

# A Guide to Steel

Steel is a term used for iron to which between 0.02 to 1.7% carbon has been added. The old definition of steel used to be something like "it rusts and it sinks in water." This material comprises the most diverse group of alloys and applications in the metals world. If there is something that needs to be made, there probably is a steel alloy that it can be made of. Steel does, of course, have poor corrosion resistance, but its relatively low cost and ease of painting make it a common choice.

The numbering system for steel is actually one of the few things in the metals industry that seems to make sense. You can determine the alloying ingredients by the first two digits of the alloy number, and the carbon content by the last two digits. For instance, 1018 is simply iron with a carbon content of 0.18%. Generally speaking, as the carbon content goes up, strength increases, but machinability and weldability decrease.

- [1018 Steel](#) (available in Plate, Rectangle, Rectangle, Round, Square, Square, Square)
- [A36 Steel](#) (available in Angle, EXPANDED, Perforated Sheet, Plate, Rectangle, Round, Square)
- [1144 Steel](#) (available in Round)
- [12L14 Steel](#) (available in HEX, Round)
- [A653 Steel](#) (available in Sheet)
- [A366/1008 Steel](#) (available in Sheet)
- [A513 Steel](#) (available in Rectangle Tube, Square Tube, Tube)
- [8620 Steel](#) (available in Round)

## 1018 Mild Steel

Alloy 1018 is the most commonly available of the cold-rolled steels. It is generally available in round rod, square bar, and rectangle bar. It has a good combination of all of the typical traits of steel - strength, some ductility, and comparative ease of machining. Chemically, it is very similar to A36 Hot Rolled steel, but the cold rolling process creates a better surface finish and better properties.

1018 Mild (low-carbon) steel		
Minimum Properties	Ultimate Tensile Strength, psi	63,800
	Yield Strength, psi	53,700
	Elongation	15.0%
	Rockwell Hardness	B71
Chemistry	Iron (Fe)	98.81 - 99.26%
	Carbon (C)	0.18%
	Manganese (Mn)	0.6 - 0.9%
	Phosphorus (P)	0.04% max
	Sulfur (S)	0.05% max

### A36 Mild Steel

ASTM A36 steel is the most commonly available of the hot-rolled steels. It is generally available in round rod, square bar, rectangle bar, as well as steel shapes such as I-Beams, H-beams, angles, and channels. The hot roll process means that the surface on this steel will be somewhat rough. Note that its yield strength is also significantly less than 1018 - this means that it will bend much more quickly than will 1018. Finally, machining this material is noticeably more difficult than 1018 steel, but the cost is usually significantly lower.

ASTM A36 Mild (low-carbon) steel		
Minimum Properties	Ultimate Tensile Strength, psi	58,000 - 79,800
	Yield Strength, psi	36,300
	Elongation	20.0%
Chemistry	Iron (Fe)	99%
	Carbon (C)	0.26%
	Manganese (Mn)	0.75%
	Copper (Cu)	0.2%
	Phosphorus (P)	0.04% max
	Sulfur (S)	0.05% max

### 1144 (Stressproof-equivalent) steel

This material is actually pretty cool, at least for steel. It is a higher-strength alloy than 1018 or A36, but in addition has improved ductility as well. The chief feature of 1144 steel, however, is that it has very low distortion or warpage after machining due to a combination of its chemistry, method of manufacture, and heat treatment. Finally, 1144 is relatively easy to machine, with a machinability rating of 83% of AISI 1212 steel.

1144 (Stressproof-equivalent) steel		
Minimum Properties	Ultimate Tensile Strength, psi	115,000
	Yield Strength, psi	100,000
	Elongation	8.0%
	Rockwell Hardness	B95 / C17
Chemistry	Iron (Fe)	97.54 - 98.01%
	Carbon (C)	0.4 - 0.44%
	Manganese (Mn)	1.35 - 1.65%
	Phosphorus (P)	0.04% max
	Sulfur (S)	0.24 - 0.33%

### 12L14 free machining steel

This alloy has lead added to the mix in order to enhance its machinability. In fact, it is rated with a machinability of 160% of AISI 1212 steel. The addition of lead does, however, reduce the strength of this alloy, although it is generally stronger than 1018.

12L14 free machining steel		
Minimum Properties	Ultimate Tensile Strength, psi	78,300
	Yield Strength, psi	60,200
	Elongation	10.0%
	Rockwell Hardness	B84
Chemistry	Iron (Fe)	97.91 - 98.7%
	Carbon (C)	0.15% max
	Manganese (Mn)	0.85 - 1.15%
	Phosphorus (P)	0.04 - 0.09%
	Lead (Pb)	0.15 - 0.35%
	Sulfur (S)	0.26 - 0.35%

### A653 Galvanized Steel

Galvanized steel is simply hot rolled steel to which a zinc coating has been applied for protection against corrosion.

ASTM A653 Mild (low-carbon) Hot Dipped Galvanized Steel		
Minimum Properties	Ultimate Tensile Strength, psi	58,000 - 79,800
	Yield Strength, psi	36,300
	Elongation	20.0%
Chemistry	Iron (Fe)	99%
	Carbon (C)	0.26%
	Manganese (Mn)	0.75%
	Copper (Cu)	0.2%
	Phosphorus (P)	0.04% max
	Sulfur (S)	0.05% max

### A366/1008 Steel

This alloy is generally used for "commercial quality" cold rolled steel sheet. It is known for its very good formability and comparatively high strength. It has a very good surface finish that is far superior to hot rolled A36.

ASTM A366 (alloy 1008) steel		
Minimum Properties	Ultimate Tensile Strength, psi	43,900 - 51,900
	Yield Strength, psi	26,100 - 34,800
	Elongation	42 - 48%
Chemistry	Iron (Fe)	99%
	Carbon (C)	0.08%
	Manganese (Mn)	0.6% max
	Phosphorus (P)	0.035% max
	Copper (Cu)	0.2% min
	Sulfur (S)	0.04%

### A513 (alloy 1020-1026) Steel

**A513 (alloy 1020-1026) Steel**

This alloy is generally used for DOM tubing. Its higher carbon content means higher strength, but lower weldability and machinability.

ASTM A513 alloys 1020 - 1026 Mild (low-carbon) steel		
Minimum Properties	Ultimate Tensile Strength, psi	87,000
	Yield Strength, psi	72,000
	Elongation	10.0%
	Rockwell Hardness	B89
Chemistry	Iron (Fe)	99.08 - 99.53%
	Carbon (C)	0.18 - 0.23%
	Manganese (Mn)	0.3 - 0.6%
	Phosphorus (P)	0.04% max
	Sulfur (S)	0.05% max

**8620 Alloy Steel**

This material is characterized by a hard outer surface, combined with a ductile interior for higher strength.

8620 (chrome-nickel-moly) Alloy Steel		
Minimum Properties	Tensile Strength, psi	97,000
	Yield, psi	57,000
	Brinell Hardness	201
	Elongation	25%
	Machinability	66%
Chemistry	Carbon (C)	0.18 - 0.23%
	Manganese (Mn)	0.7 - 0.9%
	Phosphorus (P)	0.35% Max
	Sulphur (S)	0.4% Max
	Silicon (Si)	0.15 - 0.35%
	Chromium (Cr)	0.4 - 0.6%
	Nickel (Ni)	0.4 - 0.7%
Molybdenum (Mo)	0.15 - 0.25% max	