

Salt Spray Versus Cyclic Corrosion Testing: What's the Difference?

Q: I am very familiar with salt spray requirements, but I have been hearing a lot about cyclic corrosion testing and requirements related to automotive specs. Can you explain the difference and why cyclic corrosion seems to be so important to automotive OEMs?

A: Salt spray testing has long served as a common method to evaluate the corrosion resistance of coatings and surface treatments. Today, however, automotive OEMs are increasingly emphasizing cyclic corrosion testing (CCT) when approving coatings, chemistries and finished components. This shift has left applicators wondering why cyclic corrosion testing has become so important and wanting to understand how it differs from traditional salt spray testing. It's worth noting that while both methods evaluate corrosion resistance, they use different procedures and often produce different results.

Overview of salt spray testing

The salt spray test involves placing test parts or panels into a chamber and exposing them to a controlled, continuous, dense salt fog at a fixed temperature to evaluate the relative corrosion resistance of the coating or part.

Commonly performed according to ASTM B117 and other industry specifications, salt spray testing is widely used because it is relatively simple, repeatable and cost-effective. Automotive requirements can range anywhere from 72 hours to more than 1,000 hours depending on the coating system and performance expectations.

A limitation of salt spray testing is that it does not accurately simulate the real-world environment automotive parts are subject to during their service life. As previously mentioned, parts in salt spray testing are exposed to a continuous spray of salt fog at a controlled temperature. While this constant moisture and temperature certainly accelerate corrosion, it does not reflect the changing environmental conditions vehicle components are in contact with such as temperature swings, dry periods, rain, road salt, humidity, freezing and thawing, etc.

As a result, salt spray performance and real-world performance do not always correlate. In fact, data has shown coatings that perform exceptionally well in salt spray testing may not necessarily deliver the same level of protection when exposed to actual service conditions. This inconsistency is one of the main reasons automotive OEMs have adopted CCT when validating and approving new coatings and chemistries for their finished parts.

Nevertheless, the test does provide a practical benchmark for evaluating corrosion resistance and comparing the performance of different coating systems. As a result, salt

spray testing remains a common requirement for Production Part Approval Process (PPAP) submissions and quality control programs throughout the automotive supply chain.

Understanding cyclic corrosion testing

CCT was developed to more closely simulate the environmental conditions encountered by automotive components during real-world use. The process involves placing sample parts or panels in a cyclic corrosion test chamber that can alternate between multiple environmental conditions. The chamber precisely automates these conditions according to a programmed schedule, thereby ensuring consistency and repeatability. Many cyclic corrosion chambers are also designed to store multiple test profiles for various automotive OEMs.

A typical automotive test may include 24-hour cycles that are repeated over several weeks. Depending on the OEM specification, testing may range from 40-100 cycles, representing approximately 960-2,400 hours of exposure. Some programs may run for six to 16 weeks before completion.

Exposing the coated parts to these alternating periods of higher and lower temperatures, humidity, salt spray and dry-off cycles helps replicate the natural product corrosion that occurs over time. The outcomes allow engineers to assess potential weaknesses in material design and develop strategies to improve product resilience against corrosion.

For this reason, many automotive OEMs now use CCT as a critical part of their coating approval and qualification processes, recognizing its ability to predict field performance better than traditional continuous salt spray testing.

Moving toward real-world corrosion performance

Salt spray testing remains an important tool and will continue to play a significant role in quality control, PPAP testing and spec compliance. However, performance of coatings in the real world is what matters most, and the automotive industry has recognized CCT as a preferred method for more accurately reproducing changing environmental conditions. Therefore, suppliers seeking approval for coatings, whether it be for plating systems, passivates, sealers, topcoats or lubricants, will increasingly find CCT included in qualification requirements. ■■■



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