

Mechanical properties of nuts with ISO metric threads (coarse)

according to ISO 898, part 2

Property class		Thread-Ø					
		to M4	> M4 to M7	> M7 to M10	> M10 to M16	> M16 to M39	
04	Stress under proof load, S_p , [N/mm ²]		380	380	380	380	380
	Vickers hardness HV	min.	188	188	188	188	188
		max.	302	302	302	302	302
05	Stress under proof load, S_p , [N/mm ²]		500	500	500	500	500
	Vickers hardness HV	min.	272	272	272	272	272
		max.	353	353	353	353	353
4	Stress under proof load, S_p , [N/mm ²]		–	–	–	–	510
	Vickers hardness HV	min.	–	–	–	–	117
		max.	–	–	–	–	302
5	Stress under proof load, S_p , [N/mm ²]		520	580	590	610	630
	Vickers hardness HV	min.	130	130	130	130	146
		max.	302	302	302	302	302
6	Stress under proof load, S_p , [N/mm ²]		600	670	680	700	720
	Vickers hardness HV	min.	150	150	150	150	170
		max.	302	302	302	302	302
8 ³⁾	Stress under proof load, S_p , [N/mm ²]		800	855	870	880	920
	Vickers hardness HV	min.	180	200	200	200	233
		max.	302	302	302	302	353
9	Stress under proof load, S_p , [N/mm ²]		900	915	940	950	920
	Vickers hardness HV	min.	170	188	188	188	188
		max.	302	302	302	302	302
10	Stress under proof load, S_p , [N/mm ²]		1040	1040	1040	1050	1060
	Vickers hardness HV	min.	272	272	272	272	272
		max.	353	353	353	353	353
12 ¹⁾	Stress under proof load, S_p , [N/mm ²]		1140	1140	1140	1170	–
	Vickers hardness HV	min.	295	295	295	295	–
		max.	353	353	353	353	–
12 ²⁾	Stress under proof load, S_p , [N/mm ²]		1150	1150	1160	1190	1200
	Vickers hardness HV	min.	272	272	272	272	272
		max.	353	353	353	353	353

¹⁾ Nuts style 1 (ISO 4032) $\approx 0,9 d$ nuts

²⁾ Nuts style 2 (ISO 4033) $\approx 1,0 d$ nuts

³⁾ Class 8 \leq M16 only type 1 (not heat-treated)

> M16 type 1 (hardened and tempered) and type 2 (not heat-treated)

Notes

- The minimum hardness values are binding only for nuts for which a test stress measurement can not be performed and for heat treated nuts. The minimum values are guidelines for all other nuts.
- The minimum hardness values for nuts with nominal thread diameters above 39 and to 100 mm are for information only and are considered reference values.

The mechanical properties as listed apply to heat-treated nuts:

Property class	Nuts	Thread
05 to 8	Type1	metric ISO thread > M16
05 to 8	Type1	fine pitch thread
10 and 12	–	metric ISO thread fine pitch thread

Designation system and stress under proof load for nuts with height $\geq 0,5 d$, but $< 0,8 d$

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The standard values for strip resistance relate to the given bolt classes. The exterior thread may be expected to strip if the nuts are paired with screws of lower property classes, while the thread of the nut will strip if it is paired with screws of higher property classes.

