

SSPC: The Society for Protective Coatings

COMMENTARY ON PAINTING SYSTEMS

1. Introduction

SSPC has three types of painting system documents: complete painting systems, painting system guides, and performance-based painting system material specifications. The SSPC documents of this type were developed only for steel, not for wood or concrete.

- **Painting System:** Each of these painting systems combines in a single specification all of the requirements necessary for a complete paint job. It therefore includes by reference all of the specifications for surface preparation, paint application, paint thickness measurement, primer, mid-coat, topcoat, safety, and inspection. In most cases it is recommended that the particular painting system is specified by number.
- **Painting System Guides:** The painting system guides are to be used to prepare modified systems for special cases. Unlike the other guides in this section, SSPC-Guide 8.00 does not address the surface preparation of a steel substrate, but rather provides guidance in selecting the proper topcoat for use over a zinc-rich primer.
- **Painting System Material Specifications – Performance-based:** These documents specify the performance requirements for a multi-coat system based on a particular generic class of coatings, e.g., aluminum epoxy. These documents serve only to qualify a coating material and do not address other items such as surface preparation and thickness measurement. Hence, these painting system material specifications serve only to specify the coating material to be used in a complete painting system specification.

By disregarding the more unusual combinations and circumstances, the SSPC Painting Systems are able to offer in complete but compact form the minimum number of combinations necessary to paint the great preponderance of steel structures. For unusual circumstances, users of the specifications may devise their own painting systems by choosing from among the alternative specifications listed in the Painting System Guides. These models offer a large number of compatible combinations of surface preparations, primers, intermediates, and finish paints.

SSPC Painting Systems and Guides were originally published in 1955. They were revised and expanded to incorporate

improvements in concept and in technology. The Painting System Material Specifications – Performance-Based were first introduced in 2000. The descriptions of painting systems are listed in Table 1. Within each generic type, there may be several systems, each a complete paint scheme in itself. Each scheme is designed for a specific application where a particular combination of durability, drying time, tolerance for surface preparation, cost, color, etc., is desired.

2. Using SSPC Painting Systems by Number

The preferred method of using the SSPC Painting Systems is simply to specify, for example, that the steel or the structure shall be painted in accordance with the SSPC-PS 1.09 “Three Coat Oil Base Zinc Oxide Painting System.” This is similar to the procedure that would be used in specifying the steel.

By using this method, the specifier can procure a standard painting system consisting of a surface preparation suitable for the priming paint; the specification for an intermediate coat (sometimes a primer or top-coat tinted to contrasting shade); usually one standard finish coat, often offering an option of colors and a specified thickness for each coat. Use of the standard painting system will generally result in satisfactory performance if the recommendations are followed.

Within each general type of painting system (Table 1) an exceedingly large number of combinations would be possible. As an aid in selecting a specific system for a specific need, some general types are divided into a limited number of proven SSPC Painting Systems. (See Tables 2 and 3 of this commentary and the descriptions accompanying them.)

3. Using SSPC Painting System Guides

Rather than using the SSPC Painting System Specifications, the specifier may wish to employ the SSPC Painting System Guides. These worksheets (or models) are useful for special painting problems not covered by the standard painting systems. To use them, one first decides what generic type of coating is to be used - oil base, alkyd, zinc-rich, coal tar, etc. For each of these types there is usually a corresponding painting system guide. For example, the oil base painting system guide is numbered SSPC-PS Guide 1.00, the alkyd guide is numbered PS Guide 2.00, and so on. In these guides are descriptions of each specification, including the principal public specifications of SSPC, the government, the American Association of State Highway and Transportation Officials (AASHTO), and others. A complete painting system can therefore be made up by choosing, from one of these worksheets, the desired stipulations on surface preparation, application, primer, topcoat, etc.

TABLE 1
OUTLINE OF SSPC PAINTING SYSTEMS AND GUIDES

System Number	Code	Description
1	SSPC-PS 1.00-1.13	Oil Base Painting Systems
2	SSPC-PS 2.00-2.05	Alkyd Painting Systems
4	SSPC-PS 4.00-4.04	Vinyl Painting Systems
7	SSPC-PS Guide 7.00	Guide for Selecting One-Coat Shop Painting Systems
8	SSPC-PS Guide 8.00	Guide to Topcoating Zinc-Rich Primers
10	SSPC-PS 10.01-10.02	Hot- and Cold-Applied Coal Tar Painting Systems
11	SSPC-PS 11.01	Black (or Dark Red) Coal Tar Epoxy Polyamide Painting System
12	SSPC-PS 12.00-12.01	Zinc-Rich Painting Systems
13	SSPC-PS 13.01	Epoxy Polyamide Painting System
14	SSPC-PS 14.01	Steel Joist Shop Painting System
15	SSPC-PS 15.00-15.04	Chlorinated Rubber Painting System
16	SSPC-PS 16.01	Silicone Alkyd Painting System for New Steel
17	SSPC-PS Guide 17.00	Guide for Selecting Urethane Painting Systems
18	SSPC-PS 18.01	Three-Coat Latex Painting System
19	SSPC-PS Guide 19.00	Guide for Selecting Painting Systems for Ship Bottoms
20	SSPC-PS Guide 20.00	Guide for Selecting Painting Systems for Boottoppings
21	SSPC-PS Guide 21.00	Guide for Selecting Painting Systems for Topsides
22	SSPC-PS Guide 22.00	Guide for Selecting One-Coat, Pre-Construction or Pre-Fabrication Painting Systems for Ships
23	SSPC-CS 23.00	Specification for the Application of Thermal Spray Coatings (Metallizing) of Aluminum, Zinc, and Their Alloys and Composites for the Corrosion Protection of Steel
24	SSPC-PS 24.00	Latex Painting System for Industrial and Marine Atmospheres, Performance Based
26	SSPC-PS 26.00	Aluminum Pigmented Epoxy Coating System for Steel Surfaces, Performance-Based
27	SSPC-PS 27.00	Alkyd Coating System, Performance-Based

