

# Stainless Steel Pipe

## The Clear Choice for Pure and Reliable Water Systems



SPLASH  
P.O. Box 8232  
Huntington, WV 25705  
304-733-1516

[www.S-P-L-A-S-H.org](http://www.S-P-L-A-S-H.org)

## What is SPLASH?

Stop Pipe Leaks Ask for Stainless Help (SPLASH) is a non-profit association of suppliers, fabricators, equipment manufacturers and two metals associations with the common goal of developing the market for nickel and molybdenum-bearing corrosion resistant materials for potable water distribution and transmission.

It is our goal to have communities throughout the United States accept wrought and cast **stainless steel** components for use in the storage, distribution, and transmission of potable water.



## Why Stainless Steel?

### Material Cost Savings

Stainless Steels have higher strength and ductility when compared to steel and cast iron pipes. The higher strength results in pipe wall thickness reductions.

### Corrosion Protection

Coating or cathodic protection is not required for Stainless Steel in most locations. A thin chromium-rich self-healing oxide film provides corrosion protection for Stainless Steel and no corrosion allowance is required.

### Erosion Resistance

Stainless Steels are much more resistant to erosion-corrosion caused by high flow rates and particulate matter than steel. They can handle high velocity and turbulence (pumps) without suffering wall thickness erosion.

### Low Coefficient of Friction

Stainless Steel retains low hydraulic friction properties as compared to aging cement lined or corroded steel pipes, which results in lower water pressure losses and pumping cost savings.

### Ease of Fabrication

Stainless Steels have excellent ductility and can be formed and welded into lightweight shapes, which assists in the handling and installation of pipelines. Stainless steel pipe is highly interchangeable and easily connected with other water piping systems and materials using couplings and fittings.

### Long Pipe Lengths

Stainless Steel pipe can be ordered in 20-foot and 40-foot lengths and even 60-foot lengths for pipe diameters up to 16-inches. Ductile iron is only available up to 20 feet in length. The number of joints, and therefore cost, is reduced for long Stainless Steel pipe strings.



**Utility** water piping for process industry  
(Photo Courtesy of the Nickel Institute)

**Title:** Greater Vancouver Regional Water District installation of the 120-inch diameter stainless steel water pipe in British Columbia, Canada (Photo Courtesy of the Greater Vancouver Regional Water District).



**Stainless Steel Water Pipe** 6-inch Schedule 40 x 52-foot lengths, Mesa Verde National Park, Colorado  
 (Photo Courtesy of the Nickel Institute)

**Recyclable**

Unlike cement lined and non-metallic pipe, Stainless Steels are easily recycled and their alloy content is highly valued. Recycled stainless steel and other recycled ferrous materials are used in the melting process to produce Stainless Steel, which has an average recycled content of approximately 60%.

**Low Leakage Rates**

Stainless Steels do not suffer from uniform corrosion like their ductile iron or steel counterparts, which can result in the rupture and failure of pipelines. Fully welded or fully restrained stainless steel joints can lower leakage rates.

**Hygienic**

Due to their protective passive film Stainless Steels are basically inert in potable waters, which maintains water quality and drinking water integrity. Stainless Steels are used for high purity pharmaceutical water and ANSI/NSF drinking waters.

**Extended Service Life**

Stainless steel components can provide 100 years of service due to their excellent corrosion resistance and ductility at all service temperatures.

**Environmental Effects**

- **Temperature** – As operating temperatures decrease, ductile iron, carbon steel and non-metallic pipes decrease in impact strength and become more brittle. Brittle water main failures may result during low temperature weather conditions. Stainless Steel remains ductile and flexible at all temperature exposures.
- **UV Resistance** – Stainless Steel properties are not affected by exposure to UV light, which will degrade non-metallic pipe.
- **Soil Corrosion** – Stainless Steels resist corrosion in most soils and do not require coatings or electro chemical protection systems.



