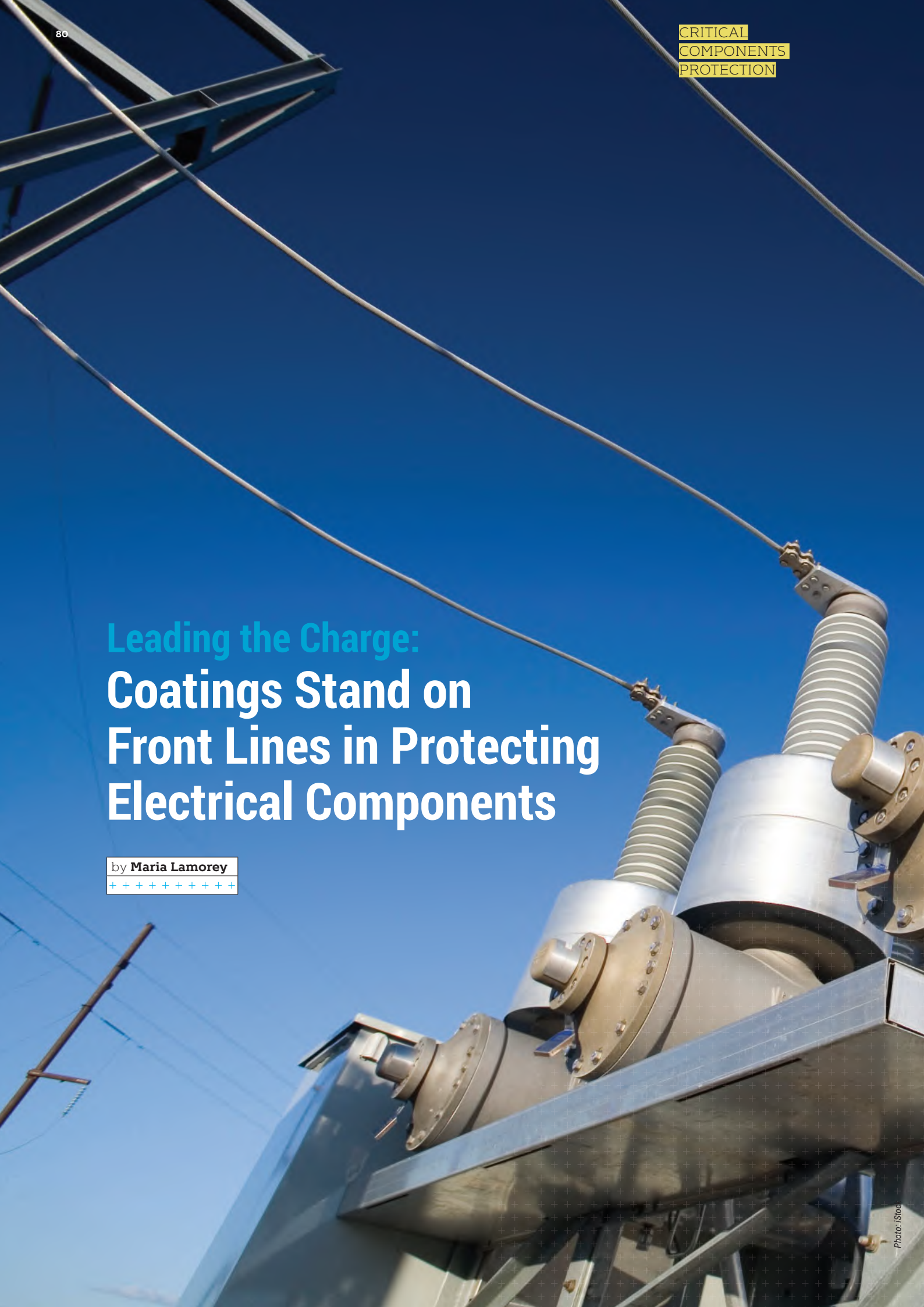

Leading the Charge:

Coatings Stand on Front Lines in Protecting Electrical Components

by **Maria Lamorey**

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Coatings are the first line of defense to safeguard the critical infrastructure from a variety of conditions. Selecting the proper coating materials to help preserve power generators, transformers, switchgear and more is crucial.

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Millions of cars and trucks over the next decade will be running solely on electricity, while wind- and hydrogen-based power sources continue to gain momentum. In fact, 20% of all electricity generation in the United States came from renewables in 2020, a number that is only expected to increase.

This growing demand, coupled with an aging power grid in the U.S., creates a need for an infrastructure built for longevity. Promising new developments will help. The recent infrastructure bill has become law, an act that allocates $65 billion in support for our electric and grid infrastructure.

While most electrical equipment holds a minimum life expectancy of 20 years, many components are expected to survive 50 years or more. Harsh elements can accelerate corrosion and leave sensitive instrumentation vulnerable during storms and compromise its reliability. Unfortunately, many manufacturers still combine old "cut-and-paste" specifications that date back 20 to 30 years with current industry-standard regulatory requirements written by IEEE, UL, CSA and ASTM when painting and protecting new equipment.

