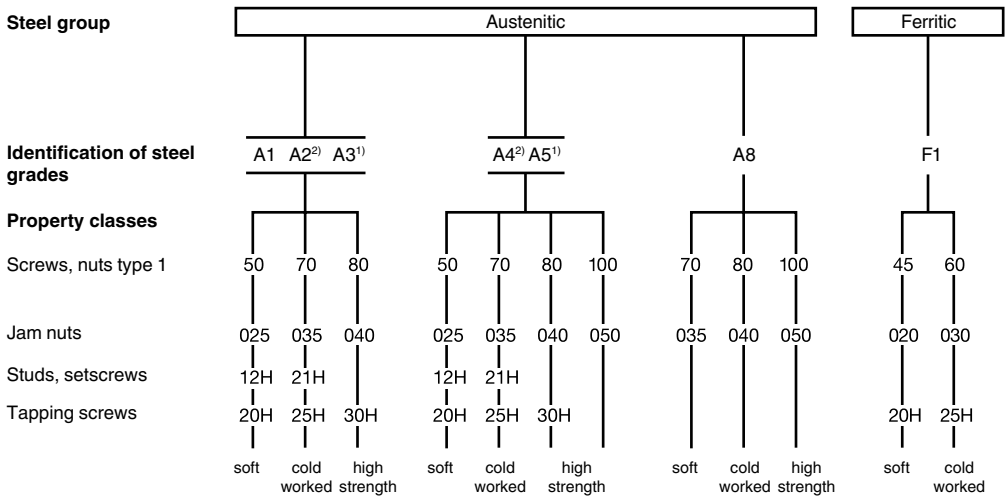
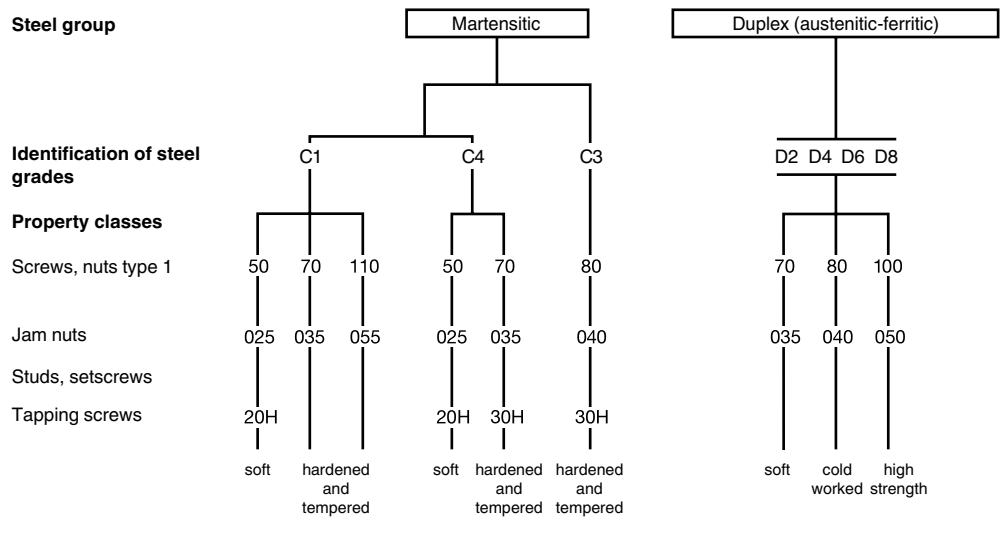
ISO-designated steel groups

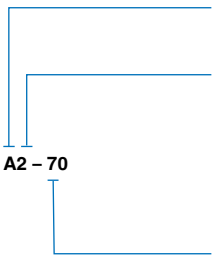
according to ISO 3506





[1] Stabilized against intergranular corrosion through addition of titanum, possibly niobium, tantalum.
[2] Low carbon austenitic stainless steels with carbon content not exceeding 0,03 % may additionally be marked with an «L», e.g. A4L-80.

