

Nuts, Property class 04 to 12

Mechanical properties of nuts with ISO metric threads (coarse)

according to ISO 898, part 2

Property class			Thread-Nenn-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 nuts²⁾ Nuts style 2 (ISO 4033) $\approx 1,0$ d nuts³⁾ Class 8 $\leq$ M16 only type 1 (not heat-treated)

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

i 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	Typee1	metric ISO thread > M16
05 to 8	Typee1	fine pitch thread
10 and 12	–	metric ISO thread fine pitch thread

Nuts, Property class 04 to 12

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

according to ISO 898, part 2

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 x 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	10 000	10 100
M5	14,2	5400	7100	–	8250	9500	12 140	–	13 000	14 800	16 200	16 300
M6	20,1	7640	10 000	–	11 700	13 500	17 200	–	18 400	20 900	22 900	23 100
M7	28,9	11 000	14 500	–	16 800	19 400	24 700	–	26 400	30 100	32 900	33 200
M8	36,6	13 900	18 300	–	21 600	24 900	31 800	–	34 400	38 100	41 700	42 500
M10	58,0	22 000	29 000	–	34 200	39 400	50 500	–	54 500	60 300	66 100	67 300
M12	84,3	32 000	42 200	–	51 400	59 000	74 200	–	80 100	88 500	98 600	100 300
M14	115	43 700	57 500	–	70 200	80 500	101 200	–	109 300	120 800	134 600	136 900
M16	157	59 700	78 500	–	95 800	109 900	138 200	–	149 200	164 900	183 700	186 800
M18	192	73 000	96 000	97 900	121 000	138 200	176 600	170 900	176 600	203 500	–	230 400
M20	245	93 100	122 500	125 000	154 000	176 400	225 400	218 100	225 400	259 700	–	294 000
M22	303	115 100	151 500	154 500	190 900	218 200	278 800	269 700	278 800	321 200	–	363 600
M24	353	134 100	176 500	180 000	222 400	254 200	324 800	314 200	324 800	374 200	–	423 600
M27	459	174 400	229 500	234 100	289 200	330 500	422 300	408 500	422 300	486 500	–	550 800
M30	561	213 200	280 500	286 100	353 400	403 900	516 100	499 300	516 100	594 700	–	673 200
M33	694	263 700	347 000	353 900	437 200	499 700	638 500	617 700	638 500	735 600	–	832 800
M36	817	310 500	408 500	416 700	514 700	588 200	751 600	727 100	751 600	866 000	–	980 400
M39	976	370 900	488 000	497 800	614 900	702 700	897 900	868 600	897 900	1 035 000	–	1 171 000

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).

Nuts, Property class 04 to 12

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	–	2500	3000	4000	5000	6000
M3,5	6,78	–	3400	4050	5400	6800	8150
M4	8,78	–	4400	5250	7000	8750	10500
M5	14,2	–	7100	8500	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 max.	Mn min.	P max.	S 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:
sulfur 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.