Coatings are the first line of defense to safeguard this critical infrastructure from a variety of conditions. Selecting the proper coating materials to help preserve power generators, transformers, switchgear and more is crucial. According to the Electric Power Research Institute (EPRI), the cost of corrosion-related problems in the electrical industry exceeded $17 billion as recently as just a few years ago. Yet, roughly 20% or more of these corrosion costs are avoidable.

There is a wide range of coatings available that are engineered to preserve the future of our power generation infrastructure.

Gaining an Edge

Metal substrates that typically comprise electrical components can corrode for a number of reasons, including repeated exposure to high temperatures and humidity, damaging pH (acid) levels, electrolytes, chemicals and ultraviolet (UV) light.

This type of corrosion typically starts on sharp edges or an oddly shaped part that may be difficult to coat. In harsh environments, weaknesses on areas like louvers and sharp corners can lead to subsequent damage. That's why high-edge coatings, equipped with superior sharp edge coverage, along with edge and face corrosion protection properties, can help to provide the exterior durability that electrical components require for reliability and longevity.

For components such as transformers that contain elements like oil, it's important to utilize coatings not only for their corrosion resistance, but for their chemical-resistant properties. It's also important to consider heat dissipation and size when it comes to coating transformers. Some transformers, especially those that are larger, are required to be fully assembled prior to their last coat of paint, then properly air-dried. High-edge coatings help to ensure that even the hardest-to-reach parts are covered.

Smart Specification

On average, finished electrical components are composed of about 70% metal and 30% non-metal substrates, yet nearly 100% of electrical equipment manufacturers view painting metal as beyond their core competency. An average-sized switchgear manufacturer running 10 to 15 million square feet of coated metal through its facility is staking a lot of its reputation on work considered outside of their scope.

Additionally, some equipment manufacturers still base their paint specifications solely on achieving a minimum industry standard or according to a specification written by a paint supplier. Paint manufacturers often contribute to the problem by designing coatings systems that merely meet old specifications or achieve industry standards dictated by customers, instead of featuring the newer technologies that provide better field appearance and anti-corrosive properties.

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If the goal of an electrical equipment manufacturer is to build next-generation components that exceed performance mandates while protecting its brand reputation, paint specifications should be reviewed and updated regularly. In addition to product scope and substrate type, manufacturers should address the following criteria:

- Paint type
- Substrate preparation and protection
- Color
- Gloss
- Texture
- Cure
- Product handling and storage
- Performance

High-edge coatings, equipped with superior sharp edge coverage, an edge and face corrosion protection properties, can help to provide the exterior durability that electrical components require for reliability and longevity.

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When reviewing these specification criteria for electrical components, there are three major coatings technologies that can be considered—powder, liquid and electrocoating formulations.

Powder coatings are formulated for applications that require the ultimate combination of corrosion resistance, weathering performance and operational attributes. These coatings are typically formulated with specific resins combined to provide excellent corrosion and chemical resistance, as well as all-around application versatility.

Since powder coatings are made without solvents, they generate virtually no volatile organic compound (VOC) emissions, which can help to achieve environmental compliance and reduce material usage, energy consumption and maintenance costs, thanks to a first-pass transfer rate of up to 85%.

Liquid coatings use solvents or water and are applied to pretreated metal with electrostatic spray, dipping and other conventional methods before

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being air-dried or force-cured. When used as part of an integrated primer, pretreatment and topcoat system, liquid coatings offer exceptional resistance to corrosion and chemicals, excellent sag resistance and strong adhesion.

During the electrocoating process, pretreated metal substrates are immersed in an electrically charged paint bath. Charged coating particles form a tightly packed, insulating layer that reaches every recessed area of the coated part. At the end of the coating line, the metal part is baked, creating a tough finish that offers more thorough coverage.

Aesthetic Considerations

While anti-corrosive properties are the driving force behind most specifications, color is also an important consideration. In fact, corrosion and color are essentially linked. The best-looking generators are the ones you can't see, as weathered components that appear orange and rusty are not aesthetically pleasing.

Transformers and generators that are rusty often raise questions about performance and effectiveness. Coatings that help these components essentially blend into their environments tend to be preferred, helping these components look the part and withstand corrosive environments.

Finding the Best Solutions

Electrocoat, pretreatment, powder and liquid technologies are all great coating solutions for electrical equipment. It is important to consider several different factors to select a customized coating system that is ideally suited for the project and based on specific objectives, including:

- The specific region to determine how the weather will influence corrosion, color fade, performance, etc.
- The specific substrate and shape to be coated; specific coatings are better for coverage on complex parts and sharp edges
- Aesthetics and color
- Product longevity and life cycle requirements

Utilizing this information and working with an industry expert can help determine the best coating system for the project.

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