

Description of the groups and grades of stainless steels

General:

In ISO 3506-1, ISO 3506-2 and ISO 3506-3 reference is made to steel grades A1 to A5, C1 to C4 and F1 covering steels of the following groups:

Austenitic steel	A1-A5
Martensitic steel	C1-C4
Ferritic steel	F1

The characteristics of the above mentioned steel groups and grades are described on this page.

This page also gives some information on the non-standardized steel group FA.

Steel group A (austenitic structure)

Five main grades of austenitic steels, A1 to A5, are included in ISO 3506-1, ISO 3506-2 and ISO 3506-3. They cannot be hardened and are usually non-magnetic. In order to reduce the susceptibility to work hardening copper may be added to the steel grades A1 to A5 as specified in table 6.1.

For non-stabilized steel grades A2 and A4 the following applies.

As chromic oxide makes steel resistant to corrosion, low carbon content is of great importance to non-stabilized steels. Due to the high affinity of chrome to carbon, chrome carbide is obtained instead of chromic oxide which is more likely at elevated temperature.

For stabilized steel grades A3 and A5 the following applies. The elements Ti, Nb or Ta affect the carbon and chromic oxide is produced to its full extent.

For offshore or similar applications, steels with Cr and Ni contents of about 20% and Mo of 4,5% to 6,5% are required. When risk of corrosion is high experts should be consulted.

Steel grade A1

Steel grade A1 is especially designed for machining. Due to the high sulfur content of the steels within this grade have lower resistance to corrosion than corresponding steels with normal sulfur content.

Steel grade A2

Steels of grade A2 are the most frequently used stainless steels. They are used for kitchen equipment and apparatus for the chemical industry. Steels within this grade are not suitable for use in non-oxidizing acid and agents with chloride content, i.e. swimming pools and sea water.

Steel grade A3

Steels of grade A3 are stabilized "stainless steels" with properties of steels in grade A2.

Steel grade A4

Steels of grade A4 are "acid proof steels", which are Mo alloyed and give considerably better resistance to corrosion. A4 is used to a great extent by the cellulose industry as this steel grade is developed for boiling sulfuric acid (thus given the name "acid proof") and is, to a certain extent, also suitable in an environment with chloride content.

A4 is also frequently used by the food industry and by the ship-building industry.

Steel grade A5

Steels of grade A5 are stabilized "acid proof steels" with properties of steels in grade A4.

Steel group F (ferritic structure)

The steels within the steel grade F1 cannot be hardened normally and should not be hardened even if possible in certain cases. The F1 steels are magnetic.

Steel grade F1

Steel grade F1 is normally used for simpler equipment with the exception of the superferrites which have extremely low C and N contents. The steels within grade F1 can, if need be, replace steels of grades A2 and A3 and be used at higher chloride content.

Steel group C (martensitic structure)

Three types of martensitic steel grades, C1, C3 and C4, are included in ISO 3506-1, ISO 3506-2 and ISO 3506-3. They can be hardened to an excellent strength and are magnetic.

Steel grade C1

Steels within the grade C1 have limited resistance to corrosion. They are used in turbines, pumps and for knives.

Steel grade C3

Steels within the grade C3 have limited resistance to corrosion though better resistance than C1. They are used in pumps and valves.

Steel grade C4

Steels within grade C4 have limited resistance to corrosion. They are intended for machining, otherwise they are similar to steels of grade C1.

Steel group FA (ferritic-austenitic structure)

Steel group FA is not included in ISO 3506-1, ISO 3506-2 and ISO 3506-3 but will most probably be included in the future. Steels of this steel group are the so-called duplex steels. The first FA steels to be developed had some drawbacks that have been eliminated in the recently developed steels. The FA steels have better properties than steels of the types A4 and A5 especially as strength is concerned. They also exhibit superior resistance to pitting and crack corrosion.

Examples of composition are shown in the table below.

What is the difference between A4 and A4-2343?

A4-2343 has theoretically a better protection against corrosion (point and slit corrosion), due to a higher molybdenum content.

A4 and A4-2343 are the same in ordinary corrosion. According to Swedish steel grade, the tolerances within the different alloy components are such, that the differences are practically erased. The screw producers choice in material is more an issue of standardisation than corrosion resistance.

Table 194 Ferritic-austenitic steels - Chemical composition

Group	Chemical composition % (m/m)						
	C max.	Si	Mn	Cr	Ni	Mo	N
Ferritic- austenitic	0,03	1,7	1,5	18,5	5	2,7	0,07
	0,03	<1	<2	22	5,5	3	0,14