Mechanical properties min. 0,2 % yield strength values at increased temperatures

according to DIN EN 10269 (old DIN 17240)

Material abbreviation Name	Material number	Diameter range d [mm]	Tensile strength R_m [N/mm²]	Elongation at facture A_{min} [%]	notch bar impact value K_{Vmin} [J]	Minimum value for the 0,2 % limit $R_{p0,2}$ at [N/mm²] at a temperature [°C] of 20	100	200	300	400	500	600
hardened and tempered steels												
C35E	1.1181	d ≤ 60	500 to 650	22	55	300	270	229	192	173		
35B2	1.5511	d ≤ 60	500 to 650	22	55	300	270	229	192	173		
25CrMo4	1.7218	d ≤ 100	600 to 750	18	60	440	428	412	363	304	235	
42CrMo4	1.7225	d ≤ 60	860 to 1060	14	50	730	702	640	562	475	375	
40CrMoV4-6	1.7711	d ≤ 100	850 to 1000	14	30	700	670	631	593	554	470	293
X22CrMoV12-1	1.4923	d ≤ 160	800 to 950	14	27	600	560	530	480	420	335	
X19CrMoNbVN11-1	1.4913	d ≤ 160	900 to 1050	12	20	750	701	651	627	577	495	305
austenitic steels solution annealed												
X5CrNi18-10	1.4301	d ≤ 35	500 to 700	45	100	190	155	127	110	98	92	
X5CrNiMo17-12-2	1.4401	d ≤ 35	500 to 700	40	100	200	175	145	127	115	110	
X5NiCrTi26-5	1.4980	d ≤ 160	900 to 1150	15	50	600	580	560	540	520	490	430

Value for fasteners made from austenitic stainless steel
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Typical values for the density and static modulus of elasticity

according to DIN EN 10269 (old DIN 17240)

Material abbreviation Name	Material number	Density ρ [kg/dm³]	Static modulus of elasticity E in [kN/mm²] at a temperature [°C] 20	100	200	300	400	500	600
hardened and tempered steels									
C35E	1.1181	7,85	211	204	196	186	177	164	127
40CrMoV4-7	1.7711								
X19CrMoNbVN11-1	1.4913	7,7	216	209	200	190	179	167	127
X22 CrMoV12-1	1.4923								
austenitic steels solution annealed									
X5CrNi18-10	1.4301	7,9	200	194	186	179	172	165	–
X5CrNiMo17-12-2	1.4401	8,0							
X5NiCrTi26-15	1.4980	8,0	211[1]	206[1]	200[1]	192[1]	183[1]	173[1]	162[1]

[1] Dynamic modulus of elasticity

Typical values for the coefficient of thermal expansion, thermal conductivity and heat capacity

according to DIN EN 10269 (old DIN 17240)

Material abbreviation Name	Material number	Coefficient of thermal expansion in 10^{-6}/K between 20 °C and 100 °C	200 °C	300 °C	400 °C	500 °C	600 °C	Thermal conductivity at 20 °C $\left[\frac{W}{m \cdot K}\right]$	Specific thermal conductivity at 20 °C [J/(kg · K)]
hardened and tempered steels									
C35E	1.1181	11,1	12,1	12,9	13,5	13,9	14,1	42	460
40CrMoV4-7	1.7711							33	
austenitic steels solution annealed									
X5CrNi18-10	1.4301	16,0	16,5	17,0	17,5	18,0	n. a.	15	500
X5CrNiMo17-12-2	1.4401								
X5NiCrTi26-15	1.4980	17,0	17,5	17,7	18,0	18,2	n. a.	n. a.	n. a.

n. a. = no data available

Table of materials for temperature over +300 °C

according to DIN 267, part 13

Material abbreviation			
Name	Material number	Marking	Utilisation temperature limits
C35E (N)[1]	1.1181	Y	+350 °C
C35E (QT)	1.1181	YK	+350 °C[2]
35B2	1.5511	YB	+350 °C[2]
24CrMo5	1.7258	G	+400 °C
25CrMo4	1.7218	KG	+550 °C
42CrMo4	1.7225	GC	+500 °C
21CrMoV5-7	1.7709	GA	+550 °C
40CrMoV4-6	1.7711	GB	+520 °C
X22CrMoV12-1	1.4923	V[3], VH[4]	+580 °C
X19CrMoNbVN11-1	1.4913	VW	+580 °C
X7CrNiMoBNb16-16	1.4986	S	+650 °C
X6NiCrTiMoVB25-15-2	1.4980	SD	+650 °C
NiCr20TiAl	2.4952	SB	+700 °C

