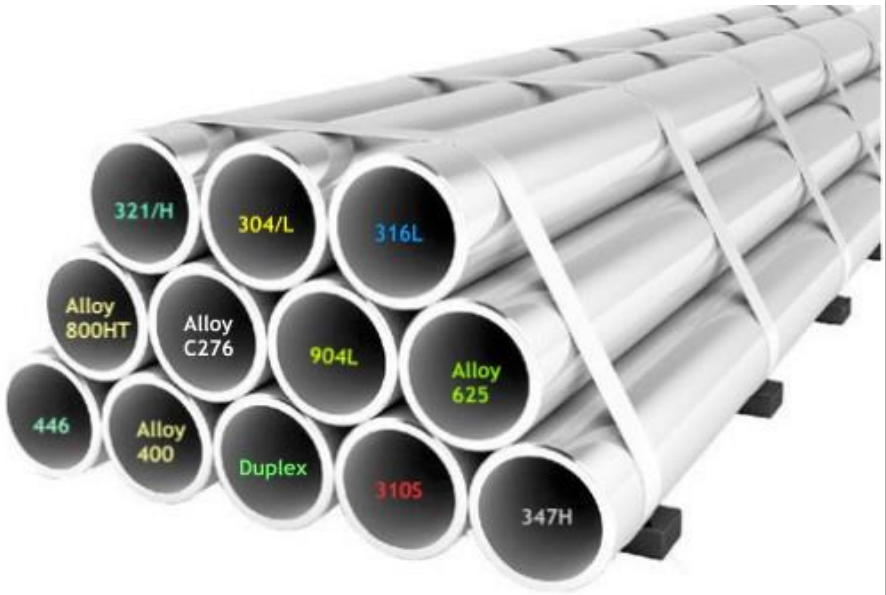
A106 GRADE B CARBON STEEL

Datasheet for A106 Grade B Carbon Steel

- Pipes & Tubes
- Sheets & Plates
- Bars & Rods, Forgings
- Fittings & Flanges
- Nuts & Bolts
- Valves



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Datasheet for Carbon Steel A106 Grade B

What is Carbon Steel A106 Grade B?

Carbon steel is a steel with carbon content up to 2.1% by weight. The definition of carbon steel from the American Iron and Steel Institute (AISI) states: Steel is considered to be carbon steel when: no minimum content is specified or required for chromium, cobalt, molybdenum, nickel, niobium, titanium, tungsten, vanadium or zirconium, or any other element to be added to obtain a desired alloying effect; the specified minimum for copper does not exceed 0.40 percent; or the maximum content specified for any of the following elements does not exceed the percentages noted: manganese 1.65, silicon 0.60, copper 0.60.
The term "carbon steel" may also be used in reference to steel which is not stainless steel; in this use carbon steel may include alloy steels.

As the carbon percentage content rises, steel has the ability to become harder and stronger through heat treating; however, it becomes less ductile. Regardless of the heat treatment, a higher carbon content reduces weldability. In carbon steels, the higher carbon content lowers the melting point.

Carbon Steel A106 Grade B Product Specification

Product	ASTM A106 Gr. B Seamless Pipes
Brand	Jindal, MSL, ISMT
Shapes	Round
Types	Seamless and Welded
Size	1/2" to 48"
Thickness	SCH 40, SCH 80, SCH 160, SCH XS, SCH XXS, All Schedules
Common Grades	API 5L Gr. B, ASTM A106 Gr. B, ASTM A333 Gr. 6, ASTM A53 Gr. B, ASTM A500 Gr. B
Fittings Type	Seamless Butt Weld, Flanges, Black, Galvanised
Other Fittings	Elbows, Tees, Reducers, Caps, Stub Ends, Flanges (ANSI, Table E, D and H)

Difference Between Carbon Steel and Stainless Steel

Carbon steel and stainless steel have the same basic ingredients of iron and carbon. Their main difference is alloy content—carbon steel has under 10.5 percent alloy content, while stainless steel must contain 10.5 percent chromium or more. That essential difference is what gives carbon steel and stainless steel their distinct physical characteristics.