**Horizontally drilled pipeline** Joint connections involve welded couplings, Mesa Verde (Photo Courtesy of the Nickel Institute)

## Which Stainless Steel?

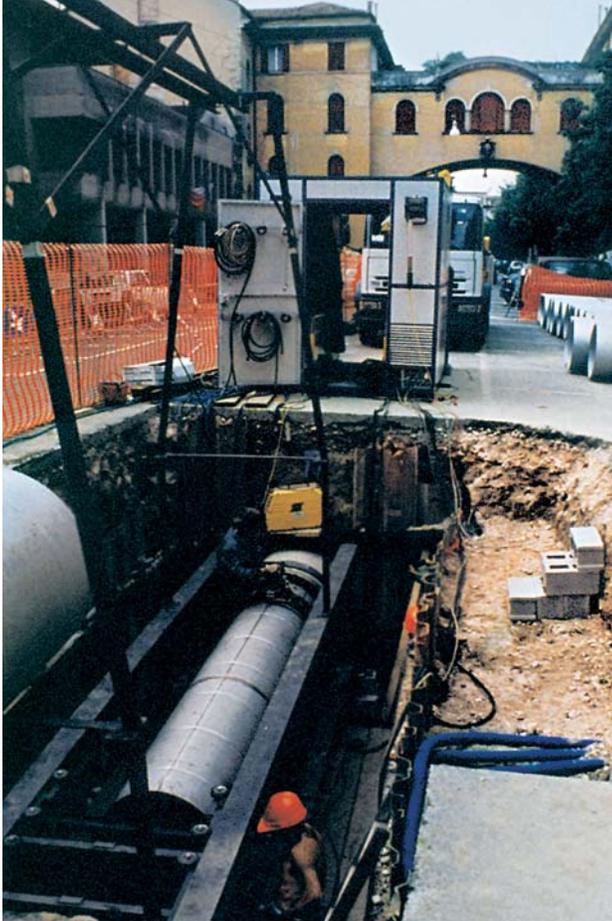
Types 304L and 316L stainless steel piping have been successfully used in over 100 potable water treatment plants and related potable water applications in North America. These readily available stainless steels have given excellent performance in transporting potable water from desalination plants, potable water distribution systems, and potable water treatment plants all over the world. Type 304L stainless steel has shown excellent corrosion resistance handling finished waters with a residual chlorine content up to 2 ppm, while 316L and higher alloys have the capability to handle waters with up to 5 ppm residual chlorine.

For selection of stainless steel for buried piping applications, it is important to consider corrosion resistances of buried stainless steels in relation to the presence of chloride ions in the soil and secondly according to the soil resistivity and pH. Lower resistivity soils can be more corrosive especially when the resistivity is less than 1000 ohm cm. Acidic soils tend to be more aggressive than near neutral or alkaline soils. Poor aeration and drainage also increase the corrosivity of the soil.

The composition of some stainless steels approved for potable water applications are shown in Table 1. The PREN number is “the pitting resistance equivalent number” and is calculated using the weight percent of alloying elements. A higher PREN number relates semi-quantitatively to a higher resistance to localized corrosion in chloride-bearing soils. **PREN = %Cr + 3.3%Mo + 16%N.**

Grade	Cr	Ni	Mo	N	Fe	PREN
<b>Austenitic</b>						
304/304L	18	8	-	-	balance	18
316/316L	16	10	2.1	-	balance	24
<b>Duplex</b>						
2205	22	5	3.1	0.17	balance	35
2003	20	3	1.7	0.16	balance	28
2304	23	4	0.3	0.12	balance	26
2101	21	1	0.3	0.22	balance	26

**Table 1** Nominal Composition (wt%) and Pitting Resistance Equivalent **PREN = Cr + 3.3Mo + 16N**



**Rehabilitation of a failed DCI line** with thin-wall stainless steel pipe going under a road thoroughfare in Padua, Italy (Photo Courtesy of the Nickel Institute)

The duplex family of stainless steels has a structure that is approximately 50% ferrite and 50% austenite. As shown in Table 2, the duplex materials provide significantly higher strength levels but somewhat lower elongations than austenitic stainless steels. Stainless steels possess higher levels of tensile strength and ductility when compared to ductile iron. Ductile iron has a minimum elongation of 10% versus 40% minimum for 300 series stainless steels and 25% minimum for most duplex stainless steels. Stainless steels are significantly more ductile than cast iron.

