AK Steel
A CLEVELAND-CLIFFS COMPANY

ALUMINIZED STEEL TYPE 2

PERFORMANCE

Technical Bulletin

FIGURE 1– Comparative attack of Alclad on test pipe exposed to soil backfill (top) and that exposed to concrete (middle and bottom). Cladding (lighter etched) is penetrated and there is none of the usual lateral growth of pitting through the cladding. Instead, there is a continuing progress into the core, indicating no effective galvanic protection by the cladding. Galvanic protection is normally lost at excessively high or low pH. Thus, even without cladding galvanic protection, the progress of aluminum corrosion after 14 years is quite minor.

Performance of Aluminized Type 2 Drainage Pipe in Contact with Cementitious Materials

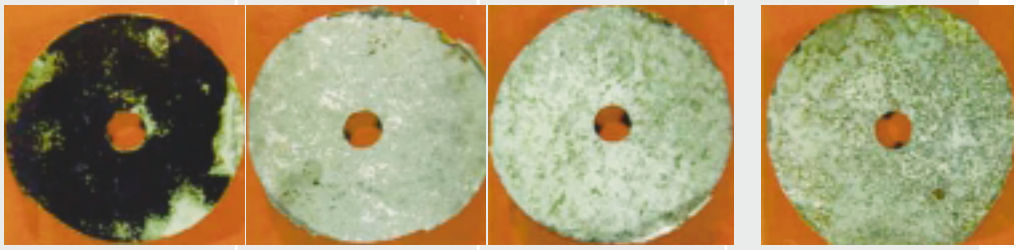
Aluminized Steel Type 2 superior durability is not impacted by concrete headwalls or cementitious backfills. The coating aluminum layer is subject to attack by cement alkalinity. However, the coating intermetallic Al-Fe alloy layer is resistant to cement alkalinity and also provides good protection against soilside corrosion. As is well known, the corrosion behavior of a steel substrate is enhanced by cement alkalinity due to passivation.

By 1984, 30 year field tests had shown that concrete headwalls had no significant adverse effect on Aluminized Type 2. There is some spotty attack of the coating Al layer during the concrete curing period, but this is arrested at the Al-Fe coating layer which is fully resistant to cement alkalinity due to its iron content. But even on solid aluminum pipe, which has no Al-Fe coating barrier, the long-term alkalinity attack by concrete headwalls has been shown to be minimal. This has been demonstrated by CALTRANS in 14 year testing of Alclad pipe. AK Steel examination of specimens of the Alclad pipe supplied by CALTRANS showed that even on this solid aluminum material there was no significant progress of corrosion in 14 years of underground exposure while encased in a concrete envelope. (See Figure 1 illustrating pitting limited to just 7 mils maximum penetration on 14 year old material.)

ALUMINIZED STEEL TYPE 2 PERFORMANCE

The results of the 1984 studies on Aluminized Type 2 behavior at concrete headwalls led to studies on behavior in the increasingly important cementitious backfills. Recent AK Steel field evaluations in the wetter climate of Houston, Texas showed that cement-stabilized sand backfill had no significant adverse effect beyond attack of the Al layer of the coating. The Al layer was removed in places during the curing stage but the Al-Fe alloy layer was fully protective against cement alkalinity and soilside corrosion. Such results show that there is no need for any supplemental coating protection on Aluminized Steel Type 2 pipe in cementitious backfill. The results are not surprising in view of the known high resistance of the coating Al-Fe alloy layer to alkalinity and soilside corrosion.

FIGURE 2 – SOILSIDE CONDITION OF METAL CORINGS FROM 4 SUBJECT PIPE SITES WITH CEMENT STABILIZED SAND BACKFILL

	Site A	Site B	Site C	Site D
	On these three-year-old specimens, most of the coating's free Aluminum layer is gone but the intermetallic layer is completely intact. There is an adherent black film overlying the intermetallic layer on portions of specimens.		There are only small discontinuities in the free Aluminum layer on this 3 year old specimen.	Most of the coating's free Aluminum layer is gone from this 5 year old specimen but the coating intermetallic layer is intact.
Coating #2				
Coating #1				

Soilside surfaces on 2 in. diameter pipe metal corings.

AK Steel
A CLEVELAND-CLIFFS COMPANY

AK Steel Corporation
9227 Centre Pointe Drive
West Chester, OH 45069
844.STEEL99 | 844.783.3599

www.aksteel.com
sales@aksteel.com

Founded in 1847, Cleveland-Cliffs is among the largest vertically integrated producers of differentiated iron ore and steel in North America. With an emphasis on non-commoditized products, the Company is uniquely positioned to supply both customized iron ore pellets and steel solutions to a quality-focused customer base. AK Steel, a wholly-owned subsidiary of Cleveland-Cliffs, is a leading producer of flat-rolled carbon, stainless and electrical steel products. The AK Tube and Precision Partners businesses provide customer solutions with carbon and stainless steel tubing products, die design and tooling, and hot- and cold-stamped components. In 2020, Cliffs also expects to be the sole producer of hot briquetted iron (HBI) in the Great Lakes region. Headquartered in Cleveland, Ohio, Cleveland-Cliffs employs approximately 11,000 people across mining and steel manufacturing operations in the United States and Canada.

Additional information about AK Steel is available at www.aksteel.com.

 5.20