Descriptions using a letter/figure combination mean the following:



Abbreviation of composition group:
A = austenitic chromium-nickel steel

Abbreviation of chemical composition:
1 = free-cutting steel with sulphur additive
2 = cold-heading steel alloyed with chromium and nickel
3 = cold-heading steel alloyed with chromium and nickel stabilised with Ti, Nb, Ta
4 = cold-heading steel alloyed with chromium, nickel and molybdenum
5 = cold-heading steel alloyed with chromium, nickel and molybdenum stabilized with Ti, Nb, Ta
8 = cold drawn steel with a high content of chrome, nickel and molybdenum

Abbreviation of property class:
50 = 1/10 of tensile strength (min. 500 N/mm²)
70 = 1/10 of tensile strength (min. 700 N/mm²)
80 = 1/10 of tensile strength (min. 800 N/mm²)
100 = 1/10 of tensile strength (min. 1000 N/mm²)

Thin nuts:
025 = proof stress min. 250 N/mm²
035 = proof stress min. 350 N/mm²
040 = proof stress min. 400 N/mm²
050 = proof stress min. 500 N/mm²

Screws with reduced load bearing capacity due to the head or shaft design that can be subjected to a tensile test are now labeled with the property class by the supplementary number 0. For example **050, 070, 080, 0100.**

The designation of the steel grade (first block) consists of one of the letters:
– **A** for austenitic steel
– **C** for martensitic steel
– **F** for ferritic steel
– **D** for Duplex steel

Example:
A2-70 indicates: austenitic steel, cold worked, min. 700 N/mm² tensile strength
A8-100 indicates: austenitic steel, cold worked, min. 1000 N/mm² tensile strength
C4-70 indicates: martensitic steel, hardened and tempered, min. 700 N/mm² tensile strength

The designation of the property class consists of two digits representing 1/10 of the tensile strength of the fasteners respectively 1/10 of the proof load of the nuts.

If fastener elements are classified over the hardness, the hardness class is given according to Vickers by 2 digits standing for 1/10 of the minimum hardness value. The letter H refers to the hardness.

Designation example of a minimum hardness 250 HV: **A4 25 H, austenitic steel, work hardened**

Material groups

according to ISO 3506

Austenitic steel, steel grades A1, A2, A3, A4, A5 and A8, with high amounts of chrome and nickel that cannot be hardened by a heat treatment and that has excellent corrosion resistance and good ductility, and is usually only slightly magnetizable.

Ferritic steel, steel grade F1 containing less than 0,1 % carbon and usually 11 to 18 % chromium that cannot be hardened by a heat treatment and that is significantly magnetizable. If a lower corrosion resistance than that of the austenitic grades A2 or A3 is suitable for the planned application, the stainless steel grade F1 may be a good economic compromise.

Martensitic steel, steel grade C1, C3, C4 with high amounts of chromium, but a very low nickel content, that can be hardened by a heat treatment to increase the strength, but has reduced ductility and is significantly magnetizable. Martensitic grades C1 and C4 have a lower corrosion resistance than austenitic grades.

Duplex steel, steel grades D2, D4, D6 and D8 with a microstructure with austenitic and ferritic phases (typically 40 % – 60 %), which has a higher content of chromium and a lower content of nickel compared to austenitic steel, with a high strength and magnetizability. Duplex stainless steels have excellent corrosion resistance and, compared to austenitic stainless steels A1 to A5, have a much better resistance to stress cracking corrosion. With regard to pitting and crevice corrosion, D2 has at least the equivalent corrosion resistance to A2 and D4 the equivalent to A4. D6 has an improved corrosion resistance compared to A4 and D4. D8 has a corrosion resistance that is comparable to A8.

Chemical composition of corrosion resistant stainless steels

according to ISO 3506

More than 97 % of all fasteners made from stainless steels are produced from this steel composition group. They are characterised by impressive corrosion resistance and excellent mechanical properties.

Austenitic stainless steels are divided into 6 main groups whose chemical compositions are as follows:

Steel group **Austenitic**	Chemical composition in % (maximum values, unless otherwise indicated)									Notes
	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	
A1	0,12	1,0	6,5	0,200	0,15–0,35	16–19	0,7	5–10	1,75–2,25	2) 3) 4)
A2	0,10	1,0	2,0	0,050	0,03	15–20	–	8–19	4	5) 6)
A3	0,08	1,0	2,0	0,045	0,03	17–19	–	9–12	1	1) 7)
A4	0,08	1,0	2,0	0,045	0,03	16–18,5	2–3	10–15	4	6) 8)
A5	0,08	1,0	2,0	0,045	0,03	16–18,5	2–3	10,5–14	1	1) 7) 8)
A8	0,03	1,0	2,0	0,040	0,03	19–22	6–7	17,5–26	1,5	

