

# Low Alloy Steels



### 1. Low Alloy Steel Definition

Among alloy steels, when Ni, Cr, Mo, and other alloy elements content consist of less than 10.5% are defined as low alloy steels.

### 2. Company products compatible with low alloy steels

- High heat resistance steel (Chromium- Molybdenum Steel)
- Low temperature use steel (Nickel Steel)
- Weathering Steel
- High yield and high tensile strength steel

### 3. Low alloy steels general description

- Chromium-Molybdenum Steel :

This low alloy steel series contains 0.5% ~ 9% Cr and 0.5% ~ 1% Mo. Its carbon content on average is lower than 0.20%, with decent weldability and higher hardening ability due to its alloy trait. The Cr content improves its anti-oxidization and anti-corrosion ability, and Mo enhances its strength in high temperature condition; The steel supplying conditions are generally gone through annealing or normalizing and tempering processes. Chromium-Molybdenum Steel has been widely used in the areas such as petrol chemical industry, steam power equipment, and high temperature services.

- Nickel Steel :

The average steel in low temperature environment will have higher strength but lower elongation and toughness, thus increases the chance for brittle fracture. If the steel is needed in a low temperature environment, having superior low temperature toughness is essential. Any suitable steel for this purpose is called low temperature service steel or Nickel steel. Low Alloy Low Temperature Service Steel is formed by adding 2.5% to 3.5 % of Ni in the carbon steel to enhance its low temperature toughness. Ni can strengthen ferrite matrix while lowering Ar<sub>3</sub> (third transformation temperature) which helps with fine grain formation. In addition to the normalizing treatment during the production process of low alloy low temperature service steel, quenching and tempering are also parts of the mechanical properties improvement treatment.

- Weathering Steel :

Generally there are two categories of rust prevention methods: one type for instance, is paint coating, electroplate, ceramic coating, or adding layers of anti-corrosion material, anything to shield the steel surface from corrosive environment. Another type is to use stainless steel or weather steel, meaning adding anti-corrosion alloy elements into the steel. Weathering steel is formed by adding small amounts of Cu, Cr, P, Ni, and other alloy elements into low alloy steel. During the initial application, it will also rust like the average carbon steel; however, after certain period (usually one year) the rustic surface will serve as an impermeable protective cover, preventing the further expansion of rust into inner part of steel.

- High Tensile and High Yield Strength Steel :

This low alloy steel series are added Mn, Ni, Cr, and Mo etc, can increase strength of ferrite matrix; improve the hardening tendency; and allow better control of grain size. This type of steel under as welded condition can meet the demand of high strength, corrosion resistance, or improve notch toughness and other mechanical properties.

This steel type has good weld ability with the yield strength from 70 to 120 ksi, and tensile strength from 90 to 150 ksi.

### Low Alloy high heat resistant steel (Cr – Mo Steel) Welding Consumables Selection

Steel category	ASTM / ASME standard		SMAW Electrode	Flux Cored Wire
	Steel Plate	Steel Pipe		
0.5%Mo steel	A204 Gr. A,B,C A336 Gr.F1	A209 Gr.T1 A335 Gr.P1	GL76/78A1	GMX 811A1
0.5%Cr-0.5%Mo steel	A387 Gr.2 Cl.1,2	A213 Gr.T2 A335 Gr.P2	GL86/88B1	
1.25%Cr-0.5%Mo steel	A387 Gr.12 Cl.1,2 A387 Gr.11 Cl.1,2 A336 Gr.F11	A213 Gr.T11,12 A335 Gr.P11,12 A182 Gr.F11	GL86/88B2	GMX 811B2
2.25%Cr-1.0%Mo steel	A387 Gr.22 Cl.1,2 A336 Gr.F22	A213 Gr.T22 A335 Gr.P22 A182 Gr.F22	GL86/88B3	GMX 911B3
5.0%Cr-0.5%Mo steel	A387 Gr.5 Cl.1,2	A335 Gr.P5	GL86/88B6	
9.0%Cr-1.0%Mo steel	A387 Gr.9 Cl.1,2	A335 Gr.P9	GL86/88B8	