

Comparing PPG Polysiloxane Coatings and Traditional Coating Systems



INTRODUCTION AND EXECUTIVE SUMMARY

The last two decades have seen continuous improvement in the performance and aesthetic versatility of polysiloxane coatings. Recently, PPG achieved a significant technological advance with the launch of PSX®700SG, a new semi-gloss (SG) polysiloxane coating developed for applications where the ultra-high solids content, long-term weatherability and performance of standard polysiloxane coatings are desired, but the inherent high gloss of the coating is not.

This document examines the chemistry behind PSX 700 and PSX 700SG coatings, and explains why they offer superior long-term economic and environmental performance compared to traditional epoxy/urethane and epoxy/silicone-alkyd coating systems.

PSX 700 COATINGS TECHNOLOGY

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PSX 700SG is the latest advance in the PSX 700 line of polysiloxane coatings by PPG. It offers all the performance and aesthetic advantages of earlier PSX 700 coatings, but with a new proprietary formulation that tempers the high-gloss appearance of earlier-generation products.

The origins of the PSX 700 product line can be traced to 1994 when Ameron International, which was acquired by PPG in 2006, introduced the first polysiloxane coatings to the protective and marine coatings market. PPG currently owns 16 patents for the original and continued development of PSX coatings.

Since their introduction two decades ago, polysiloxane coatings have continued to grow in both development and application. Like urethanes and alkyds, they are recognized as a distinct category of products within the coatings industry and, according to listings in a major industry trade magazine, the number of polysiloxane coatings manufacturer tripled between 2000 and 2004.

Even more importantly, polysiloxanes are now a preferred coating system for numerous industrial, military, recreational and infrastructure applications, including marine vessels, roller coasters, oil platforms, water tanks, bridges, smokestacks and other structures.

POLYSILOXANE CHEMISTRY

The rapid growth of polysiloxane coatings is tied to their unique chemistry, which is a blend of organic, epoxy-based and inorganic, siloxane-based binder systems. This robust chemical structure enables the coatings to achieve the superior long-term color and gloss characteristics of urethane coatings, and to resist the chalking, fading and corrosion that deteriorate traditional epoxy urethane systems after long periods of environmental exposure.

The Silicon-Oxygen Bond

The hallmark durability of polysiloxane coatings comes from chemical bonding. Silicon-oxygen bonds repeat, giving the coatings a strong polymeric backbone. Because the silicon-oxygen bonds present in these hybrid coatings are stronger than the carbon-carbon bonds found in organic

epoxy/urethane and epoxy/silicone-alkyd coatings, they are able to resist degradation from continuous exposure to sunlight, high temperatures, chemicals, abrasion and other environmental hazards.

The chemical structure of polysiloxane coatings also makes them less susceptible to degradation by oxidation. Each silicon atom in the binder matrix of the polysiloxane polymer is bonded to two or three oxygen atoms. As a consequence, the silicon is already 50 to 75 percent oxidized and, therefore, nearly impervious to the oxidation that weakens the carbon-carbon bonds in epoxy/urethane and epoxy/silicone-alkyd coatings.

Many polysiloxane coatings also have low volatile organic compound (VOC) content. That is because the siloxane binders that are the building blocks

of polysiloxane coatings generally have low viscosity levels. This facilitates the formulation of high-solids coatings that apply easily without the need for thinning with solvents. Consequently, polysiloxane coatings can typically meet stringent environmental emissions regulations, unlike many epoxy/urethane and epoxy/silicone-alkyd coatings.

Finally, polysiloxane coatings are made without isocyanates, which eliminates health and safety concerns about exposure to these compounds.

PSX 700 COATINGS PERFORMANCE

Three-coat zinc/epoxy/urethane and zinc/epoxy/silicone-alkyd and two-coat epoxy/urethane coating systems have been industry benchmarks for decades. For many applications and industries, they continue to provide the best balance of appearance and cost-effectiveness.

Nevertheless, due to nearly two decades of rigorous product development at PPG laboratories, PSX 700 and PSX 700SG coatings have steadily supplanted traditional coating systems in applications where the ability to retain long-term color and gloss in difficult environments is paramount.

