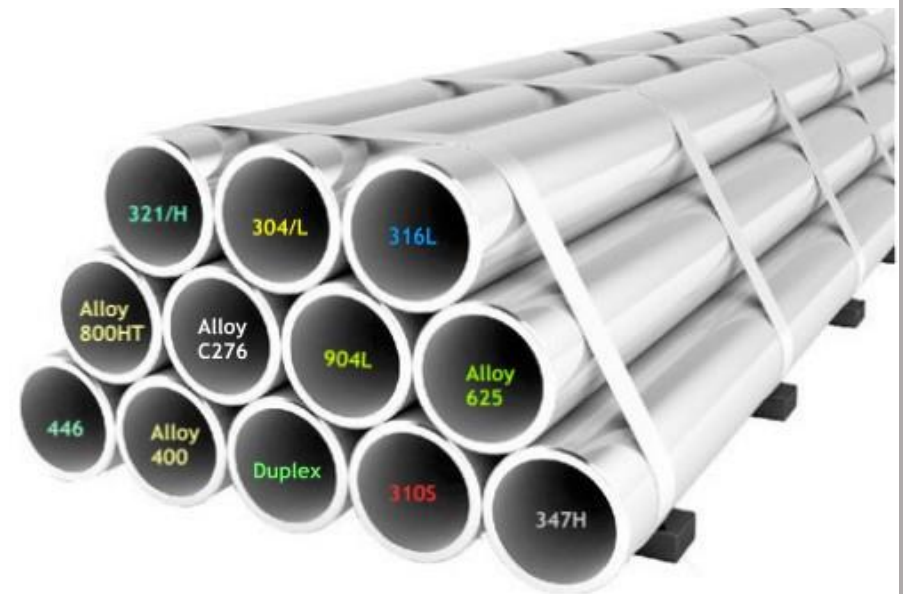


## A179 CARBON STEEL

### Datasheet for A179 Carbon Steel

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



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# Datasheet for Carbon Steel A179

## ASME SA 179, UNS K01200, 1.0309/1.0305

### What is Carbon Steel A179?

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 A179 Product Specification

Product	ASTM A179 Seamless Low-Carbon Tubes
Specification	ASTM A179
Type	Seamless
Size	1/8 to 3 in. [3.2 to 76.2 mm]
Diameter	10.3-76.2mm
Thickness	1.2 to 12mm
Length	6m or above, or as customer's requirement.
Surface Quality	Black, Oiled, Phosphating, Bright

## 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 form 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  $\alpha$ -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 A179 Low-Carbon Steel Heat Exchanger Tubes

Chemical Components (%)			
C	Mn	P	S
0.06-0.18	0.27-0.63	0.035 max	0.035 max

#### Mechanical Properties of ASTM A179 Low-Carbon Steel Heat Exchanger Tubes

Tensile Strength (Mpa)	Yield Strength (Mpa)	Elongation (%)	Hardness (HRB)
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325 min	180 min	35 min	72 max
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### Manufacturing Carbon Steel Pipes & Tubes in ASTM A179

CS ASTM A179 Seamless Tubing	ASME SA 179 Low Carbon Tubes
ASTM A179 Heat Exchanger Tubes	CS ASME SA179 Condenser Tubes
ASTM A179 Cold Drawn Tubes	ASTM A179M Polish Tubes
ASTM A179 Polish Seamless Tubes	ASME SA179 Rectangular Tubes Supplier
ASTM A179 Square Tubing	ASME SA179 Low Carbon Steel Round Tubes
ASTM A179 Condenser Tubes	ASTM A179 Heat Exchanger Tubing
Low Carbon ASME SA179 Tubes	CS ASTM A179 Tubing
ASME SA179 Seamless Tubing Exporter	ASTM A179M Cold Drawn Tube
Low Carbon ASTM A179 Plain End Tubes	ASME SA179 Beveled End Tube
ASME SA179 Single Random Tube	ASTM SA179 Double Random Tubes
ASTM A179 Seamless Tubing	ASTM A 179 Condenser Tubes
ASTM A179M Carbon Steel Tubes	ASME SA179 Heat Exchanger Tubes
ASME SA 179 Cold Drawn Tubing	ASTM A179 Boiler Tubes

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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)

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Seamless Tubing  
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Electropolish Tube  
Heat Exchanger Tubes  
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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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