Carbon Steel	Stainless Steel
Vulnerable to rust	Resistant to rust
Brittle	Less Brittle
Wear-resistant	Less wear-resistant

Types of Carbon Steel

1. Low carbon steel – Carbon content 0.55-1.05%
2. Medium carbon steel- Carbon content 0.25-10.6%
3. High carbon steel- Carbon content 0.9-2.5%
4. Super High carbon steel- Carbon content 2.5-3.0%

Commonly used Carbon Steel explained below:

1. Low Carbon Steel

- Plain carbon steels - very low content of alloying elements and small amounts of Mn.
- Most abundant grade of steel is low carbon steel - greatest quantity produced; least expensive.
- Not responsive to heat treatment; cold working needed to improve the strength.
- Good Weldability and machinability.
- High Strength, Low Alloy (HSLA) steels - alloying elements (like Cu, V, Ni and Mo) up to 10 wt %; have higher strengths and may be heat treated.

2. Medium Carbon Steel

- Carbon content in the range of 0.3 – 0.6%.
- Can be heat treated - austenitizing, quenching and then tempering.
- Most often used in tempered condition – tempered martensite.
- Medium carbon steels have low hardenability.
- Addition of Cr, Ni, Mo improves the heat treating capacity.
- Heat treated alloys are stronger but have lower ductility.
- Typical applications – Railway wheels and tracks, gears, crankshafts.

3. High Carbon Steel

- High carbon steels – Carbon content 0.6 – 1.4%.
- High C content provides high hardness and strength.
- Hardest and least ductile.
- Used in hardened and tempered condition.
- Strong carbide formers like Cr, V, W are added as alloying elements to from carbides of these metals.
- Used as tool and die steels owing to the high hardness and wear resistance property.

4. Super High Carbon Steel

- Approximately 1.25–2.0% carbon content.
- Steels that can be tempered to great hardness.
- Used for special purposes like (non-industrial-purpose) knives, axles or punches.
- Most steels with more than 2.5% carbon content are made using powder metallurgy.

Application of Carbon Steel

Carbon steel is used in boilers, pressure vessels, heat exchangers, piping, and other moderate-temperature service systems in which good strength and ductility are desired. Significant other factors include cost, availability, and the ease of fabrication.

Effects of Alloying Elements on Steel

•Manganese – strength and hardness; decreases ductility and weldability; effects hardenability of steel.
•Phosphorus – increases strength and hardness and decreases ductility and notch impact toughness of steel.
•Sulfur decreases ductility and notch impact toughness Weldability decreases. Found in the form of sulfide inclusions.
•Silicon – one of the principal deoxidizers used in steel making. In low-carbon steels, silicon is generally detrimental to surface quality.
•Copper – detrimental to hot-working steels; beneficial to corrosion resistance (Cu>0.20%).
•Nickel - ferrite strengthener; increases the hardenability and impact strength of steels.
•Molybdenum - increases the hardenability; enhances the creep resistance of low-alloy steels.

Frequently Used ASTM Grades of Carbon Steel

Carbon Steel	Type	Standard	Grades	Specification
Medium-Temp	Pipes	A106	A, B, C	This specification covers carbon steel pipe for high-temperature service.
	Fittings	A234	WPA, WPB, WPC	This specification covers wrought carbon steel and alloy steel fittings of seamless and welded construction.
	Flanges	A105		This specification covers standards for forged carbon steel piping components, that is, flanges, fittings, Valves, and similar parts, for use in pressure systems at ambient and higher-temperature service conditions.
	Valves	A216	WCB	This specification covers carbon steel castings for Valves, flanges, fittings, or other pressure-containing parts for high-temperature service and of quality suitable for assembly with other castings or wrought-steel parts by fusion welding.
	Bolts & Nuts	A193	B7	This specification covers alloy and stainless steel bolting material for pressure vessels, Valves, flanges, and fittings for high temperature or high pressure service, or other special purpose applications.
		A194	2H	Standard specification for nuts in many different material types.