Grade	0.2% Yield Strength (ksi)	Tensile Strength (ksi)	% Elongation
<b>Austenitic</b>			
304	30	75	40
304L	25	70	40
316	30	75	40
316L	25	70	40
<b>Duplex</b>			
2205	65	95	25
2003	65	90	25
2304	58	87	25
2101	65	94	30
<b>Ductile Iron</b>			
	42	60	10

**Table 2** Minimum Tensile Properties of Stainless Steel (ASTM A 240) and Ductile Iron



**Stainless Steel Tapping Sleeve**  
Large diameter tapping sleeve  
(Photo Courtesy of JCM Industries)

## Which Standards?

Grades 304L, 316L, 2205, 2003, 2304, and 2101 meet EPA and ANSI/NSF International Standard 61, Addendum C. Stainless Steel is also included in the International Building and International Plumbing Codes.

**AWWA C219** - Bolted Sleeve-Type Couplings on Plain end Pipe

**AWWA C220** - Stainless Steel Piping

**AWWA C221** - Fabricated Steel Mechanical Slip-Type Expansion Joints

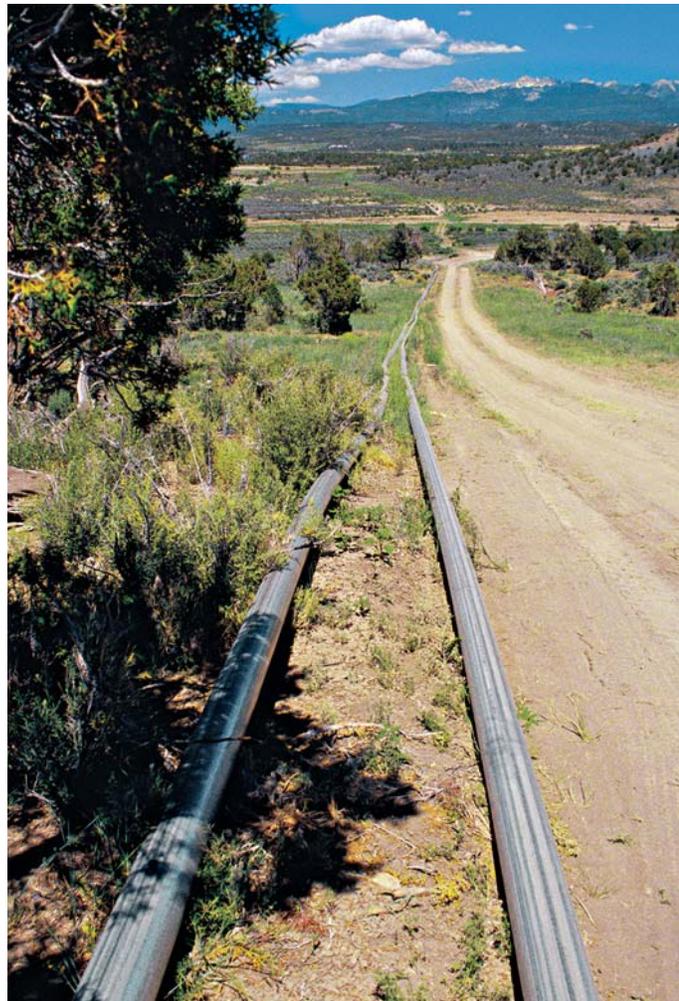
**AWWA C223** - Tapping Sleeves

**AWWA C226** - Stainless Steel Fittings

**AWWA C606** - Grooved and Shouldered Joints

**AWWA C2BB** - Stainless Steel Flanges

**AWWA C2DD** - Bolted Split Sleeve Type Couplings



**Stainless Steel Water Pipe** Above ground application (Photo Courtesy of the Nickel Institute)

## Stainless Steels References for Water Applications

### United States:

Colorado – Mesa Verde National Park, 11 km of 316L pipe used for a water pipeline that was installed using a directional drilling technique