[1] Applies only to nuts
[2] For nuts the usual upper bound of the temperature in service may be around 50 °C higher.
[3] Symbol V for material with a 0,2 % proof strength $R_{p0,2} \geq 600$ N/mm²
[4] Symbol VH for material with a 0,2 % proof strength $R_{p0,2} \geq 700$ N/mm²

Table of materials for low temperatures from –200 °C to –10 °C

according to DIN 267, part 13

Material abbreviation				
Name	Material number	Marking	Screws	Utilisation temperature limits
25CrMo4	1.7218	KG		–60 °C
X12Ni5	1.5680	KB		–120 °C
X5CrNi18-10	1.4301	A2[1]		–200 °C
X4CrNi18-12	1.4303	A2[1]		–200 °C
X2CrNi18-9	1.4307	A2L[1]		–200 °C
X6CrNiMoTi-17-12-2	1.4571	A5[1]	with head[2]	–60 °C
			without head[2]	–200 °C
X2CrNi17-12-2	1.4404	A4L[1]	with head[2]	–60 °C
			without head[2]	–200 °C

[1] The property class must be added to this marking of austenitic steel grades, e.g. A2-70
Application temperatures down to –200 °C for screw property class 70 and 80, nut property class 80. Lower strengths down to –60 °C.
[2] As a result of the molybdenum content when below the temperature shown these can no longer be expected to have a homogenous austenitic micro-structure.

! Note
At the lower limits of the operation temperature indicated in the table, the impact work of notched bar (K_V) of the material must be at least 40 Joules.

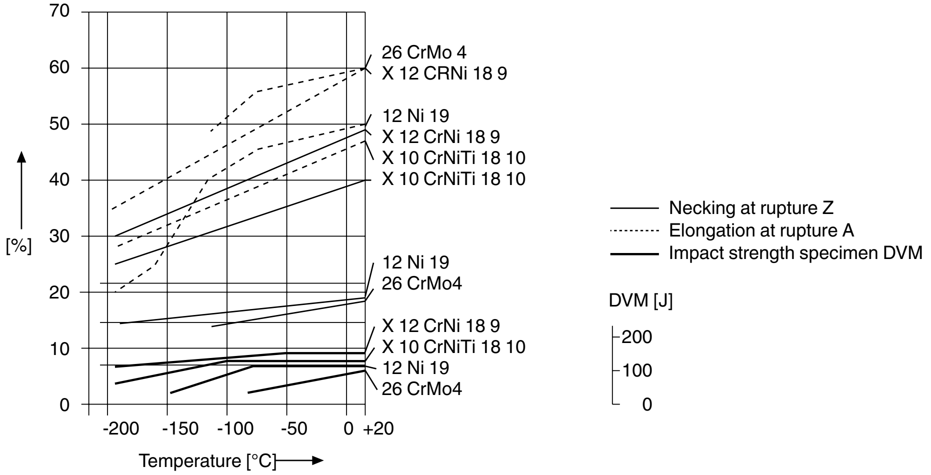
Pairing materials for screws and nuts

according to DIN 267, part 13

Material Screw	Material Nut
C35E (QT), 35B2	C35E (N), C35E (QT), 35B2
25CrMo4, 24CrMo5	C35E (QT), 35B2, 25CrMo4
21CrMoV5-7	25CrMo4, 21CrMoV5-7
40CrMoV47, 42CrMo4	21CrMoV5-7, 42CrMo4
X22CrMoV12-1	X22CrMoV12-1
X19CrMoNbVN11-1	X22CrMoV12-1
X7CrNiMoBNb16-16	X7CrNiMoBNb16-16
X6NiCrTiMoVB25-15-2	X6NiCrTiMoVB25-15-2
NiCr20TiAl	NiCr20TiAl