By using this alternative, painting systems may be prepared to cover special requirements. It should be emphasized, however, that judgment must be used in selecting the proper painting systems, the surface preparations, and priming and finish paints. The recommended systems are completely compatible and should result in satisfactory paint life from both the protective and decorative viewpoint. Volume 1, SSPC Good Painting Practice should also be consulted for further detailed information.

The painting systems are occasionally used in a third way. This method is similar to the preceding one, but the users may vary any of the surface preparations, primer, etc., that are listed by substituting proprietary products or other specifications as desired. A painting system is then a model for the preparation of the user's own painting system, which may be more suitable for particular requirements. Here, the user must be extremely careful that compatible surface preparations, paints, and meth-

ods are specified. The use of proprietary priming and finish paints is highly recommended provided the user has sufficient experience to know that they will perform satisfactorily.

4. Using SSPC Painting System Material Specifications – Performance-Based

These specifications are used to specify only the coating material, i.e., the paints, in a complete painting system specification. One of the SSPC Painting Systems or Painting System Guides can be used as a template in preparing the job specification incorporating the performance-based coating material specification. This approach allows the coating manufacturer to custom match each coat of a multi-coat system with the adjacent coating layer.

5. Limitations

The use of specifications alone cannot guarantee performance; neither can strict compliance with the recommendations of the specifications prevent all future paint failures. For example, when hand cleaning is used as a method of surface preparation, it is impossible to guarantee that there will be no lifting of mill scale. Even when blast cleaning is used as a method of surface preparation, and the proper paints are used, paints may fail due to the great number of factors that cannot be controlled in every case. One can be safely assured, however, that if this good practice has been followed, the possibility of failure is reduced to the minimum consistent with the present state of the art.

Regulations governing the content of volatile organic compounds (VOC) of coatings vary from state to state and among districts within a state. Before choosing a painting system it is therefore imperative that all applicable federal, state, and local regulations and restrictions are known so that the appropriate surface preparation and coatings can be specified.

6. Summary of SSPC Painting Systems

6.1 OIL BASE PAINTING SYSTEMS (NO. 1): Oil base painting systems are summarized in Table 2, which shows three basic oil base paint systems. These are numbered SSPC-PS 1.09, 1.10, and 1.13. For special paint problems not covered by the standard paint systems, an oil base painting system guide SSPC-PS Guide 1.00 is also presented.

6.1.1 Use: The oil base painting systems do not necessarily require complete removal of intact mill scale by blast cleaning or pickling. However, thorough surface preparation by hand tool or power tool cleaning is mandatory. The primers in these systems are based chiefly upon linseed oil vehicles with good surface wetting properties and upon rust-inhibitive pigmentation.

These painting systems are intended primarily for structural steel exposed to atmospheric conditions. They are particularly suitable for outdoor weather exposure, but may also be used for the interior of buildings subjected to moderately corrosive conditions. They have only limited resistance to chemical exposure, immersion, brine, condensation, high humidity, burial, very corrosive environments, high temperatures, or abrasion. Blast cleaning or pickling may be used to prolong expected paint life, to counteract severe exposures, or to assure adequate cleaning of badly rusted steel surfaces.

These painting systems have been used successfully on a wide variety of weather-exposed structural steel constituting the major surface areas of many structures. They are satisfactory for structural steel in industrial, rural, or mild marine atmospheres. Typical structures are highway, railroad, and ore bridges; tank exteriors; building exteriors; interiors exposed to occasional condensation and fumes; bandstands, grandstand frames, and platforms; bin exteriors; belt conveyors; unheated parts of blast furnaces; catenary poles and towers; industrial

plant yard areas; cranes, derricks, runways, and heavy equipment; dock and dam superstructures; fences, posts, guard rails, iron railings; fire escapes, door frames, window sills and coamings.

6.1.2 Description: Primer vehicles made up of raw linseed oil only are very slow drying (at least 48 hours to handle). Additions of boiled oil reduce the drying time but also reduce the wetting efficiency. Additions of alkyd resins further reduce the drying time but also reduce the wetting efficiency. Inhibitive pigments help retard corrosion. Other pigments enhance the functionality (hardness, UV stability, etc.) of the coating.

