Stainless Steel Pipe
The Clear Choice for Pure and Reliable Water Systems
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.
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.
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. \[ \text{PREN} = %\text{Cr} + 3.3\%\text{Mo} + 16\%\text{N}. \]

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Table 1 Nominal Composition (wt%) and Pitting Resistance Equivalent. \[ \text{PREN} = %\text{Cr} + 3.3\%\text{Mo} + 16\%\text{N}. \]
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.

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)

<table>
<thead>
<tr>
<th>Grade</th>
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<th>Tensile Strength (ksi)</th>
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*Table 2* Minimum Tensile Properties of Stainless Steel (ASTM A 240) and Ductile Iron
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 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

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