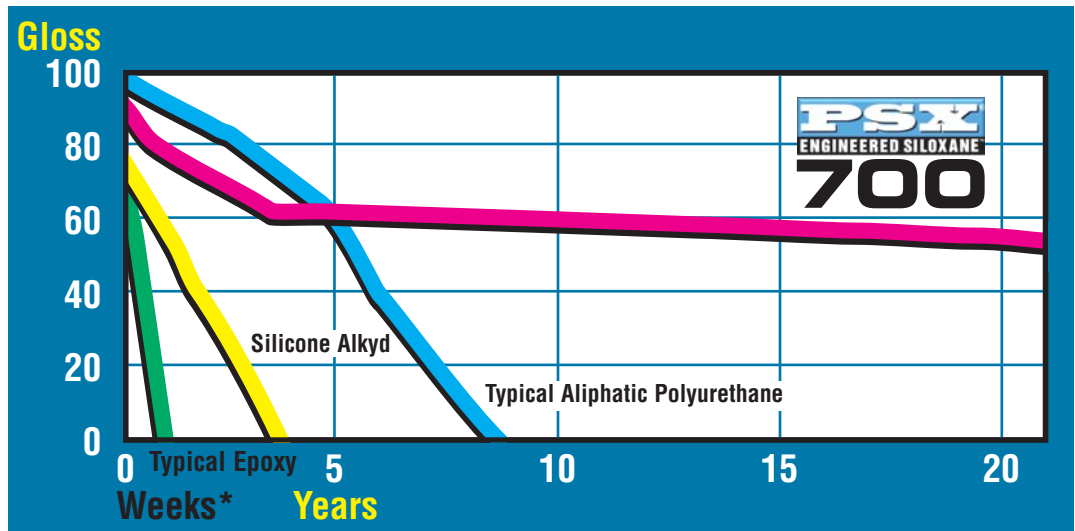
Following is a summary of product-related advantages that PSX 700 and PSX 700SG coatings have over traditional epoxy/urethane and epoxy/silicone-alkyd systems:

Extended Service Life/Superior Color Retention

As highlighted earlier, PSX 700 and PSX 700SG coatings take advantage of a robust silicon-oxide chemical structure that prevents degradation from exposure to environmental hazards. Although traditional epoxy-based coatings systems exhibit excellent corrosion resistance (and good adhesion to metals), they tend to chalk, fade or lose gloss within two to five years.

The chart below shows the gloss retention performance of PSX 700 coatings compared to traditional three-coat systems in QUV accelerated weather testing.

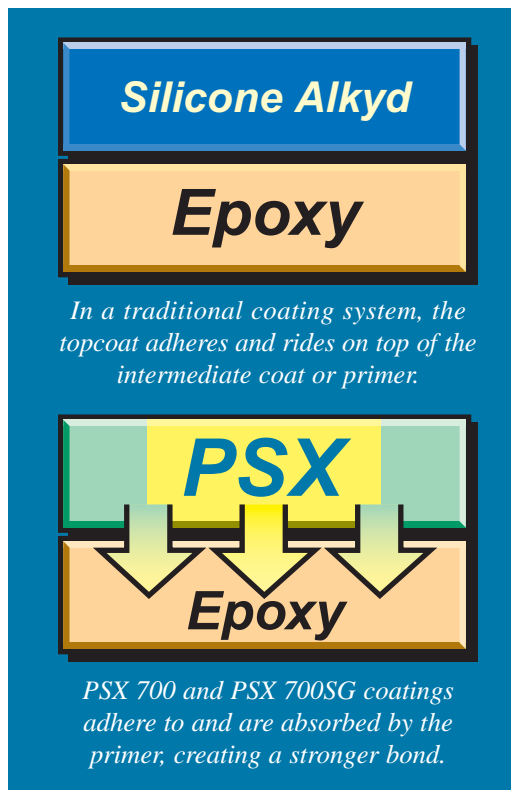
QUV Accelerated Weathering Test



In standard testing, the polysiloxane coating retained 90 percent of its initial gloss for white and an average of 90 percent for other colors, with no chalking or checking, after 12 months of 45-degree South Florida exposure. In the same testing, the polyurethane coating demonstrated 88 percent gloss retention for white and an average of 67 percent for other colors.