1) Stabilized against intergranular corrosion through addition of titanium, possibly niobium, tantalum.
2) Sulfur may be replaced by selenum.
3) If the nickel content is below 8 %, the min. manganese content shall be 5 %.
4) There is no min. limit to the copper content, provided that the nickel content is greater than 8 %.
5) If the chromium content is below 17 %, the min. nickel content should be 12 %.
6) For austenitic stainless steels having a max. carbon content of 0,03 %, nitrogen may be present to a max. of 0,22 %.
7) This shall contain titanium ≥ 5 x C up to 0,8 % max. for stabilization and be marked appropriately as specified in this table, or shall contain niobium (columbium) and / or tantalum ≥ 10 x C up to 1 % maximum for stabilization and be marked appropriately as specified in this table.
8) At the discretion of the manufacturer, the carbon content may be higher where required in order to obtain the specified mechanical properties at larger diameters, but shall not exceed 0,12 % for austenitic steels.

The other grades of stainless steel for fasteners (ferritic, martensitic, duplex) differ in the following chemical composition. These grades are usually not standard and require special production.

Steel group **Martensitic**	Chemical composition in % (maximum values, unless otherwise indicated)									Notes
	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	
C1	0,09–0,15	1,0	1,0	0,050	0,03	11,5–14	–	1,0	–	8)
C3	0,17–0,15	1,0	1,0	0,040	0,03	16–18	–	1,5–2,5	–	
C4	0,17–0,15	1,0	1,5	0,050	0,15–0,35	12–14	0,6	1,0	–	2) 8)

2) Sulfur may be replaced by selenum.
8) At the discretion of the manufacturer, the carbon content may be higher where required in order to obtain the specified mechanical properties at larger diameters.

Steel group **Ferritic**	Chemical composition in % (maximum values, unless otherwise indicated)									Notes
	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	
F1	0,08	1,0	1,0	0,040	0,03	15–18,5	–	1,0	–	[9] [10]

[9] Titanium or niobium may be contained in order to improve corrosion resistance.
[10] Molybdenum is permitted at the manufacturer's discretion. If it is necessary to restrict the molybdenum content for a certain application, this must be specified by the customer at the time of ordering.

Steel group **Duplex**	Chemical composition in % (maximum values, unless otherwise indicated)									Notes
	C	Si	Mn	P	S	Cr	Mo	Ni	Cu	
D2	0,03	1,0	6,0	0,040	0,03	19–24	0,1–1	1,5–5,5	3	[11]
D4	0,04	1,0	6,0	0,040	0,03	21–25	0,1–2	1–5,5	3	[11]
D6	0,03	1,0	2,0	0,040	0,015	21–23	2,5–3,5	4,5–6,5	–	[11]
D8	0,03	1,0	6,0	0,035	0,015	24–26	3–4,5	6–8	2,5	[11] [12]

[11] The following limit exists for the weight percent of nitrogen. For duplex grade D2 from 0,05 to 0,20 %, for duplex grade D4 from 0,05 to 0,30 %, for duplex grade D6 from 0,08 to 0,35 %, for duplex grade D8 from 0,20 to 0,35 %.
[12] Tungsten ≤ 1.0

Chemical composition of corrosion resistant stainless steels by material number

according to ISO 3506

The standard series ISO 3506 specifies the composition ranges for the different stainless steels, which are used for fasteners. As an example, a possible selection of suitable material numbers is specified according to the European designation system for steels, depending on the steel group.

Other material designations according to American, Japanese or other standards, which are not mentioned here, may also be within the chemical composition range according to the standard ISO 3506 and may be used for fasteners as well.

The chemical compositions of the most common grades for the different steel groups are given in the following table.

