Thought leadership
White paper

B-LINE SERIES

A beautiful friendship: Materials and finishes for electrical enclosures

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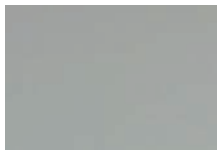
Enclosures greatest enemy

Aside from leakage, which can be controlled by installing the right kinds of gaskets, perhaps the greatest danger to the integrity of electrical enclosures is corrosion. This particular enemy is especially insidious because it can go unnoticed until it's too late to prevent serious damage to sensitive equipment from water and other causes.

Fortunately, it's possible to construct electrical enclosures using materials and finishes that stave off corrosion and add years of high-performance service. Some metals and metal alloys are especially useful under differing conditions, and different finishes add to the metals' corrosion resistance.



ANSI 61 Gray smooth finish.

304 & 316L Stainless Steel

RA 7035 Light gray textured finish

Powering Business Worldwide

Choosing the right material

Corrosion happens. It's unavoidable, but it can be delayed and minimized. When corrosion occurs, it is of two general kinds: chemical or electromechanical.

Electromechanical, or galvanic, corrosion is measured in volts and happens when different metals or alloys are in electrical contact in an electrolytic solution. An example would be two metals together in a saltwater solution.

Chemical corrosion results when metals or alloys come in direct contact with corrosive agents, such as acids. How severe the corrosion can become depends on the agent's concentration as well as how often the metal is cleaned and the operating temperature.

A special case that can result in both chemical and electromechanical corrosion is atmospheric corrosion. Moisture, salt, dirt and sulfuric acid, among other agents, cause this kind of damage. Most often, it happens to enclosures located outdoors and near marine environments.

The National Electrical Manufacturers Association has developed a special rating, NEMA 4X, for enclosures subject to atmospheric corrosion. Among the requirements for the 4X rating is the ability to withstand 200 hours of salt spray with no greater corrosive pitting than would be found on a Type 304 stainless steel sample tested at the same time.

Combatting electromechanical and chemical corrosion requires using the right metal for the conditions the electrical enclosure needs to withstand. Companies like Eaton, manufacturer of the B-Line series of electrical enclosures, offer a range of material solutions to protect enclosures under a wide variety of conditions.

These materials include

Hot rolled pickled and oiled steel sheets (ASTM A1011). After undergoing an acid bath to remove normal mill oxide, this low-carbon, hot-finished steel is de-scaled, and an oil film is applied to protect the surface. Removing the mill oxide improves surface appearance, uniformity and finishing quality.

- Cold rolled steel (ASTM A1008). This low-carbon, cold-finished steel is commercial quality with close thickness tolerance and provides a better surface than hot rolled pickled and oiled steel.

- Galvanized/galvanneal steel (ASTM A653). A zinc coating applied during the hot-dip galvanizing process provides a degree of corrosion protection. It also gives the steel some protection at the sheared edges.
- Stainless steel, Type 304, 316 or 316L. With excellent corrosion resistant and excellent mechanical properties, stainless steel of these types has many of the chemical-resistance attributes of fiberglass materials.
- 5052-H32 aluminum. Offering good resistance to corrosion in marine environments, this alloy also is excellent for use in electrical enclosure manufacturing.

The right material is the first line of defense against corrosion. The choice of finish is also critically important.

Finding the right finish

Like materials, finishes offer different solutions for different applications. Not all finishes are equally suitable to protect the underlying material under various conditions.

For instance, it's important to consider factors such as:

- Will the enclosure be located inside or outside?
- What temperatures will the finish be required to withstand?
- What kind of chemicals might pose a threat to the finish?
- Is resistance to UV radiation a concern?

A number of finishes are available to supplement a material's ability to fight corrosion. Eaton, for example offers:

- Polyester urethane powder. Durable and smooth with good adhesion, this coating provides corrosion resistance suitable for outdoor installations. It also offers good impact protection against heat and chemicals.
- Electrocoat (E-Coat) liquid. The unique combination of durability and corrosion resistance of this coating results from its cathodic acrylic composition. It's an especially rugged finish.
- Epoxy powder. Also tough and durable, this finish is corrosion resistant and resistant to many solvent oils. Its glossy appearance can be affected by prolonged UV exposure.

The right combination for the best corrosion resistance

Working together, the best materials and finishes for any electrical enclosure application help keep sensitive equipment safer longer. It's a formula that leads to greater economy and better performance, which, for electrical contractors, means a healthier bottom line.

It's always a good idea to consult with manufacturers whose expertise in selecting enclosures and finishes has been well established. Such knowledge and capabilities are worth looking into before choosing an enclosure brand.

For guidance in determining the best material and finish for a particular electrical enclosure application, it's a good idea to consult a Corrosion Resistance Table, like the one available from Eaton.

More information about electrical enclosures and choices of materials and finishes is available by contacting Eaton.

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