Better Adhesion

The compounds used to catalyze PSX 700 and PSX 700SG coatings cause them to bond strongly with primers, metals and concrete substrates. In fact, when used with a zinc primer as part of a two-coat system, PSX 700 and PSX 700SG coatings create an extremely tight bond with the primer. That bond is stronger than the bond of traditional three-coat systems, which have a urethane top coat over the primer layer, as illustrated below:



Lower Labor and Installation Costs

PSX 700 and PSX 700SG coatings are less expensive to apply than traditional epoxy/urethane and epoxy/silicone-alkyd systems. Because of their ability to bond directly to primers and substrates, little or no abrasion is required before paint application, a preliminary step common to traditional coating systems.

There also is no need to apply the epoxy mid-coat associated with traditional three-coat systems in most cases. This minimizes costs associated with scaffolding and labor, which helps return the coated asset to service more quickly. There also are fewer paint cans to remove and less product waste.

Application Versatility

Because of their ultra-high volume solids, PSX 700 and PSX 700SG coatings can be applied directly to primed steel and previously painted substrates by brush, roller or spray. (A primer is recommended to assist in chemical and corrosion resistance.) Once a substrate is coated with PSX 700 or PSX 700SG, it can be recoated indefinitely with the products from the same line (after proper cleaning and drying).

PSX 700SG and MIL-Spec 24635

MIL-Spec 24635 establishes performance requirements by the U.S. military for weather-resistant coating systems for primed, smooth metal; glass reinforced plastic (GRP); wood; and plastic/composite exterior surfaces. PSX 700SG has been engineered to meet and exceed these coating requirements.

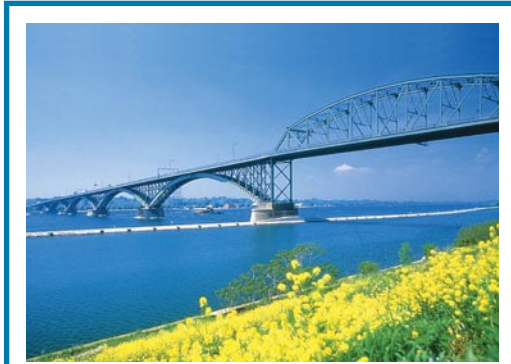
This development is significant for two reasons. First, the semi-gloss appearance of PSX 700SG enables it to be used in a variety of applications typically reserved for semi-gloss epoxy/silicone-alkyd systems. The second is the potential for related cost savings.



PSX 700SG meets MIL-PRF-24635E, Type V (high-durability), Type VI (high-durability, low-VOC <100 g/L), Class 2 (semi-gloss), add Grade B (LSA).

In corrosion testing conducted by the U.S. Navy, epoxy/polysiloxane coating systems, featuring products such as first-generation PSX 700 coatings, significantly outperformed 17 competing coating systems on topside naval systems. These applications are considered especially rigorous because of their exposure to high temperatures, seawater spray and exhaust gases.

Now that the durable PSX 700 coating is available in the standard semi-gloss (SG) colors required by the U.S. Navy and other federal marine vessels, it has the potential to be applied fleet-wide and thereby save the federal government hundreds of millions of dollars in lifetime operational costs.



PSX 700 Keeps the Peace Bridge Colorful

When the Peace Bridge between the Buffalo, N.Y. and Fort Erie, Ontario, was last refurbished in 1994, the structure was painted with PSX 700 polysiloxane coatings. Nearly two decades later, the coating, which is subject to heavy traffic and difficult weather extremes, remains in near pristine condition. Regular inspection shows almost no sign of chalking and little, if any, loss of gloss. Even more impressively, PSX 700 has demonstrated excellent corrosion resistance on steel edges and rivet heads, areas that had been especially difficult to protect with traditional three-coat systems.

The PSX 700/PSX 700SG Advantage

- Superior chemical and corrosion resistance of traditional epoxy/urethane coating systems
- Long-term color and gloss retention of fine urethane coatings
- Better adhesion than epoxy/urethane coatings
- Proven performance in more than a decade of rigorous testing and field application
- Low VOC emissions (60 to 75 percent less than urethane coating systems)
- Isocyanate-free
- Unlimited recoatability on itself (no surface abrading required)
- Lower application-related expense and labor costs
- Lower environmental removal costs (fewer cans and hazardous waste)
- Significantly reduced total operation costs

For More Information

For more information about PSX 700, PSX 700SG and the entire line of PPG protective and marine coatings, call **1-888-9-PPGPMC (1-888-977-4762)**, visit www.ppgpmc.com/northamerica, or email PMCMarketing@ppg.com



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