Steel group	Material number	Chemical composition, % by mass								
		C	Si max.	Mn max.	P max.	S max.	Cr	Mo	Ni	Other
Ferritic steels										
F1	1.4016	max. 0,08	1,0	1,0	0,04	0,030	16,0 to 18,0			
F1	1.4511	max. 0,05	1,0	1,0	0,04	0,030	16,0 to 18,0			Nb 10xC to 1,0
F1	1.4113	max. 0,08	1,0	1,0	0,04	0,030	16,0 to 18,0	0,90 to 1,40		
F1	1.4526	max. 0,08	1,0	1,0	0,04	0,015		0,80 to 1,40		Nb 0,1+7x(C+N) ≤ 1.0 / N ≤ 0,04
[2]	1.4105	max. 0,08	1,0	1,5	0,04	0,15 to 0,35	16,0 to 18,0	0,20 to 0,60		
Martensitic steels										
C1	1.4006	0,08 to 0,15	1,0	1,5	0,04	0,030	11,0 to 13,5		max. 0,75	
C1	1.4034	0,43 to 0,50	1,0	1,0	0,04	0,030	12,5 to 14,5			
C3	1.4057	0,12 to 0,22	1,0	1,5	0,04	0,030	15,0 to 17,0		1,5 to 2,5	
C4	1.4005	0,06 to 0,15	1,0	1,5	0,04	0,15 to 0,35	12,0 to 14,0	0,6		
[2]	1.4110	0,48 to 0,60	1,0	1,0	0,04	0,015	13,0 to 15,0	0,50 to 0,80		V max. 0,15
[2]	1.4116	0,45 to 0,55	1,0	1,0	0,04	0,030	14,0 to 15,0	0,50 to 0,80		V 0,10 to 0,20
[2]	1.4122	0,33 to 0,45	1,0	1,5	0,04	0,030	15,5 to 17,5	0,80 to 1,30	max. 1,0	

[1] Austenitic stainless steels with particular resistance to chloride induced stress corrosion.
The risk of failure of bolts, screws and studs by chloride induced stress corrosion can be reduced by using the materials marked in the table.
Especially recommended for critical fastening elements in indoor pools and proven in practice: 1.4529, 1.4547 and 1.4565.
[2] Special grade, labeling / steel group not specified in the standard 3506
[3] Can be identified as steel grade D4, if %C + 3,3%Mo + 13%N > 24.