Each of these oil base painting systems represents a proven combination selected for specific properties and uses. System PS 2.05 provides some alkyd in the primer and is especially good for steel that is thoroughly wire brushed. Systems PS 1.09 and 1.10, three and four coat systems, respectively, use zinc oxide primers that are free of lead and chromate pigments. System PS 1.13 consists of a single coat of a slow drying maintenance primer.

If this alternate finish coat is used, then the intermediate coat shall consist of one coat of SSPC-Paint 101, Alkyd Aluminum Paint, Type II, Non-Leafing.

6.2 ALKYD PAINTING SYSTEMS (NO. 2)

6.2.1 Use: Alkyd painting systems are satisfactory for structural steel in industrial, rural, or marine atmospheres, particularly those that are too severe for oil base paints, such as high humidity, industrial fumes, etc. Typical structures are plants and refineries; moderately heated parts of blast furnaces; industrial buildings; chemical plants, yard areas or mild interiors; interiors of buildings of high humidity but not continuous condensation; bins, belt conveyors, platforms; grandstands; highway, railroad, and ore bridges; dam and dock superstructures; topsides and superstructures of vessels; cranes and derricks; guard posts and rails; and railings.

An alkyd painting system may be used for production items such as siding, door and window frames and sash, or for equipment used in highway construction, mining, and excavating. For such items, hot phosphate pretreatment or wash primer is recommended. Colored high gloss enamel finishes may be selected from proprietary sources. Where conditions are more severe than normally encountered, or faster drying topcoats are desired, alkyd finish paints should be selected rather than oil paints.

Generally, linseed oil paints or alkyds are not considered satisfactory for continuous water immersion.

When very short oil alkyds are specified for use over softer paints, it is important that at least one week of drying be allowed before application of the alkyd paint.

A performance-based alkyd system is described in PS 27.00.

6.2.2 Description: Alkyd painting systems are intended primarily for structural steel exposed to atmospheric conditions.



TABLE 2
OIL BASE PAINTING SYSTEMS
(FOR WEATHER-EXPOSED, WIRE-BRUSHED STEEL)

	SSPC 1.09 Zinc Oxide Primer	SSPC-PS 1.10 Zinc Oxide Primer	SSPC-PS 1.13 Slow Drying Maintenance
Min. Surface Prep.		SSPC-SP 2, Hand-Tool Cleaning	
Paint Application		SSPC-PA 1	
No. of Coats	3	4	1
First Coat	SSPC-Paint 25	SSPC-Paint 25	SSPC-Paint 26
Touch-Up		SSPC-PA 1	
Second Coat	SSPC-Paint 104	SSPC-Paint 25	None
Third coat	SSPC-Paint 104, White or Tinted Alkyd Paint		None
Fourth coat	None	SSPC-Paint 104	None
Alternate finish coat	SSPC-Paint 101, Aluminum Alkyd Paint ¹ ; or SSPC-Paint 108, High-Build Thixotropic Leafing Aluminum Paint ²		None
Minimum dry film thickness	Primer—50 μm (2 mils) System—115 μm (4.5 mils)		100 μm (4 mils)
Color	Varies	Varies	Black
Drying time (max at 21°C/70°F)	18 to 24 hours (recoat); Alternate Finish – 10 hours (hard)		168 hours (hard)
	Recommended/Not Recommended ³		
Rural	R	R	R
Industrial (mild)	R	R	R
Marine (mild)	R	NR	NR

¹ If this alternate finish coat is used, then the intermediate coat shall consist of one coat of SSPC-Paint 101, Alkyd Aluminum Paint, Type II, Non-Leafing.

² If this alternate finish coat is used, then no intermediate coat shall be required, but the dry film thickness shall not be less than 50 μm (2.0 mils) for the finish coat and 115 μm (4.5 mils) for the painting system.

³ Oil base systems are not recommended for fresh or salt water immersion, chemical, or underground

tions, but they may be used for infrequent immersion in fresh or salt water, or infrequent exposure to condensation. They are particularly suited for severe weather exposure, but they may also be used for the interiors of buildings subjected to corrosive conditions such as mild chemical exposure, high humidity, or infrequent condensation. They have only limited resistance to strongly chemical environments, complete immersion, burial, or severe abrasion. Because of the reduced performance of the primers on dirty, oily, or rusting steel, it is recommended that blast cleaning or pickling of steel be used as the surface preparation for new work.

6.3 VINYL PAINTING SYSTEMS (NO. 4)

6.3.1 Use: SSPC vinyl painting systems are intended for very severe exposures. They are satisfactory for most of the severe chemical atmospheres; they may be used with discretion for immersion in corrosive chemicals such as inorganic acids, alkalis, and salts; or liquids such as aliphatics, alcohols, oils, grease; but they are dissolved by some organic solvents such as aromatics, ketones, ethers, and esters, and attacked by some chemicals such as fuming nitric acid, 98 percent sulfuric acid, and acetic acid. Solution vinyls are seldom used today because of their high VOC contents.