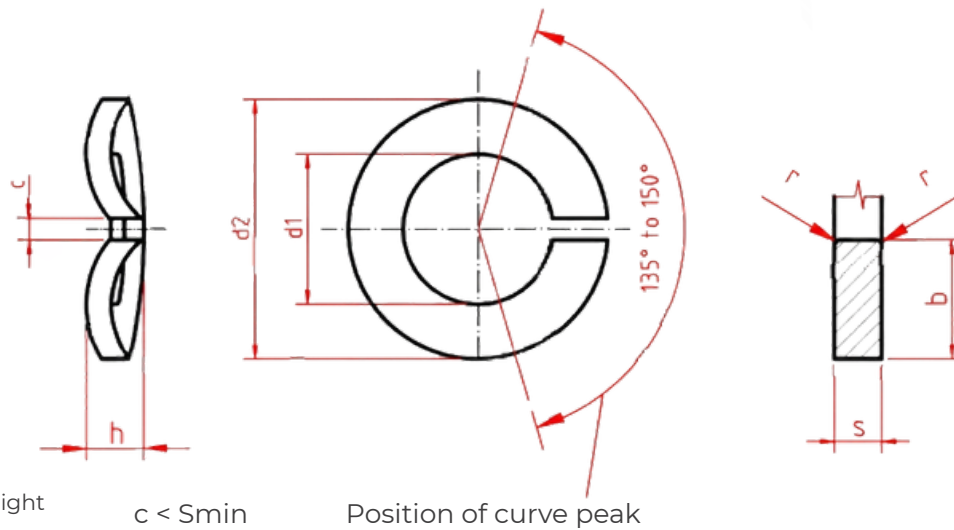


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**Legend:**

- d1 - Inner diameter
- d2 - Outer diameter
- S - Washer width
- h - unload washer height
- r - radius
- b - side length
- c - width of opening

$c < S_{min}$

Position of curve peak

**Notes:**

**TABLE 1: ACCORDING TO DIN 128**

Nominal	For thread	d1 min.	d1 max.	d2 max.	b	s	h min.	h max.	Weight kg /1000pcs
2	M2	2,1	2,4	0,9 ± 0,1	0,5 ± 0,1	0,7	0,9	0,1	0,035
2,5	M2,5	2,6	2,9	1 ± 0,1	0,6 ± 0,1	0,9	1,1	0,1	0,055
3	M3	3,1	3,4	1,3 ± 0,1	0,7 ± 0,1	1,1	1,3	0,1	0,09
3,5	M3,5	3,6	3,9	1,3 ± 0,1	0,7 ± 0,1	1,1	1,3	0,1	0,1
4	M4	4,1	4,4	1,5 ± 0,1	0,8 ± 0,1	1,2	1,4	0,2	0,15
5	M5	5,1	5,4	1,8 ± 0,1	1 ± 0,1	1,5	1,7	0,2	0,3
6	M6	6,1	6,5	2,5 ± 0,15	1,3 ± 0,1	2	2,2	0,3	0,7
7	M7	7,1	7,5	2,5 ± 0,15	1,3 ± 0,1	2	2,2	0,3	0,75
8	M8	8,1	8,5	3 ± 0,15	1,6 ± 0,1	2,45	2,75	0,5	1,3
10	M10	10,2	10,7	3,5 ± 0,2	1,8 ± 0,1	2,85	3,15	0,5	2,1
12	M12	12,2	12,7	4 ± 0,2	2,1 ± 0,15	3,35	3,65	1	3,2
14	M14	14,2	14,7	4,5 ± 0,2	2,4 ± 0,15	3,9	4,3	1	4,8
16	M16	16,2	17	5 ± 0,2	2,8 ± 0,15	4,5	5,1	1	7
16	M16	16,2	17	27,4	5 ± 0,2	3,5 ± 0,2	7	8,3	8,91