Steel group	Material number	Chemical composition, % by mass								
		C	Si max.	Mn max.	P max.	S max.	Cr	Mo	Ni	Other
Austenitic steels										
A1	1.4305	max. 0,10	1,0	2,0	0,045	0,15 to 0,35	17,0 to 19,0		8,0 to 10,0	Cu max. 1,00/N max. 0,10
A1	1.4570	max. 0,08	1,0	2,0	0,045	0,15 to 0,35	17,0 to 19,0	0,6	8,0 to 10,0	Cu 1,40 to 1,80/N max. 0,10
A2	1.4301	max. 0,07	1,0	2,0	0,045	0,030	17,5 to 19,5		8,0 to 10,5	N max. 0,10
A2L	1.4307	max. 0,03	1,0	2,0	0,045	0,030	17,5 to 19,5		8,0 to 10,5	N max. 0,10
A2	1.4567	max. 0,04	1,0	2,0	0,045	0,030	17,0 to 19,0		8,5 to 10,5	Cu 3,0 to 4,0/N max. 0,10
[2]	1.4310	0,05 to 0,15	2,0	2,0	0,045	0,015	16,0 to 19,0	max. 0,80	6,0 to 9,5	N max. 0,10
A3	1.4541	max. 0,08	1,0	2,0	0,045	0,030	17,0 to 19,0		9,0 to 12,0	Ti 5xC ≤ 0,70
A3	1.4550	max. 0,08	1,0	2,0	0,045	0,030	17,0 to 19,0		9,0 to 12,0	Nb 10xC ≤ 1,0
A4	1.4401	max. 0,07	1,0	2,0	0,045	0,030	16,5 to 18,5	2,00 to 2,50	10,0 to 13,0	N max. 0,10
A4L	1.4404	max. 0,03	1,0	2,0	0,045	0,030	16,5 to 18,5	2,00 to 2,50	10,0 to 13,0	N max. 0,10
A4L	1.4435	max. 0,03	1,0	2,0	0,045	0,030	17,0 to 19,0	2,50 to 3,00	12,5 to 15,0	N max. 0,10
A5	1.4571	max. 0,08	1,0	2,0	0,045	0,030	16,5 to 18,5	2,00 to 2,50	10,5 to 13,5	Ti 5xC ≤ 0,70
A8	1.4529[1]	max. 0,02	0,5	1,0	0,035	0,015	19,0 to 21,0	6,00 to 7,00	24,0 to 26,0	N 0,15 to 0,25/Cu 0,5 to 1,5
A8	1.4547[1]	max. 0,02	0,7	1,0	0,035	0,015	19,5 to 20,5	6,00 to 7,00	17,5 to 18,5	N 0,18 to 0,25/Cu 0,5 to 1,0
A8	1.4478[1]	max. 0,03	1,0	2,0	0,040	0,030	20,0 to 22,0	6,00 to 7,00	23,5 to 25,5	N 0,18 to 0,25/Cu to 0,75
[2]	1.4439[1]	max. 0,03	1,0	2,0	0,045	0,025	16,5 to 18,5	4,00 to 5,00	12,5 to 14,5	N 0,12 to 0,22
[2]	1.4539[1]	max. 0,02	0,7	2,0	0,030	0,010	19,0 to 21,0	4,00 to 5,00	24,0 to 26,0	N max. 0,15/Cu 1,2 to 2,0
[2]	1.4565[1]	max. 0,03	1,0	7,0	0,030	0,015	24,0 to 26,0	4,00 to 5,00	16,0 to 19,0	N 0,30 to 0,60/Nb max. 0,15
Precipitation hardening steels										
[2]	1.4542	max. 0,07	0,7	1,5	0,040	0,030	15,0 to 17,0	max. 0,60	3,0 to 5,0	Nb 5xC ≤ 0,45/Cu 3,0 to 5,0
[2]	1.4568	max. 0,09	0,7	1,0	0,040	0,015	16,0 to 18,0		6,5 to 7,8	Al 0,70 to 1,50
Duplex steels										
D2[3]	1.4482	max. 0,03	1,0	4 - 6	0,035	0,030	19,5 to 21,5	0,10 to 0,60	1,5 to 3,5	N 0,05 to 0,20/Cu max. 1,0
D2[3]	1.4362	max. 0,03	1,0	2,0	0,035	0,015	21,0 to 24,5	0,10 to 0,60	3,5 to 5,5	N 0,05 to 0,20/Cu 0,1 to 0,6
D4	1.4062	max. 0,03	1,0	2,0	0,040	0,010	21,5 to 24,0	max. 0,45	1,0 to 1,9	N 0,16 to 0,28
D4	1.4162	max. 0,04	1,0	4 - 6	0,040	0,015	21,0 to 22,0	0,10 to 0,80	1,35 to 3,5	N 0,20 to 0,25/Cu 0,1 to 0,8
D6	1.4462	max. 0,03	1,0	2,0	0,035	0,015	21,0 to 23,0	2,50 to 3,50	4,5 to 6,5	N 0,10 to 0,22
D6	1.4481	max. 0,03	1,0	1,5	0,040	0,030	24,0 to 26,0	2,50 to 3,50	5,5 to 4,5	N 0,08 to 0,30
D8	1.4410[1]	max. 0,03	1,0	2,0	0,035	0,015	24,0 to 26,0	3,0 to 4,50	6,0 to 8,0	N 0,24 to 0,35
D8	1.4507[1]	max. 0,03	0,70	2,0	0,035	0,015	24,0 to 26,0	3,0 to 4,0	6,0 to 8,0	N 0,20 to 0,30/Cu 1,0 to 2,5
[2]	1.4658[1]	max. 0,03	0,5	1,5	0,035	0,010	26,0 to 29,0	4,0 to 5,0	5,5 to 9,5	N 0,30 to 0,50/Cu max. 1,0

[1] Austenitic stainless steels with particular resistance to chloride induced stress corrosion.
The risk of failure of bolts, screws and studs by chloride induced stress corrosion can be reduced by using the materials marked in the table.
Especially recommended for critical fastening elements in indoor pools and proven in practice: 1.4529, 1.4547 and 1.4565.

[2] Special grade, labeling/steel group not specified in the standard 3506

[3] Can be identified as steel grade D4, if %C + 3,3%Mo + 13%N > 24.

Distinctive features of stainless austenitic steels

Over 97 % of all fasteners made of stainless steel are made from this steel group. Of these, steel grades A2 and A4 offer the standard quality.
For this reason, the other grades of stainless steels are not standard for fasteners (ferritic, martensitic, duplex) and require special fabrication.

Please contact us directly for more information or an offer. We will be happy to help you with our experience so you can find the ideal solution for your specific requirements.

