SSPC: The Society for Protective Coatings

PAINTING SYSTEM GUIDE NO. 8.00

Guide to Topcoating Zinc-Rich Primers

1. Scope

1.1 This guide covers the selection and application (including surface preparation) of topcoats to surfaces coated with a zinc-rich primer. Both organic and inorganic zinc-rich primers are included.

1.2 The guide does not cover the selection and application of the zinc-rich primer.

2. Description

2.1 This guide represents good practice for topcoating zinc-rich primers as determined by industry consensus. It may not be applicable to all materials and conditions encountered.

2.2 Zinc-rich primers are topcoated to provide extended exterior durability in severe exposures; to improve color, gloss, and appearance; and to provide resistance to specific conditions such as highly acidic or highly alkaline environments.

2.3 Information on the use of one coat zinc-rich painting systems is provided in SSPC-PS 12.01.

2.4 DEFINITIONS:[1]

Bubbling: Air bubbles or solvent vapor bubbles found temporarily in the wet film of a coating or permanently in the dry film.

Burnish: To polish or rub to a smoother or glossier surface.

Craters: Small, rounded depressions in a coating film that do not expose the previous coat or the substrate.

Curing (cure): The process by which a coating changes from a liquid state into a dry stable solid protective film. Curing of a coating may involve chemical reaction with oxygen, moisture, or chemical additives, or the application of heat or radiation. Cure time and dry time are generally not identical, as curing may continue after the coating is dry to touch.

Dry spray: A rough, powdery, noncoherent film produced when an atomized coating partially dries before reaching the intended surface.

Intermediate coat: One or more coats of paint between the primer and the finish coat, sometimes called a mid-coat. If a mist coat is necessary to reduce bubbling, it is considered part of the intermediate coat in a 3-coat system.

Microcracking: Cracks in the dried film that are visible only under magnification and are not detrimental to zinc-rich coatings.

Mist coat: Also called a fog coat or tack coat. A thin coat applied as a mist of spray and used to achieve maximum adhesion of a new coat to an existing partially or fully cured coat.

Mudcracking: A coating defect resembling the irregular cracking of drying mud that typically arises during the curing of a relatively inflexible coating applied too thickly.

Pinhole: A holiday or discontinuity that extends entirely through a coating film, approximately the size of a pin; caused by solvent bubbling, moisture, or foreign particles.

Primer: The first full coat of paint applied to a surface when a multicoat system is being used.

Reduced coat: A thin coat containing extra solvent, used to reduce bubbling, cratering, and pinholing of the finish coat applied over it.

Sealer: A coating that provides a seal against absorption or bleeding.

Tie coat: A paint formulated specifically to provide a transition from a primer or undercoat to a finish coat. Tie coats are used to seal the porous surface (e.g., zinc-rich primer) to bond generically different types of coatings or to improve the adhesion of a succeeding coating.

Topcoat: The last coating material applied in a coating system, specifically formulated for aesthetics and/or environmental resistance. Also referred to as a finish coat. If a mist coat is necessary to reduce bubbling, it is considered part of the topcoat in a two-coat system.

Zinc-rich primer: Zinc-rich primers as referenced in this guide are broadly defined as primers containing high levels of zinc such as SSPC-Paint 20 or SSPC-Paint 29.

[1] Definitions taken from the SSPC Protective Coatings Glossary [SSPC publication 00-07].

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Zinc salts: White oxidation products (oxide, hydroxide, carbonate) of zinc formed on galvanized and other zinc coated surfaces. (Defined as "white rust" in PCG.)