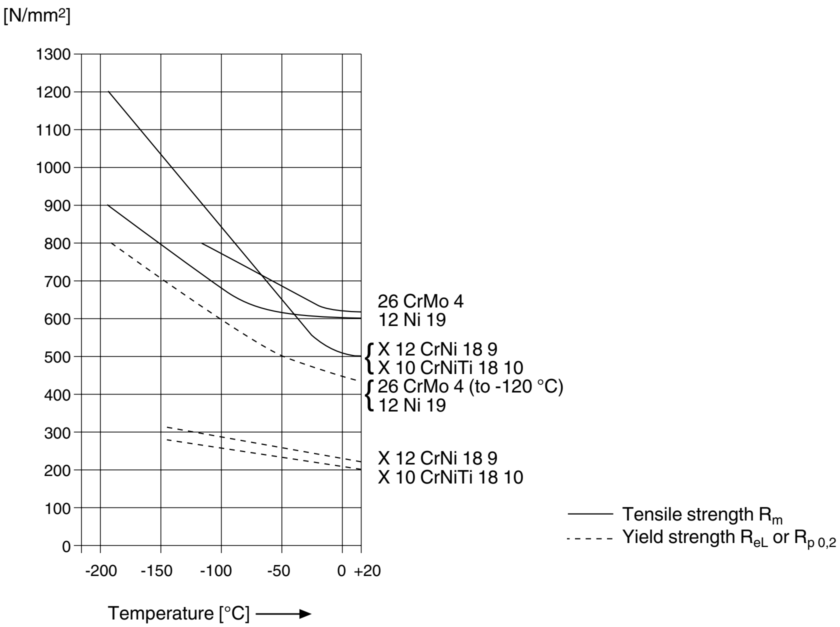
Ductility of steels at low temperatures

according to manufacturer's specifications



Yield strength and tensile strength of steels at low temperatures

according to manufacturer's specifications



Elastic elongation of bolts with reduced shanks

according to DIN 2510

Overview of material
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Materials	Elastic elongation λ [mm] preloaded up to approx. 70 % of yield stress at room temperature							
L [mm]	YK	G	GA	GB	V	VW	S	SB
E [10^3 N/mm²]	211	211	211	211	216	216	196	216
60	0,056	0,088	0,109	0,139	0,116	0,152	0,107	0,116
70	0,065	0,102	0,127	0,162	0,136	0,177	0,125	0,136
80	0,074	0,117	0,146	0,186	0,155	0,202	0,143	0,155
90	0,084	0,131	0,164	0,209	0,175	0,228	0,161	0,175
100	0,093	0,146	0,182	0,232	0,194	0,253	0,179	0,194
110	0,102	0,161	0,200	0,255	0,213	0,278	0,197	0,213
120	0,112	0,175	0,218	0,278	0,233	0,304	0,215	0,233
130	0,121	0,190	0,237	0,302	0,252	0,329	0,233	0,252
140	0,130	0,204	0,255	0,325	0,272	0,354	0,251	0,272
150	0,140	0,291	0,273	0,348	0,291	0,280	0,269	0,291
160	0,149	0,234	0,291	0,371	0,310	0,405	0,286	0,310
170	0,158	0,248	0,309	0,394	0,330	0,430	0,304	0,330
180	0,167	0,263	0,328	0,418	0,349	0,455	0,322	0,349
190	0,177	0,277	0,346	0,441	0,369	0,481	0,340	0,690
200	0,186	0,292	0,364	0,464	0,388	0,506	0,358	0,388
210	0,195	0,307	0,382	0,487	0,407	0,531	0,376	0,407
220	0,205	0,321	0,400	0,510	0,427	0,557	0,394	0,427
230	0,214	0,336	0,419	0,534	0,446	0,582	0,412	0,446
240	0,223	0,350	0,437	0,557	0,466	0,607	0,430	0,466
250	0,233	0,365	0,455	0,580	0,485	0,633	0,448	0,485
260	0,242	0,380	0,473	0,603	0,504	0,658	0,465	0,504
270	0,251	0,394	0,491	0,626	0,524	0,683	0,483	0,524
280	0,260	0,409	0,510	0,650	0,543	0,708	0,501	0,543
290	0,270	0,423	0,528	0,673	0,563	0,734	0,519	0,563
300	0,279	0,438	0,546	0,696	0,582	0,759	0,537	0,582

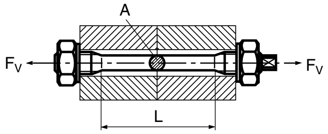
Calculation

$$\lambda = \frac{F_V \cdot L}{E \cdot A} \text{ [mm]}$$

λ [mm] = elastic elongation under preload F_V
F_V [N] = preload
E [N/mm²] = elasticity module
A [mm²] = cross section area of reduced shank
L [mm] = reduced shank length

where:

$$0{,}7 \frac{F_V}{A} = 70\,\%\ R_{p\,0,2}$$



Length of reduced shank

Example

X8CrNiMoBNb16-16 = [S]
$R_{p\,0,2}$ = 500 N/mm²
length of reduced shank L = 220 mm

Elastic elongation

$$\lambda = 0{,}7 \cdot 500 \frac{220}{196000} = 0{,}394 \text{ mm}$$

see table:
column S for L = 220 mm