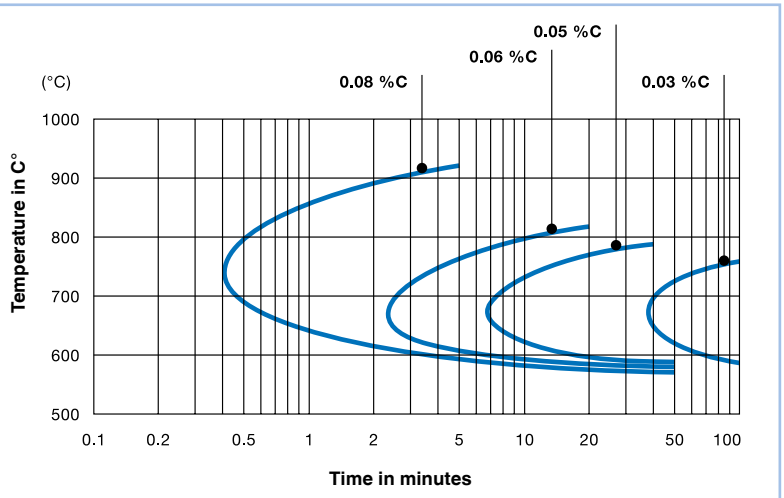
Material designation	A1	A2	A3	A4	A5	A8
Material number	1.4300	1.4301	1.4541	1.4401	1.4436	1.4529
	1.4305	1.4303	1.4590	1.4435	1.4571	1.4547
		1.4306	1.4550	1.4439	1.4580	1.4478
Properties	for machining – rust-resistant to a certain degree – corrosion-resistant to a certain degree – weldable to a certain degree	standard quality – rust-resistant – acid-resistant – weldable to a certain degree		highest resistance to corrosion – rust-resistant – highly acid-resistant – easily weldable		6 % Mo stainless steel – high resistance to all types of corrosion, including stress cracking corrosion
	A3, A5 as A2, A4 but stabilised against intergranular corrosion following welding, annealing or when used at high temperatures.					

› Further details on the chemical stability of rust-resistant and acid-resistant steels can be found on **Page F.027**

Time-temperature diagram of intergranular corrosion in austenitic stainless steels

Figure gives the approximate time for austenitic stainless steels, grade A2 (18/8 steels), with different carbon contents in the temperature zone between 550 °C and 925 °C before risk of intergranular corrosion occours.

Note
With lower carbon contents, the resistance against intergranular corrosion is improved.



The following stainless steel grades are recommended if there is a risk of intercrystalline corrosion:
– A3 or A5 stabilized
– A2 or A4 with max. carbon content 0,030 % (marked with «L»)
– A8

Chemical resistance of stainless austenitic steels

based on information provided by the manufacturer's

Austenitic steels A1, A2, A4 and A8 obtain their resistance to corrosion through a surface protective layer of oxide. If this is damaged it uses atmospheric oxygen to regenerate itself. If access to atmospheric oxygen is blocked by an unfavourable style of construction or through dirt, then even these steels will corrode!

General rules:
- A1 this steel contains small particles of sulphur, which gives it a good machinability. Its resistance to corrosion is lower than that of A2.
- A2 above water, inland climate
- A4 under water, coastal climate
- A8 resistant to sea water, high resistance to all types of corrosion, in particular stress cracking corrosion

Please avoid: cracks, separation joints, pockets of water, poor ventilation, layers of dirt

The resistance to corrosion can be reduced in the presence of a coating (prevents access to the air), or chemical blackening or a roughening of the surface.

Under certain conditions, **media containing chlorine** may lead to a dangerous stress cracking corrosion, which is often difficult to see from the outside, which may result in a sudden failure of the steel piece. The steel grade A8 offers a much better resistance here compared to the steels A1 to A5.

ISO standard 3506 defines rust and acid-resistant steels. It also contains details of their mechanical properties, chemical composition and a number of notes on the selection of the right steel for high and low temperature applications.

The reference data with respect to corrosion resistance
Indications on resistance to corrosion are preferably obtained from laboratory and practical trials!
Ask for information on our «**Bossard Expert Test Services**».

Attention
- Martensitic chrome steels (e.g. 1.4110, 1.4116, 1.4112) are normally used for corrosion-resistantretaining rings and washers. The corrosion resistance of these steels is lower than that of austenitic chrome-nickel steels.
- Recent experience indicates that there is a risk of stress corrosion cracking. In order to reduce this risk the depth of the nuts can be selected so that the fitted rings are not subjected to stress. This will reduce their load-bearing capacity.

