	0,90	22,6	23,9	1,00
M 27	41	22,5	23,8	0,88	25,4	26,7	0,99
M 30	46	24,3	25,6	0,85	27,3	28,6	0,95
M 33	50	27,4	28,7	0,87	30,9	32,5	0,98
M 36	55	29,4	31	0,86	33,1	34,7	0,96
M 39	60	31,8	33,4	0,86	35,9	37,5	0,96

Table 83 Performance and property classes for nuts

Nut	Property class	Size		State
		above	up to	
Style 1	4	M16	M39	Not tempered
	5	—	M39	Not tempered
	6	—	M39	Not tempered
	8	—	M16	Not tempered
		M16	M39	Tempered
	10	—	M39	Tempered
Style 2	12	—	M16	Tempered
	8	M16	M39	Not tempered
	9	—	M16	Not tempered
	12	—	M39	Tempered

Table 84 Nuts with nominal height $\geq 0,8 D$ (ISO metric coarse thread)

Nut property class	Mating bolts		Nuts	
	Property class	Nominal diameter	Style 1	Style 2
4	3.6; 4.6; 4.8	$d > 16$	$d > 16$	—
5	3.6; 4.6; 4.8	$d \leq 16$	$d \leq 39$	—
	5.6; 5.8	$d \leq 39$		
6	6.8	$d \leq 39$	$d \leq 39$	—
8	8.8	$d \leq 39$	$d \leq 39$	$d > 16$ $d \leq 39$
9	9.8	$d \leq 16$	—	$d \leq 16$
10	10.9	$d \leq 39$	$d \leq 39$	—
12	12.9	$d \leq 39$	$d \leq 16$	$d \leq 39$

Generally nuts in higher property classes can replace nuts in lower property classes. This is recommended for screw-nut joints that will be loaded beyond yield stress or test tension.

Source: ISO 898-2.

Table 85 Nuts with nominal height $\geq 0,8 D$ (ISO metric fine thread)

Nut property class	Mating bolts		Nuts	
	Property class	Nominal diameter	Style 1	Style 2
5	3.6; 4.6; 4.8 5.6; 5.8	$d \leq 39$	$d \leq 39$	—
6	6.8	$d \leq 39$	$d \leq 39$	—
8	8.8	$d \leq 39$	$d \leq 39$	$d \leq 16$
10	10.9	$d \leq 39$	$d \leq 16$	$d \leq 39$
12	12.9	$d \leq 16$	—	$d \leq 16$

Source: ISO 898-6.

Table 185 Designation system and stresses under proof load for nuts with nominal heights $\geq 0,5 D$ but $< 0,8 D$

Property class of nut	Nominal stress under proof load N/mm ²	Actual stress under proof load N/mm ²
04	400	380
05	500	500

Source: ISO 898-2.

Table 186 Minimum bolt stress when stripping occurs

Property class of the nut	Proof load stress of the nut N/mm ²	Minimum stress in the core of bolt when stripping occurs N/mm ² for bolts with property class			
		6.8	8.8	10.9	12.9
04	380	260	300	330	350
05	500	290	370	410	480

Table 12 Mechanical properties nuts (coarse thread)

Nominal size (thread diameter)		Property class														
mm		04					05					4				
		Stress under proof load Sp	Vickers hardness HV		Nut		Stress under proof load Sp	Vickers hardness HV		Nut		Stress under proof load Sp	Vickers hardness HV		Nut	
Above	up to	N/mm ²	min.	max.	state	style	N/mm ²	min.	max.	state	style	N/mm ²	min.	max.	state	style
—	M4	380	188	302	NQT ¹⁾	thin	500	272	353	QT ²⁾	thin	—	—	—	—	—
M4	M7															
M7	M10															
M10	M16															
M16	M39															
		510	117	302	NQT ¹⁾	I										

Nominal size (thread diameter)		Property class																			
mm		5 ³⁾					6					8									
		Stress under proof load Sp	Vickers hardness HV		Nut		Stress under proof load Sp	Vickers hardness HV		Nut		Stress under proof load Sp	Vickers hardness HV		Nut						
Above	up to	N/mm ²	min.	max.	state	style	N/mm ²	min.	max.	state	style	N/mm ²	min.	max.	state	style					
—	M4	520	130	302	NQT ¹⁾	I	600	150	302	NQT ¹⁾	I	800	180	302	NQT ¹⁾	I	—	—	—	—	—
M4	M7	580					670					855	200								
M7	M10	590					680					870									
M10	M16	610					700					880									
M16	M39	630					720					920	233								
		146																			

Nominal size (thread diameter)		Property class																			
mm		9 ³⁾					10					12									
		Stress under proof load Sp	Vickers hardness HV		Nut		Stress under proof load Sp	Vickers hardness HV		Nut		Stress under proof load Sp	Vickers hardness HV		Nut						
Above	up to	N/mm ²	min.	max.	state	style	N/mm ²	min.	max.	state	style	N/mm ²	min.	max.	state	style					
—	M4	900	170	302	NQT ¹⁾	2	1040	272	353	QT ²⁾	I	1140	295	353	QT ²⁾	I	1150	272	353	QT ²⁾	2
M4	M7	915	1040				1140					1150									
M7	M10	940	1040				1140					1160									
M10	M16	950	1050				1170					1190									
M16	M39	920	1060				—					—					—				

1) NQT = Not quenched or tempered.

2) QT = Quenched and tempered.

3) The maximum bolt hardness of property classes 5.6 and 5.8 is 220 HV. This is the maximum bolt hardness in the thread engagement area whereas only the thread end or the head may have a maximum hardness of 250 HV. Therefore the values of stress under proof load are based on a maximum bolt hardness of 220 HV.

Note - Minimum hardness is mandatory only for heat-treated nuts and nuts too large to be proof-load tested. For all other nuts, minimum hardness is not mandatory but is provided for guidance only. For nuts which are not hardened and tempered, and which satisfy the proof-load test, minimum hardness shall not be cause for rejection.

Source: SS-ISO 898-2.