High-Temp	Pipes	A335	P1, P11, P12, P22, P5, P9	This specification covers seamless ferritic alloy-steel pipe for high-temperature service.
	Fittings	A234	WP1, WP11, WP12, WP22, WP5, WP9	This specification covers wrought carbon steel and alloy steel fittings of seamless and welded construction.
	Flanges	A182	F1, F11, F12, F22, F5, F9	This specification covers forged or rolled alloy and stainless steel pipe flanges, forged fittings, and Valves and parts for high-temperature service.
	Valves	A217	WC1, WC6, WC9, C5, C12	This specification covers steel castings, martensitic stainless steel and alloys steel castings for Valves, flanges, fittings, and other pressure-containing parts intended primarily for high-temperature and corrosive service.
	Bolts & Nuts	A193	B7	This specification covers alloy and stainless steel bolting material for pressure vessels, Valves, flanges, and fittings for high temperature or high pressure service, or other special purpose applications.
		A194	2H	Standard specification for nuts in many different material types.
Low-Temp	Pipes	A333	6, 3	This specification covers wall seamless and welded carbon and alloy steel pipe intended for use at low temperatures.
	Fittings	A420	WPL6, WPL3	Standard specification for piping fittings of wrought carbon steel and alloy steel for low-temperature service.
	Flanges	A182	F304, F316, F321, F347	This specification covers forged or rolled alloy and stainless steel pipe flanges, forged fittings, and Valves and parts for high-temperature service.
	Valves	A182	F304, F316, F321, F347	This specification covers forged or rolled alloy and stainless steel pipe flanges, forged fittings, and Valves and parts for high-temperature service.
	Bolts & Nuts	A193	B8	This specification covers alloy and stainless steel bolting material for pressure vessels, Valves, flanges, and fittings for high temperature or high pressure service, or other special purpose applications.
		A194	8	Standard specification for nuts in many different material types.

Heat Treatment

The purpose of heat treating carbon steel is to change the mechanical properties of steel, usually ductility, hardness, yield strength, or impact resistance. Note that the electrical and thermal conductivity are only slightly altered. As with most strengthening techniques for steel, Young's modulus (elasticity) is unaffected. All treatments of steel trade ductility for increased strength and vice versa. Iron has a higher solubility for carbon in the austenite phase; therefore, all heat treatments, except spheroidizing and process annealing, start by heating the steel to a temperature at which the austenitic phase can exist. The steel is then quenched (heat drawn out) at a moderate to low rate allowing carbon to diffuse out of the austenite forming iron-carbide (cementite) and leaving ferrite, or at a high rate, trapping the carbon within the iron thus forming martensite. The rate at which the steel is cooled through the eutectoid temperature (about 727°C) affects the rate at which carbon diffuses out of austenite and forms cementite. Generally speaking, cooling swiftly will leave iron carbide finely dispersed and produce a fine grained pearlite and cooling slowly will give a coarser pearlite. Cooling a hypoeutectoid steel (less than 0.77 wt% C) results in a lamellar-pearlitic structure of iron carbide layers with α-ferrite (nearly pure iron) between. If it is hypereutectoid steel (more than 0.77 wt% C) then the structure is full pearlite with small grains (larger than the pearlite lamella) of cementite formed on the grain boundaries. A eutectoid steel (0.77% carbon) will have a pearlite structure throughout the grains with no cementite at the boundaries. The relative amounts of constituents are found using the lever rule. The following is a list of the types of heat treatments possible:

1. **Spheroidizing**
2. **Full annealing**
3. **Process annealing**
4. **Isothermal annealing**
5. **Normalizing**
6. **Quenching**
7. **Martempering (Marquenching)**
8. **Tempering**
9. **Austempering**

Forging Temperature of Steel

Steel Type	Maximum forging temperature (°F / °C)	Burning temperature (°F / °C)
1.5% carbon	1920 / 1049	2080 / 1140

1.1% carbon	1980 / 1082	2140 / 1171
0.9% carbon	2050 / 1121	2230 / 1221
0.5% carbon	2280 / 1249	2460 / 1349
0.2% carbon	2410 / 1321	2680 / 1471
3.0% nickel steel	2280 / 1249	2500 / 1371
3.0% nickel–chromium steel	2280 / 1249	2500 / 1371
5.0% nickel (case-hardening) steel	2320 / 1271	2640 / 1449
Chromium–vanadium steel	2280 / 1249	2460 / 1349
High-speed steel	2370 / 1299	2520 / 1385
Stainless steel	2340 / 1282	2520 / 1385
Austenitic chromium–nickel steel	2370 / 1299	2590 / 1420
Silico-manganese spring steel	2280 / 1249	2460 / 1350

Chemical Composition of ASTM A106 Seamless Steel Pipes

ASTM A106 Steel Grade	C, max.%	Mn %	P, max	S, max	Si, min	Cr, max	Cu, max	Mo, max	Ni, max	V, max
Grade A	0.25	0.27 - 0.93	0.035	0.035	0.1	0.4	0.4	0.15	0.4	0.08
Grade B	0.3	0.29 - 1.06	0.035	0.035	0.1	0.4	0.4	0.15	0.4	0.08
Grade C	0.35	0.29 - 1.06	0.035	0.035	0.1	0.4	0.4	0.15	0.4	0.08

