

Aluminized Steel Type 2 Pipe for added durability

Strength of steel, corrosion resistance of aluminum

Corrugated Steel Pipe manufactured from Aluminized Steel Type 2 offers the corrosion resistance and surface characteristics of aluminum with the strength and economy of Corrugated Steel Pipe.

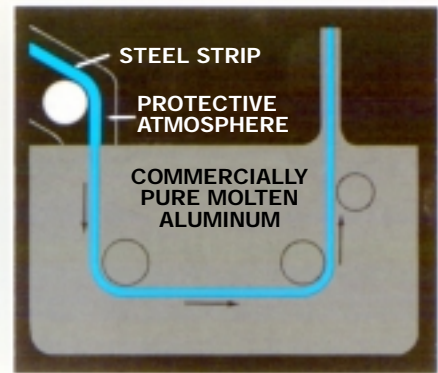
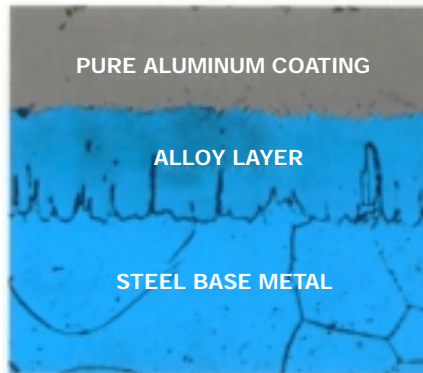
The product is fabricated from steel coils that have been hot-dip coated in a bath of commercially pure aluminum. The coating has uniform thickness on *both sides* of the sheet, with a strong metallurgical bond between the metals. The Aluminized Steel Type 2 material meets AASHTO specifications M274 and ASTM A 929.

The coils are then fabricated into helically corrugated pipe meeting the requirements of AASHTO specifications M36 and ASTM A 760. Helically corrugated steel pipe has been a standard of the construction industry for decades. Pipe is fabricated with lock seams or welded seams depending on the job requirements, and each pipe end can be reformed to provide at least two annular corrugations.

Excellent barrier protection

Aluminum forms a passive aluminum oxide film that adds to the service life by providing good barrier protection. This passive film forms rapidly and maintains better protection over a wider environmental range than zinc reaction product films. The aluminum oxide passive film is effective in both hard and soft water.

The passive oxide film will endure as long as the free aluminum coating layer lasts. When this layer is eventually penetrated, there is an underlying hard, thick aluminum-iron alloy layer that provides



The photomicrograph on the left shows how the thick alloy layer metallurgically bonds the aluminum coating to the steel base metal, as well as how the coating provides continuous protection to the base metal. The same coating protection is provided to both sides of the steel base metal.

further corrosion protection plus some significant abrasion protection.

Based on field studies of 42-43 year installations, Aluminized Steel Type 2 service life is estimated to be 75 years minimum at 16 gage in the 5-9 pH and $\geq 1,500$ ohm-cm resistivity ranges.

In some cases, the pH/resistivity ranges may be extended somewhat as is the case in arid regions where moisture availability is generally a controlling factor, and satisfactory service life may be realized at soil resistivities somewhat below the 1,500 ohm-cm lower limit. In wetter climates, satisfactory service life may be realized at soil pH values below the 5.0 lower limit when resistivities are relatively high.

In general, however, environments outside the recommended pH/resistivity ranges should be subjected to additional testing to see if conditions conducive to accelerated corrosion actually exist. For example, low resistivity waters and soils may contain excessive concentrations of corrosive chloride and sulfates salts. In addition, any dark or light gray, blue, or olive-colored clay constituents observed in a heterogeneous soil should be

isolated for pH measurement since these sometimes contain water-soluble heavy metal salts. These constituents induce strong acidification necessitating the use of a bituminous coating to ensure normal soilside corrosion behavior.

Environments that are far outside the recommended pH/resistivity ranges should be avoided, including acid mine water, seawater, estuary brackish water, and sanitary/industrial sewage.