**Table 1 (continued)**

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<b>18</b>	M18	18,2	19	5 ± 0,2	2,8 ± 0,15	4,5	5,1	1	7,8
<b>20</b>	M20	20,2	21,2	6 ± 0,2	3,2 ± 0,2	5,1	5,9	1	12,2
<b>22</b>	M22	22,5	23,5	6 ± 0,2	3,2 ± 0,2	5,1	5,9	1	13,3
<b>24</b>	M24	24,5	25,5	7 ± 0,25	4 ± 0,2	6,5	7,5	1,6	21,5
<b>27</b>	M27	27,5	28,5	7 ± 0,25	4 ± 0,2	6,5	7,5	1,6	23,7
<b>30</b>	M30	30,5	31,7	8 ± 0,25	6 ± 0,2	9,5	10,5	1,6	42,5
<b>36</b>	M36	36,5	37,7	10 ± 0,25	6 ± 0,2	10,3	11,3	1,6	68

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## Chemical Composition and Tempering

According to NEN-EN-ISO 898-1:2013 this table specifies limits for the chemical composition of steels and minimum tempering temperatures for the different property classes of bolts, screws and studs. The chemical composition shall be assessed in accordance with the relevant International Standards. For fasteners that have to be hot dip galvanized, the additional material requirements given in ISO 10684 apply.

**TABLE 2: CHEMICAL COMPOSITION AND TEMPERING**

Property class	Material and heat treatment	Chemical composition limit (cast analysis, %) <sup>a</sup>					Tempering temperature °C min
		C min.	C max.	P max.	S max.	B <sup>b</sup> max.	
4.6 <sup>c,d</sup>	Carbon steel or carbon steel with additives	-	0,55	0,050	0,060	Not specified	-
4.8 <sup>d</sup>							
5.6 <sup>d</sup>		0,13	0,55	0,050	0,060		
5.8 <sup>d</sup>		-	0,55	0,050	0,060		
6.8 <sup>d</sup>		0,15	0,55	0,050	0,060		
8.8 <sup>f</sup>	Carbon steel with additives (e.g. Boron or Mn or Cr) quenched and tempered or	0,15 <sup>e</sup>	0,40	11,2	2,4	0,003	425
	Carbon steel quenched and tempered or	0,25	0,55	0,025	0,025		
	Alloy steel quenched and tempered <sup>g</sup>	0,20	0,55	0,025	0,025		
9.8 <sup>f</sup>	Carbon steel with additives (e.g. Boron or Mn or Cr) quenched and tempered or..	0,15 <sup>e</sup>	0,40	0,025	0,025	0,003	425
	Carbon steel quenched and tempered or	0,25	0,55	0,025	0,025		
	Alloy steel quenched and tempered <sup>g</sup>	0,20	0,55	0,025	0,025		
10.9 <sup>f</sup>	Carbon steel with additives (e.g. Boron or Mn or Cr) quenched and tempered or..	0,20 <sup>e</sup>	0,55	0,025	0,025	0,003	425
	Carbon steel quenched and tempered or..	0,25	0,55	0,025	0,025		
	Alloy steel quenched and tempered <sup>g</sup>	0,20	0,55	0,025	0,025		
12.9 <sup>h,i</sup>	Alloy steel quenched and tempered <sup>g</sup>	0,30	0,50	0,025	0,025	0,003	425
12.9 <sup>h,i</sup>	Carbon steel with additives (e.g. Boron or Mn or Cr or Molybdenum) quenched and tempered	0,28	0,50	0,025	0,025	0,003	425

**a)** In case of dispute, the product analysis applies. **b)** Boron content can reach 0,005 %, provided non-effective boron is controlled by the addition of titanium and/or aluminium. **c)** For cold forged fasteners of property classes 4.6 and 5.6, heat treatment of the wire used for cold forging or of the cold forged fastener itself may be necessary to achieve required ductility. **d)** Free cutting steel is allowed for these property classes with the following maximum sulfur, phosphorus and lead contents: S: 0,34 %; P: 0,11 %; Pb: 0,35 %. **e)** In case of plain carbon boron steel with a carbon content below 0,25 % (cast analysis), the minimum manganese content shall be 0,6 % for property class 8.8 and 0,7 % for property classes 9.8 and 10.9. **f)** For the materials of these property classes, there shall be a sufficient hardenability to ensure a structure consisting of approximately 90 % martensite in the core of the threaded sections for the fasteners in the "as-hardened" condition before tempering. **g)** This alloy steel shall contain at least one of the following elements in the minimum quantity given: chromium 0,30 %, nickel 0,30 %, molybdenum 0,20 %, vanadium 0,10 %. Where elements are specified in combinations of two, three or four and have alloy contents less than those given above, the limit value to be applied for steel class determination is 70 % of the sum of the individual limit values specified above for the two, three or four elements concerned. **h)** Fasteners manufactured from phosphated raw material shall be dephosphated before heat treatment; the absence of white phosphorus enriched layer shall be detected by a suitable test method. **i)** Caution is advised when the use of property class 12.9/12.9 is considered. The capability of the fastener manufacturer, the service conditions and the wrenching methods should be considered. Environments can cause stress corrosion cracking of fasteners as processed as well as those coated.