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

Test loads for nuts

according to ISO 898, part 2

Thread ¹⁾	Nominal stress area of the material A _S [mm ²]	Test load (A _S × S _p), [N]										
		Property class										
		04	05	4	5	6	8	9	10	12		
		–	–	Style 1	Style 1	Style 1	Style 1	Style 2	Style 2	Style 2	Style 2	Style 2
M3	5,03	1910	2500	–	2600	3000	4000	–	4500	5200	5700	5800
M3,5	6,78	2580	3400	–	3550	4050	5400	–	6100	7050	7700	7800
M4	8,78	3340	4400	–	4550	5250	7000	–	7900	9150	10000	10100
M5	14,2	5400	7100	–	8250	9500	12140	–	13000	14800	16200	16300
M6	20,1	7640	10000	–	11700	13500	17200	–	18400	20900	22900	23100
M7	28,9	11000	14500	–	16800	19400	24700	–	26400	30100	32900	33200
M8	36,6	13900	18300	–	21600	24900	31800	–	34400	38100	41700	42500
M10	58,0	22000	29000	–	34200	39400	50500	–	54500	60300	66100	67300
M12	84,3	32000	42200	–	51400	59000	74200	–	80100	88500	98600	100300
M14	115	43700	57500	–	70200	80500	101200	–	109300	120800	134600	136900
M16	157	59700	78500	–	95800	109900	138200	–	149200	164900	183700	186800
M18	192	73000	96000	97900	121000	138200	176600	170900	176600	203500	–	230400
M20	245	93100	122500	125000	154000	176400	225400	218100	225400	259700	–	294000
M22	303	115100	151500	154500	190900	218200	278800	269700	278800	321200	–	363600
M24	353	134100	176500	180000	222400	254200	324800	314200	324800	374200	–	423600
M27	459	174400	229500	234100	289200	330500	422300	408500	422300	486500	–	550800
M30	561	213200	280500	286100	353400	403900	516100	499300	516100	594700	–	673200
M33	694	263700	347000	353900	437200	499700	638500	617700	638500	735600	–	832800
M36	817	310500	408500	416700	514700	588200	751600	727100	751600	866000	–	980400
M39	976	370900	488000	497800	614900	702700	897900	868600	897900	1035000	–	1171000

¹⁾ If the description of the thread does not include thread pitch then the reference is to coarse threads (see ISO 261 and ISO 262).

Test loads for nuts 0,8 d

according to DIN 267, part 4

Nuts with test loads above 350 000 N (values highlighted in blue) can be excluded from a test load trial. The buyer and the manufacturer must agree minimum hardnesses for these particular nuts.

Thread ¹⁾	Nominal stress area of the material A_S [mm ²]	Test load ($A_S \times S_p$), [N]					
		Property class (code number)					
		4	5	6	8	10	12
M3	5,03	–	2 500	3 000	4 000	5 000	6 000
M3,5	6,78	–	3 400	4 050	5 400	6 800	8 150
M4	8,78	–	4 400	5 250	7 000	8 750	10 500
M5	14,2	–	7 100	8 500	11 400	14 200	17 000
M6	20,1	–	10 000	12 000	16 000	20 000	24 000
M7	28,9	–	14 500	17 300	23 000	29 000	34 700
M8	36,6	–	18 300	22 000	29 000	36 500	43 000
M10	58,0	–	29 000	35 000	46 000	58 000	69 500
M12	84,3	–	42 100	50 500	67 000	84 000	100 000
M14	115	–	57 500	69 000	92 000	115 000	138 000
M16	157	–	78 500	94 000	126 000	157 000	188 000
M18	192	76 800	96 000	115 000	154 000	192 000	230 000
M20	245	98 000	122 000	147 000	196 000	245 000	294 000
M22	303	121 000	151 000	182 000	242 000	303 000	364 000
M24	353	141 000	176 000	212 000	282 000	353 000	423 000
M27	459	184 000	230 000	276 000	367 000	459 000	550 000
M30	561	224 000	280 000	336 000	448 000	561 000	673 000
M33	694	277 000	347 000	416 000	555 000	694 000	833 000
M36	817	327 000	408 000	490 000	653 000	817 000	980 000
M39	976	390 000	488 000	585 000	780 000	976 000	1 170 000

¹⁾ If the designation of the thread does not indicate thread pitch then the reference is to coarse threads (see DIN 13).

Chemical compositions of nuts

according to ISO 898, part 2

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

¹⁾ Nuts of these property classes may be made from free cutting steel, unless other arrangements have been agreed upon between the buyer and the supplier. When using free cutting steel, the following maximum proportions of sulphur, phosphorus and lead are permitted:
sulphur 0,34 %
phosphorus 0,11 %
lead 0,35 %

²⁾ For these property classes it may be necessary to add alloys in order to achieve the mechanical properties of the nuts.

Note

Nuts of property classes 05, 8 (style 1 above M16 or style 1 fine thread), 10 and 12 must be quenched and tempered.