

Carbon Steel and Alloy Steel Material Grade

There are four types of carbon steel based on the amount of carbon present in the alloy. Lower carbon steels are softer and more easily formed, and steels with a higher carbon content are harder and stronger, but less ductile, and they become more difficult to machine and weld. Below are the properties of the grades of carbon steel:

Low Carbon Steel: Composition of 0.05%-0.25% carbon and up to 0.4% manganese. Also known as mild steel, it is a low-cost material that is easy to shape. While not as hard as higher-carbon steels, carburizing can increase its surface hardness.

Medium Carbon Steel: Composition of 0.29%-0.54% carbon, with 0.60%-1.65% manganese. Medium carbon steel is ductile and strong, with long-wearing properties.

High Carbon Steel: Composition of 0.55%-0.95% carbon, with 0.30%-0.90% manganese. It is very strong and holds shape memory well, making it ideal for springs and wire.

Very High Carbon Steel: Composition of 0.96%-2.1% carbon. Its high carbon content makes it an extremely strong material. Due to its brittleness, this grade requires special handling.

A36 Mild Steel - ASTM A36 Mild (low-carbon) Steel

ASTM A36 steel is the most commonly available of the hot-rolled steels. It is generally available in 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.

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

1018 Mild Steel - 1018 Mild (low-carbon) 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.

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

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

Disclaimer: This information is provided “as is” and MSS makes no warranty of any kind with respect to the subject matter or accuracy of the information contained herein. MSS specifically disclaims all warranties, expressed, implied or otherwise, including without limitation, all warranties of merchantability and fitness for a particular purpose.

In no event shall MSS be liable for any special, incidental, indirect or consequential damages of any kind or any damages whatsoever resulting from loss of use, data, profits, whether or not advised of the possibility of damage, and on any theory of liability, arising out of or in connection with the use of the information contained herein.

Carbon Steel and Alloy Steel Material Grade

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.

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

A366/1008 Steel - ASTM A366 (alloy 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.

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

A513 (alloy 1020-1026) Steel - ASTM A513 Alloys 1020 - 1026 Mild (low-carbon) Steel

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

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

8620 Alloy Steel - 8620 (chrome-nickel-moly) Alloy Steel

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

Minimum Properties				
Ultimate Tensile Strength, psi	Yield Strength, psi	Brinell Hardness	Elongation	Machinability
97,000	57,000	201	B71	98.81 - 99.26%

Chemistry							
Carbon (C)	Manganese (Mn)	Phosphorus (P)	Sulphur (S)	Silicon (Si)	Chromium (Cr)	Nickel (Ni)	Molybdenum (Mo)
0.18 - 0.23%				0.15 - 0.35%	0.6 - 0.9%	0.04% max	0.05% max

Disclaimer: This information is provided "as is" and MSS makes no warranty of any kind with respect to the subject matter or accuracy of the information contained herein. MSS specifically disclaims all warranties, expressed, implied or otherwise, including without limitation, all warranties of merchantability and fitness for a particular purpose.

In no event shall MSS be liable for any special, incidental, indirect or consequential damages of any kind or any damages whatsoever resulting from loss of use, data, profits, whether or not advised of the possibility of damage, and on any theory of liability, arising out of or in connection with the use of the information contained herein.