

Materials for bolts, screws and studs

Property class	Materials and treatment	Chemical composition limits (check analysis) %					Tempering temperature °C min.
		C min.	C max.	P max.	S max.	B ⁹⁾ max.	
3.6 ¹⁾	Carbon steel	-	0,20	0,05	0,06	0,003	-
4.6 ¹⁾		-	0,55	0,05	0,06	0,003	
4.8 ¹⁾							
5.6		0,15	0,55	0,05	0,06	0,003	
5.8 ¹⁾		-	0,55	0,05	0,06	0,003	
6.8 ¹⁾							
8.8 ²⁾	Carbon steel with additives (e.g. Boron or Mn or Cr), quenched and tempered or Carbon steel quenched and tempered	0,15 ³⁾	0,40	0,035	0,035	0,003	425
		0,25	0,55	0,035	0,035		
9.8	Carbon steel with additives (e.g. Boron or Mn or Cr), quenched and tempered or Carbon steel quenched and tempered	0,15 ³⁾	0,35	0,035	0,035	0,003	425
		0,25	0,55	0,035	0,035		
10.9 ⁴⁾	Carbon steel with additives (e.g. Boron or Mn or Cr), quenched and tempered	0,15 ³⁾	0,35	0,035	0,035	0,003	340
10.9 ⁵⁾	Carbon steel quenched and tempered or Carbon steel with additives (e.g. Boron or Mn or Cr), quenched and tempered or Alloy steel quenched and tempered ⁷⁾	0,25	0,55	0,035	0,035		425
		0,20 ³⁾	0,55	0,035	0,035		
		0,20	0,55	0,035	0,035	0,003	
12.9 ^{5), 6)}	Alloy steel quenched and tempered ⁷⁾	0,28	0,50	0,035	0,035	0,003	380

- 1) Free cutting steel is allowed for these property classes with the following maximum sulfur, phosphorus and lead contents:
sulfur 0,34%; phosphorus 0,11%; lead 0,35%.
- 2) For nominal diameters above 20 mm the steels specified for property classe 10.9 may be necessary in order to achieve sufficient hardenability.
- 3) In case of plain carbon boron alloyed steel with a carbon content below 0,25% (ladle analysis), the minimum manganese content shall be 0,6% for property class 8.8 and 0,7% for 9.8 and 10.9.
- 4) Products shall be additionally identified by underlining the symbol of the property class.
- 5) For the materials of these property classes, it is intended that there should 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.
- 6) A metallographically detectable white phosphorous enriched layer is not permitted for property class 12.9 on surfaces subjected to tensile stress.
- 7) 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 classification is 70% of the sum of the individual limit values shown above for the two, three or four elements concerned.
- 9) Boron content can reach 0,005% providing that non-effective boron is controlled by titanium and/or aluminium additions.