Ideal for storm sewers

Aluminized Steel Type 2 corrugated steel pipe is an ideal material for municipal storm sewers or any

Standard specifications

1. AASHTO M274 (Aluminized Steel Type 2 material) and ASTM A 929.
2. AASHTO M36 and ASTM A 760 (conduit, pipe.)
3. AASHTO Standard Bridge Design Specifications, Section 12 (structural design) and ASTM A 796.
4. ASTM A 798 (installation).

normal drainage project. Aluminized Steel Type 2 pipe offers a durable and economical alternate to reinforced concrete pipe. Features include light weight, long lengths, and joints that have positive pull-apart resistance and the ability to adjust to yielding foundations.

Pipe and pipe-arch are available in four corrugations (2 2/3" x 1/2", 3" x 1", 125mm x 25mm, and Spiral Rib's 3/4" x 3/4" x 7 1/2" rib corrugation) and in all standard diameters and 16 gage through 10 gage.

Long-term field testing

Based on extensive data from actual field installations dating back 43 years, Aluminized Steel Type 2 is a superior product for storm sewer and drainage projects. It has better corrosion resistance than galvanized structures and displays better abrasion resistance.

Prior to 1953, Aluminized Steel Type 2 and galvanized steel culverts were exposed in sites across the U.S. These sites represented a variety of service conditions including farm field drainage, fresh water swamps, alkali soils, and erosive applications. Test installations were sampled after eight years and again after 24 years. Weight loss data analyzed at all sites indicate Aluminized Steel Type 2 provided significant additional corrosion resistance.

In addition to the careful sampling and evaluation accomplished during this 24-year program, simple visual inspection revealed that:

- The appearance of Aluminized Steel Type 2 was clearly superior to that of conventional metallic coating.

- The condition of Aluminized Steel Type 2 pipe inverts—a critical point in durability design—was excellent.

In 1952-53, an additional 135 composite culverts of Aluminized Steel Type 2 and galvanized steel were installed in 20 states. Based on the current conditions of the pipes available, the data indicates a minimum 75-year service life for 16 gage Aluminized Steel Type 2 pipe when installed in the recommended environment.

Independent studies

Many independent studies have been performed that confirm AK Steel Corporation's long-term field test.



▲ This close-up view shows the Aluminized Steel Type 2 pipe installed in Garland, Maine, with the dark staining wiped away to reveal the like-new underlying aluminum.

► This Aluminized Steel Type 2 corrugated steel pipe was installed in 1953 in El Dorado, California. It was inspected in 1982 and in 1995. Coupons were removed in 1995 for evaluation by the AK Steel Research Center and CALTRANS.



◀ AK Steel Research Center's corrosion engineers and Missouri D.O.T. material engineers inspect a 43-year old Aluminized Steel Type 2 pipe installation. This is one of two culvert installations in Carter County, Missouri, installed in a series containing half Aluminized Steel Type 2 pipe and half galvanized steel pipe.

Performance proven by 43-year field test

42- and 43-year old Aluminized Steel Type 2 coupons taken from pipe inverts around the United States



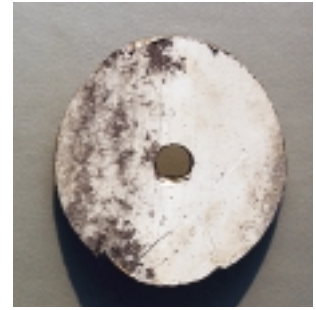
*Marshall County, IA
Installed 1952
Inspected 1995*



*Lafayette County, MO
Installed 1952
Inspected 1995*



*Snohomish County, WA
Installed 1952
Inspected 1995*



*Morgan County, IL
Installed 1952
Inspected 1995*



*Bernalillo County, NM
Installed 1952
Inspected 1995*



*Oklahoma County, OK
Installed 1953
Inspected 1995*



*San Benito County, CA
Installed 1953
Inspected 1995*



*Decatur County, KS
Installed 1953
Inspected 1995*

Newer pipe sites inspected. Same long-term performance expected.



*Richland County, SC
Installed 1978
Inspected 1995*



*Merrill Township, ME
Installed 1979
Inspected 1995*



*Montgomery County, MD
Installed 1980
Inspected 1995*



*Gwinnett County, GA
Installed in 1983
Inspected 1995*

AK Steel has inspected many more pipe sites around the United States, and these field research studies indicate a minimum 75-year service life for Aluminized Steel Type 2 Corrugated Steel Pipe installed in the recommended environment.



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