Technical arguments for the use of fasteners made from rust-resistant austenitic chrome-nickel steels A1, A2, A4, A8

Advantages	Avoidance of potential problems
Bright-finished surface, good appereance	Rusty screws create a bad impression. The customer loses trust in the product.
Savety	Corrosion reduces the strength and operational reliability of the fasteners. They become weak points.
No traces of red-rust	Red rust can discolour white-coloured plastic components and textiles and make them unusable.
No risk to health	Cutting yourself on a rusty part can lead to blood poisoning.
Food grade material	Parts made from zinc-coated steel must not be allowed to come into contact with foodstuffs.
Lick-resistant	Small children must not be able to get within reach of and lick small, zinc-coated or cadmium-coated parts.
Easy to clean and hygienic	Products or efflorescences caused by corrosion can build up on bright-polished or zinc-coated fasteners which then become difficult to remove.
Austenitic chrome-nickel steel is almost entirely non-magnetic	Magnetic fasteners used in the construction of types of apparatus or measuring devices can lead to disruptions. Magnetic parts attract iron filings. This gives rise to additional problems of corrosion.
Good temperature resistance	At temperatures above 80 °C the chromating on zinc-plated and chrome-plated fasteners is destroyed. The corrosion resistance drops dramatically.
The screw and nuts are bright-polished and so always remain workable.	If the permissible thickness of the coating on galvanically finished screws is exceeded, the parts jam up when being assembled.
No problems during maintenance work	Rusty screws or nuts just cannot be unscrewed. In order to disassemble the unit the fasteners have to be destroyed, and this involves considerable force and effort. This often results in damage to the parts.
Ecologically-oriented use of austenitic screw elements into wood	The environmental influences lead to a chemical reaction at galvanized screws with the tannic acid existing in the wood. A gray / black coloring which penetrate into the wood can not be eliminated any more. Due to the time restricted anti-corrosion protection and possible stress corrosion risk, the usage of highstrength martensitic steel is not recommended. In all corrosion relevant wood applications use of austenitic steels is recommended.

Mechanical properties for fasteners made from austenitic stainless steel

according to ISO 3506

Screws

Steel group	Steel grade	Property class	Thread diameter range	Tensile strength $R_{m\,min}$ [1] [N/mm²]	Stress at 0,2 % permanent strain $R_{p\,0,2\,min}$ [1] [N/mm²]	Elongation after fracture A_{min} [2] [mm]
Austenitic	A1, A2	50 [4]	≤ M39	500	210	0,6 d
	A3, A4	**70**	**≤ M39** [3]	**700**	**450**	**0,4 d**
	A5. A8	80	≤ M39 [3]	800	600	0,3 d
		100 [5]	≤ M39 [3]	1000	800	0,2 d

[1] All values are calculated values and refer to the stressed cross-section of the thread.
[2] The elongation after fracture is to be determined for the whole screw and not for unscrewed test pieces.
[3] Strength of the screw is indicated by the head marking and defined by the applicable product standard.
[4] Not for steel grade A8.
[5] Only for steel grades A4, A5 and A8.

Nuts

Steel group	Steel grade	Property class		Thread diameter range	Stress under proof load $S_{P\,min}$ [N/mm²]	
		Nuts Style 1 m ≥ 0,8 d	thin nuts 0,5 d ≤ m < 0,8 d	d [mm]	Nuts Style 1 m ≥ 0,8 d	thin nuts 0,5 d ≤ m < 0,8 d
Austenitic	A1, A2	50 [4]	025	≤ M39	500	250
	A3, A4	**70**	**035**	**≤ M39** [3]	**700**	**350**
	A5, A8	80	040	≤ M39 [3]	800	400
		100 [5]	050	≤ M39 [3]	1000	500

m = nut height
d = nominal thread diameter

The commercial quality of steel grades A2 and A4 is property class 70 (tensile strength 700 N/mm²). Strength of the screw is indicated by the head marking and defined by the applicable product standard.
We keep a wide range available for you from stock.

Use of screws of property class 80 or 100 is only economically justifiable if the components are made from stainless steel (high strength).