New York City - Manhattan Water Ducts: replacement of cast iron ducts using 316L clad and solid risers (1991, 2002 and 2005)

### Hong Kong:

Polluted water discharge circuits using 2205 duplex stainless steel (high strength properties + corrosion resistance)

### Tokyo:

Since 1980 : river water bridges, water tanks, potable water ducts in 316L (corrosion resistance, safe in case of earthquakes)

Replacement of all lead service water lines in the City of Tokyo with stainless steel

### Italy:

Water towers, mineral water pipes, extensive use of thin wall 316L pipes for internal retubing

### Libya:

850 km of 316L welded pipes for fresh water transportation (1987)

### Sweden:

Buried 316L pipe lines (fresh water, military fuel network since 1980, 6 km)

### Canada:

Vancouver, B.C., 1999 : 316LN water main pipeline (10 km)

Vancouver, B.C., ozonated water line (3 m diameter x 335 m length)

**Stainless Steel Water Pipe** 120-inch diameter pipe, Greater Vancouver Regional Water District, British Columbia, Canada (Photo Courtesy of GVRD)





**Installation** Stainless steel tapping installation (Photo Courtesy of JCM Industries)



**Stainless Steel Fittings/Stainless Steel Spacer** (Photo Courtesy of JCM Industries)

## What Sizes of Stainless Steel Pipe are Available?

### Range of Stainless Steel Pipe Sizes

1/2 inch – 16-inch diameter – lengths up to 60 feet  
 18 inch – 120-inch diameter - lengths up to 48 feet

Stainless Steel is also available as fittings, clamps, couplings, tapping sleeves and other standard components of construction.

## Who Provides Stainless Steel Products and Services?

### SPLASH Members:

- Allegheny Ludlum ([www.alleghenyludlum.com](http://www.alleghenyludlum.com)) - Flat-rolled stainless steel producer
- AB&H, A Donohue Group ([www.abh-donohue.com](http://www.abh-donohue.com)) - Water and transportation engineering services
- Associated Tube Industries ([www.associatedtube.com](http://www.associatedtube.com)) - Stainless steel pipe and tube producer
- Bestweld ([www.bestweld.com](http://www.bestweld.com)) - Stainless steel pipe fittings producer
- Bristol Metals, L.P. ([www.brismet.com](http://www.brismet.com)) - Stainless steel pipe producer
- Dresser Industries ([www.dresser.com](http://www.dresser.com)) - Stainless steel pipe couplings and fittings producer
- Industeel ([www.industeel.info](http://www.industeel.info)) - Stainless steel plate producer
- International Molybdenum Association ([www.imoa.info](http://www.imoa.info)) - Association that promotes use of molybdenum
- JCM Industries ([www.jcmindustries.com](http://www.jcmindustries.com)) - Stainless steel pipe couplings and fittings producer
- Nickel Institute ([www.nickelinstitute.org](http://www.nickelinstitute.org)) - Organization that promotes use of nickel
- Outokumpu Stainless ([www.outokumpu.com](http://www.outokumpu.com)) - Stainless steel pipe, bar, and flat-rolled producer
- Smith-Blair Inc. ([www.smith-blair.com](http://www.smith-blair.com)) - Stainless steel pipe couplings and fittings producer
- Southwest Research Institute ([www.swri.org](http://www.swri.org)) - Applied research and development organization
- Straub Couplings ([www.straub-couplings.com](http://www.straub-couplings.com)) - Stainless steel pipe couplings producer
- Trent Tube ([www.trent-tube.com](http://www.trent-tube.com)) - Stainless steel tube producer
- Victaulic Company ([www.victaulic.com](http://www.victaulic.com)) - Stainless steel pipe couplings and fittings producer

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