Mechanical Properties of ASTM A106 Seamless Pipes

ASTM A106 Steel Grade	Tensile Test mpa or N/mm2	
	Min. Yield Point	Tensile Strength
Grade A	205	330Min
Grade B	240	415Min
Grade C	275	485Min

Equivalents of ASTM A106 Seamless Pipes

Specification	Mechanical Properties	Grade A	Grade B	Grade C
ASTM A53	Tensile strength, min, psi (mpa)	48000(330)	60000(415)	
	Yield strength, min, psi (mpa)	30000(205)	35000(240)	
ASTM A106	Tensile strength, min, psi (mpa)	48000(330)	60000(415)	70000(485)
	Yield strength, min, psi (mpa)	30000(205)	35000(240)	40000(275)

Manufacturing Carbon Steel Pipes & Tubes in ASTM A106 Grade B

ASTM A106 Grade B Carbon Steel Pipes	ASTM A106 Grade B Carbon Steel Seamless Pipes
ASTM A53 Grade B/IS 1239 Carbon Steel Welded Pipes	ASTM A500 Grade B Carbon Steel Square Pipes
ASTM A105 Carbon Steel Flanges	ASTM A234 WPB Carbon Steel Buttweld Fittings

ASTM A105 Carbon Steel Forged Fittings	ASTM A105 Carbon Steel Socket Weld Pipe Fittings
ASTM A105 Carbon Steel Threaded Fittings	Carbon Steel Fasteners
Carbon Steel Nuts & Bolts	ASTM A106 Grade B Carbon Steel U Bends
Carbon Steel Valves	ASTM A106 Grade B Carbon Steel Tubes
Carbon Steel Pipe Fittings	ASTM A106 Grade B Carbon Steel Seamless Tubing
ASTM A179 Carbon Steel Heat Exchanger Tubes	ASTM A106 Grade B Carbon Steel Large Dia. Pipes
ASTM A106 Grade B Carbon Steel Boiler Tubes	ASTM A106 Grade B Carbon Steel High Pressure Pipes
ASTM A105 Grade B Carbon Steel Forgings	ASTM A106 Grade B Carbon Steel High Temperature Pipes

About Metallica Metals – The Steel Pipes Factory

- Established in 1975, the Metallica Metals Group (The Steel Pipes Factory) has its operations spread across major cities in India. We are a pioneer in the stainless steel pipes, nickel alloy products, titanium products, carbon steel pipes and alloy steel pipes manufacturing and processing industry. Our products including pipe fittings, flanges, pipes, sheet plates and valves are exported to over 70 countries across the world, while in India we have supplied to even the remote areas. With over 250 tons of sale in stainless steel and carbon steel pipes every day, Metallica has emerged as a prominent vendor for many buyers in India and Overseas
- More than 3000 tons ready from stock and new production ready in just a few weeks.
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Our Key Products

STAINLESS STEEL & NICKEL ALLOYS	INSTRUMENTATION TUBES & FITTINGS	PRODUCTS
Pure Nickel Alloys	Instrumentation Tube	Steel Sheet & Plate
Monel Alloys (Ni-Cu Alloys)	Hydraulic Tubing	Steel Coil & Strip
Inconel (Ni-Cr-Mo) Alloys	Seamless Tubing	Steel Pipes
Incoloy Alloys (Ni-Cr-Fe)	Instrumentation Tube Fittings	Steel Tubes

Hastelloy Alloys
Stainless Steel 304/304L
Stainless Steel 309S/309H
Stainless Steel 310/310S
Stainless Steel 316/316L
Stainless Steel 316Ti
Stainless Steel 317/317L
Stainless Steel 321/321H
Stainless Steel 347/347H
Stainless Steel 904L
Duplex Steels (UNS S32205, UNS S31803)
Super Duplex Steels (UNS S32760 / UNS S32750)
Stainless Steel 254 SMO (UNS S31254 / 1.4547)

Double Compression Tube Fittings
Precision Pipe Fittings
Needle & Guage Valves
Manifold Valves

Electropolish Tube
Heat Exchanger Tubes
Steel Bars/Rods & Wire
Fasteners (Nut, Bolt, Washer)
Steel Angle Bars
Hex Steel Bars
Round Steel Bars & Rod
Flat Steel Bars
Forgings, Rings & Forged Blocks
Stainless Steel Pipe
Stainless Steel Seamless Pipe
Stainless Steel Welded Pipe
Stainless Steel Tubes
Stainless Steel Furnace Tubes
Stainless Steel Seamless Tubing
Stainless Steel Heat Exchanger Tubes
Large Diameter Pipe

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