Minimum breaking torque $M_{B\,min}$ for screws made from austenitic steel with threads M1,6 to M16 (normal thread)

according to ISO 3506

Threads	Minimum breaking torque $M_{B\,min}$ [Nm]		
	Property class		
	50	70	80
M1,6	0,15	0,2	0,24
M2	0,3	0,4	0,48
M2,5	0,6	0,9	0,96
M3	1,1	1,6	1,8
M4	2,7	3,8	4,3
M5	5,5	7,8	8,8
M6	9,3	13	15
M8	23	32	37
M10	46	65	74
M12	80	110	130
M16	210	290	330

No values are available for:
- austenitic steel grades of the property class 100
- fasteners with fine thread
- martensitic, ferritic or duplex steel grades

Reference values for 0,2 % $R_{p0,2}$ at higher temperatures as % of the values at room temperature

according to ISO 3506

Steel grade[1]	0,2 % $R_{p0,2}$			
	+100 °C	+200 °C	+300 °C	+400 °C
A2, A4, A8	85 %	80 %	75 %	70 %

[1] applies for property classes 70 and 80

For applicability at low temperature see **Page F.018**

Marking of screws and nuts

according to ISO 3506

Requirement

Screws and nuts made from stainless austenitic steels must be marked.

Caution

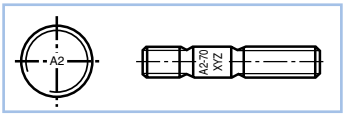
Only those fasteners marked to standard will have the desired properties. Products not marked to standard will often only correspond to property classes A2-50 or A4-50.

Screws

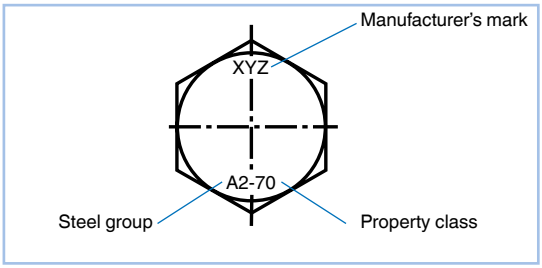
Hexagon head screws, and hexagon or hexalobular socket head cap screws from nominal diameter M5 must be marked. The marking must show the steel group, the property class and the manufacturer's mark.

Studbolts

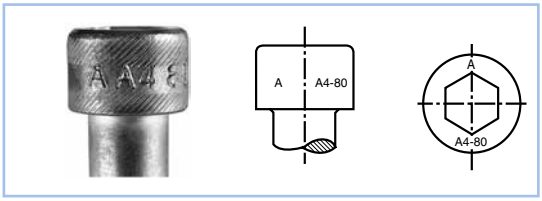
Bolts from nominal diameter M6 must be marked on the unthreaded shank with the steel group, the property class and the manufacturer's mark. If marking on the on the unthreaded shank is not possible, marking on the nut-end of the stud with only the stainless steel group is allowed.



Hexagon screws

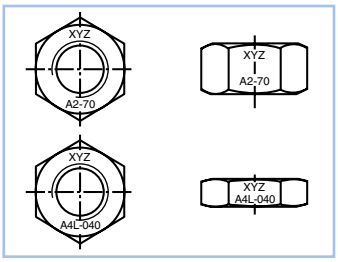


Socket head cap screws



Nuts

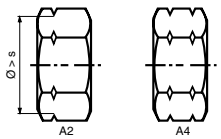
Nuts and nuts with reduced load bearing capacity (low nut) must be labeled with the steel group, property class and origin mark from thread M5.



If the nuts of grades A2 and A4 are marked with grooves and the property class is not specified, then the property class 50 of 025 applies.

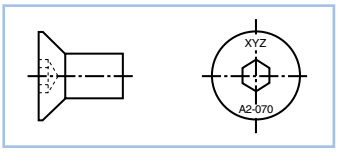
It is possible that certain nuts would not fulfil the proof load requirements because of fine pitch thread or the geometry of the nut. These nuts may be marked with the steel grade, but shall **not be marked with the property class.**

Alternative groove marking
(for steel grades A2 and A4 only)

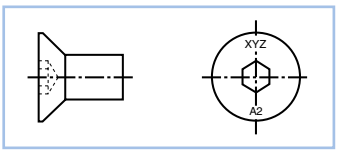


Other markings

Screws with reduced load bearing capacity due to the head or shaft design that can be subjected to a tensile test are to be labeled **with the property class by the supplementary number 0**.



Screws that do not meet the requirements for tension and torsion strength due to their geometry and cannot be subject to a tensile test due to their short length may be labeled **without the property class**.



Other types of screws can be labelled in the same way where possible, but only on the head. Additional markings may be attached, provided this does not lead to confusion.