



7MG.009 Steel

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Steel is a ferrous metal alloy. It is mainly composed of iron, but also contains carbon (0.05 to 1.5% by mass). However, this low carbon content gives steel the advantageous mechanical properties.

There are two large families of steels: alloy steels and non-alloy steels. The latter consist only of iron and carbon, whereas alloy steels include other chemical elements such as silicon, molybdenum, chromium and others.

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Applications

- Construction of bridges and buildings
- Motor vehicle sector
- Health sector
- Energy sector
- Food production industry

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Benefits (depending on grade)

- Resistance to elastic deformation
- Resistant to breakage and impacts
- Hardness

Classification of steels

Steels for general use

Steel for general use is a construction steel which requires no additional treatment. Its mechanical performance is often broadly sufficient for use without severe constraints. It is easy to use: forming, assembly, machining, welding, folding.

The most commonly used steel is steel A37 which is soft and non-alloy. It is suitable for mechanical parts requiring no particular stiffness, such as braces, rings or light axles.

Carbon steels

The main alloy component of these steels is carbon (between 2 and 2.5%). Low carbon content steels are weaker and softer, but can be machined and welded easily, whereas high carbon content steels are more resistant, but substantially more difficult to machine.

The most commonly used carbon steels are C22 - XC18 (with a low carbon content) for its good surface resistance, and C45 - XC48 (higher carbon content), for its good machinability and its mechanical characteristics.

Case hardening steels

Case hardening steels have a carbon content of 0.10 to 0.20%. They are intended for case hardening and quenching, which lead to high stiffness in the core and substantially greater hardness at the surface. They have resilience in the core and hardness externally, giving them high wear resistance. At temperatures higher than 920°C carbon enrichment ("carbonisation" or "case hardening") occurs. Case hardening steels are generally used for mechanical parts for which a high surface hardness with good stiffness in the core is required.

The most commonly used case hardening steels are 16MnCr5 and 16NC6, which have high impact and perforation resistance.

Heat treatment steel

Heat treatment steels are structural steels alloyed with nickel, chromium and molybdenum for quenching and tempering. They have excellent hardenability (self-hardening) even on large-dimension pieces. This type of steel is an excellent choice for many applications in leading industries where severe characteristics are demanded. Indeed, it has



high endurance and stiffness limits, high wear resistance and low deformation. The most commonly used steels are 42CD4T, 35NCD16 and 35CD4.

Nitriding steel

Nitriding steels are alloy tool steels with chromium, manganese and molybdenum for cold working. They have good hardenability and are suitable for all types of nitriding. This type of steel is recommended for the production of plastic dies, die holding blocks for plastic and guide rails for machine tools. Dies and holding blocks manufactured with this steel require more heat treatment. This grade is always ready to use. The most commonly used nitriding steel is 40CMD8.

Main characteristics

Variety	Designation	Hardness**	Machinability	Weldability
Steel for general use	A37	390-780 Mpa	★★	★★★★
Carbon steels	35NCD16	363/415 HB	★★★★	-
	35CD4	217 HB	★★★★	★*
	42CD4T	241 HB	★★★★	★*
Case hardening steels	C22 - XC18	130 - 150 HB	★★	★★★★
	C35 - XC38	154 à 207 HB	★★★★★	★★*
	C45 - XC48	55-61 HRC	★★★★★	★★*
Heat treatment steel	16MC5	207 HB	★★★★	★★*
	16NC6	≤ 229 HB	★★★★	★★*
Nitriding steel	32CrMoV13	850 HV	★★★★	★
	40CMD8	290 - 335 HB	★★★★	★

* Requires annealing after welding to prevent cracking

** According to available data (HB = Brinell ; HV = Vickers ; HRC = Rockwell)

Machining capacities

Specific capacity limits:

Turning: Up to Ø90 mm and 600 mm in length
Loading of max. length 3,000 mm bar material

Milling: Up to a thickness of 200 mm (must be approved according to the plan)

Free-cutting: Up to Ø32 mm max.