The Advantages of Aluminized Stainless Steel Roof Installed: 2002
Study Updated: 2012

Aluminized Type 409 and Type 439 Roofing Panels were installed in an industrial building site in place of painted GALVALUME®.

Aluminized Type 2 carbon steel was used in the roofing purlins in place of G-90 galvanized steel for improved corrosion resistance.
INDUSTRIAL ROOFING

Background

**Aluminized Stainless Steel:** In the U.S., aluminized stainless steel products have been used almost exclusively in automotive exhaust systems. In other countries, however, aluminized stainless steel has been successfully used for roofing for many years. In Japan, for example, aluminized stainless has been used in harsh industrial and marine roofing applications.

**Roof Dimensions and History:** The area associated with excessive corrosion on the subject industrial building roof is 640 ft. long and 108 ft. wide, totaling 69,120 ft². This area is divided into 32 partial bays, each 20 ft. wide and 54 ft. long. The facility’s metal roofing system has required continuous maintenance due to the extreme heat and steam generated inside the building. All of the galvanized support purlins were replaced in 1988, along with replacement of the painted GALVALUME roofing panels in the 1990's.

**DETAILS**

<table>
<thead>
<tr>
<th>Purlins</th>
<th>Aluminized carbon steel Type 2 purlins. The purlins were 0.105 in. thick and measured 3 by 6 in. A total of 250 purlins were used, weighing 37,500 lbs.</th>
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<tbody>
<tr>
<td>Panels</td>
<td>27,000 lbs. of aluminized Type 439 panels were used to cover a total of 19,440 ft². 9,000 lbs. of aluminized Type 409 panels to cover a total of 6,480 ft² area.</td>
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<tr>
<td>Panels in General</td>
<td>Each panel is based on a 2 in. rib design. All panels are 0.024 in. thick, silt to 22.375 in. wide and roll-formed on 16 in. rib-to-rib centers. There are 15 panels to every 20 ft. by 54 ft. bay. Each bay has a roofing area of 1,080 ft². Each bay consumes 15 panels totaling 1,510 ft² of steel.</td>
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Problem

In 2002, the roofing panels and purlins were replaced in an industrial manufacturing building due to excessive corrosion caused by variances in moisture and temperature within the facility. This combination of steam and heat rapidly degraded the painted GALVALUME roofing panels and galvanized support purlins. In less than 10 years, the painted GALVALUME panels failed due to perforation at sharp bends in the panels and at contact points between the panels and underlying support purlins. Rust-through had also occurred at fastener locations used to secure the panels onto the purlins as shown in the pictures below. The galvanized G-90 support purlins were heavily corroded after 15 years in service.

Perforation at contact points where the fastener joins the painted GALVALUME roofing panel to support purlin.

Corrosive crevice attack between the galvanized purlin and the painted GALVALUME roofing panel.

Note: The oxidation around the panel fastener due to crevice corrosion.

Severe corrosion is evident in this painted GALVALUME roofing panel section. Through-thickness perforation has weakened the metal substrate.

Removed painted galvanized panels show rust-through after 9 years of exposure. The topside (dark color) corroded at sharp breaks in the roll-formed roofing panel.

Crevice corrosion also occurred where the panel contacted a support purlin.

Detail above – sharp 90° break in painted GALVALUME is where corrosion began. After the protective GALVALUME coating is lost, the base metal begins to rust-through rapidly.
Problem

Additional photographs showing rust-through of the fluorocarbon coated GALVALUME roofing panels after 9 years of exposure.

Sharp breaks in the roofing panels, steam, and high temperatures result in oxidation and eventual failure of the metal substrate.
Solution

Aluminized stainless steel roofing panels were roll formed and used in the re-roofing upgrade of the industrial facility. Aluminized Type 409 (base metal with 11% chrome), and Type 439 (base metal with 17% chrome) both provide superior corrosion resistance over painted GALVALUME in industrial environments. The hot dipped aluminized Type 1 coating provides cathodic corrosion protection to the base stainless steel. Of the 32 partial roofing bays, 25 were replaced with aluminized stainless steel.

BENEFITS OF ALUMINIZED STAINLESS STEEL
- Superior corrosion resistance
- Ease of fabrication – roll forms and bends as easily as GALVALUME
- Low maintenance
- Cost effective
- Easier to post paint than uncoated stainless steel
- Long service life
- Low reflective, textured surface finishes are available for architectural applications

Aluminized carbon steel, Type 2 was selected for the roofing support purlins. Aluminum forms a passive film layer that is superior to zinc reaction product films.

No apparent corrosion was seen along the bends of the panels or near any of the fasteners after years of exposure.

Conclusion

In addition to offering superior corrosion resistance to typical GALVALUME, aluminized stainless steels possess the same linear expansion coefficients and mechanical properties as galvanized/ GALVALUME carbon metal materials. This means that roofing manufacturers and contractors should not experience any difficulties in switching from standard metal roofing products to aluminized Type 409 or Type 439. These two roofing materials are readily available and should be considered for use in harsh industrial environments, including those in the pulp and paper, wastewater treatment, aluminum melting, and carpet manufacturing industries as well as near coastal areas.
AK Steel is a leading producer of flat-rolled carbon, stainless and electrical steel products, primarily for the automotive, infrastructure and manufacturing, electrical power generation and distribution markets. Through its subsidiaries, the company also provides customer solutions through carbon and stainless steel tubing products, die design and tooling, and hot and cold stamping. Headquartered in West Chester, Ohio (Greater Cincinnati), the company employs approximately 9,200 men and women at manufacturing operations across seven states (Alabama, Indiana, Kentucky, Michigan, Ohio, Pennsylvania and West Virginia), as well as Canada and Mexico. Additional information about AK Steel is available at www.aksteel.com.

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