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## Minimum Ultimate Tensile loads

According to NEN-EN-ISO 898-1:2013 the minimum ultimate tensile loads are applicable for coarse pitch thread.

**TABLE 4: MINIMUM ULTIMATE TENSILE LOADS FOR STEEL METRIC COARSE FASTENERS**

Thread <sup>a</sup> <sub>d</sub>	Nominal stress area As,nom <sup>b</sup> mm <sup>2</sup>	Property class								
		4.6	4.8	5.6	5.8	6.8	8.8	9.8	10.9	12.9/12.9
Minimum ultimate tensile load, Fm,min (As,nom × Rm,min), N										
<b>M3</b>	5,03	2 010	2 110	2 510	2 620	3 020	4 020	4 530	5 230	6 140
<b>M3,5</b>	6,78	2 710	2 850	3 390	3 530	4 070	5 420	6 100	7 050	8 270
<b>M4</b>	8,78	3 510	3 690	4 390	4 570	5 270	7 020	7 900	9 130	10 700
<b>M5</b>	14,2	5 680	5 960	7 100	7 380	8 520	11 350	12 800	14 800	17 300
<b>M6</b>	20,1	8 040	8 440	10 000	10 400	12 100	16 100	18 100	20 900	24 500
<b>M7</b>	28,9	11 600	12 100	14 400	15 000	17 300	23 100	26 000	30 100	35 300
<b>M8</b>	36,6	14 600 <sup>c</sup>	15 400	18 300 <sup>c</sup>	19 000	22 000	29 200 <sup>c</sup>	32 900	38 100 <sup>c</sup>	44 600
<b>M10</b>	58	23 200 <sup>c</sup>	24 400	29 000 <sup>c</sup>	30 200	34 800	46 400 <sup>c</sup>	52 200	60 300 <sup>c</sup>	70 800
<b>M12</b>	84,3	33 700	35 400	42 200	43 800	50 600	67 400 <sup>d</sup>	75 900	87 700	103 000
<b>M14</b>	115	46 000	48 300	57 500	59 800	69 000	92 000 <sup>d</sup>	104 000	120 000	140 000
<b>M16</b>	157	62 800	65 900	78 500	81 600	94 000	125 000 <sup>d</sup>	141 000	163 000	192 000
<b>M18</b>	192	76 800	80 600	96 000	99 800	115 000	159 000	—	200 000	234 000
<b>M20</b>	245	98 000	103 000	122 000	127 000	147 000	203 000	—	255 000	299 000
<b>M22</b>	303	121 000	127 000	152 000	158 000	182 000	252 000	—	315 000	370 000
<b>M24</b>	353	141 000	148 000	176 000	184 000	212 000	293 000	—	367 000	431 000
<b>M27</b>	459	184 000	193 000	230 000	239 000	275 000	381 000	—	477 000	560 000
<b>M30</b>	561	224 000	236 000	280 000	292 000	337 000	466 000	—	583 000	684 000
<b>M33</b>	694	278 000	292 000	347 000	361 000	416 000	576 000	—	722 000	847 000
<b>M36</b>	817	327 000	343 000	408 000	425 000	490 000	678 000	—	850 000	997 000
<b>M39</b>	976	390 000	410 000	488 000	508 000	586 000	810 000	—	1 020 000	1 200 000

**a)** Where no thread pitch is indicated in a thread designation, coarse pitch is specified. **b)** To calculate As,nom, see 9.1.6.1. in ISO 898-1:2013 **c)** For fasteners with thread tolerance 6az in accordance with ISO 965-4 subject to hot dip galvanizing, reduced values in accordance with ISO 10684:2004, Annex A, apply. **d)** For structural bolting 70 000 N (for M12), 95 500 N (for M14) and 130 000 N (for M16).

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