3. Referenced Standards

3.1 SSPC AND JOINT STANDARDS:

PA 1	Shop, Field and Maintenance Painting of Steel
PA 2	Measurement of Dry Coating Thickness With Magnetic Gages
Paint 20	Zinc-Rich Primers (Type I–Inorganic & Type II–Organic)
Paint 27[2]	Basic Zinc Chromate-Vinyl Butyral Wash Primer
Paint 29	Zinc Dust Sacrificial Primer, Performance-Based
PS 12.01	One Coat Zinc-Rich Painting System
SP 1	Solvent Cleaning
SP 12/NACE No. 5	Surface Preparation and Cleaning of Steel and Other Hard Materials by High- and Ultra-High Pressure Waterjetting Prior to Recoating

3.3 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARD:

D 3359	Standard Test Methods for Measuring Adhesion by Tape Test
D 4541	Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers
D 4752	Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub

4. Selection of Topcoat

4.1 IDENTIFY PRIMER: Proper selection of topcoats requires identification of the generic (chemical) type of primer. Often the specific product name is needed as well. First, determine the class of primer in accordance with SSPC-Paint 20, which categorizes zinc-rich primers by the type of vehicle and curing mechanism. If the primer has already been applied, record the date of application, manufacturer's name, product identification, batch number, and manufacturing date. If the primer has been selected but not applied, record the name of the manufacturer and the product designation. It is good painting practice to obtain the primer, intermediate coat (if any), and topcoat from the same manufacturer.

4.2 COMPATIBILITY CONSIDERATIONS: When topcoating zinc-rich primers, consideration must be given to the fact that zinc is being coated, not steel. Coatings based on drying oils, such as most oil and alkyd types, tend to react with the zinc metal to form zinc soaps, resulting in loss of adhesion and peeling of the topcoat. In general, coatings that have poor alkali resistance should not be applied directly to zinc-rich primers. Coatings with oil-containing vehicles such as oil paints, alkyd enamels, vinyl alkyds of the oxidizing type, long oil silicone alkyds, and epoxy esters should not be applied directly to zinc-rich primers.

4.3 SELECT COMPATIBLE TOPCOAT: Table 1 lists combinations of commonly used zinc-rich primers and topcoats. For each combination, this table indicates the degree of acceptability, ranging from A (used directly) to E (not recommended). Although all of the generic coating types listed in Table 1, except alkyds, have been successfully applied as topcoats over zinc-rich primers, combining different manufacturers' products may adversely affect coating performance. The table reflects the application of the topcoat directly to the zinc-rich primer, not its use as a final coat in a multi-layered coating system. No coating should be applied to a zinc-rich primer unless recommended by the manufacturer for that purpose. If the primer type has previously been identified, select a topcoat based on the information in Sections 4.1, 4.2, and Table 1.

Other factors that may influence selection of topcoat and primer/topcoat combinations are: specific durability of topcoats in intended exposure environments, appearance of the finished coat, recoatability, heat resistance, and cost. Information on these factors may be found in the SSPC Painting Manual, Volume 1, Good Painting Practice, as well as in other technical publications, and from coating manufacturers. The general appearance of a properly applied zinc-rich topcoated system is acceptable for typical industrial applications; however, an appearance as smooth as an automotive finish coat should not be expected. If the primer has not been identified, select a primer based on the information in Section 4.2 and Table 1.

5. Surface Preparation and Repair of Primer

5.1 IDENTIFY AND REPAIR DEFECTS: The zinc-rich primer to be topcoated must be inspected for defects, and the defects must be repaired before the application of a topcoat. These defects include rust, low dry film thickness (DFT), high DFT, dry spray, mudcracking, foreign matter, and loose zinc salts. The coating manufacturer should supply recommended procedures for the repair of defects. Some general guidance is provided below.

5.1.1 Rust: Rust resulting from the corrosion of the steel substrate and loose deposits of rust stain must be removed. However, light adherent stain, resulting from rust running from

[2] This paint contains chromate pigments. Users are urged to follow all health, safety, and environmental requirements in applying, handling, or disposing of these materials.
[3] ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

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Table 1 - Acceptability of Primer/Topcoat Combinations[1]

Topcoat	Inorganic Zinc-Rich Primer			Organic Zinc-Rich Primer	
	Post Cure Water-Borne Type 1A[2]	Self-Cure Water-Borne Type 1B[2]	Self-Cure Solvent-Borne Type 1C[2]	Thermoplastic (Solvent Evaporation Cure) Type IIA[2]	Thermoset (Chemical Cure) Type II B[2]
Vinyl	B	B	B	C	B
Epoxy[3]	A	A	A	E	A
Water-Borne Acrylic	B	B	B	B	A
Chlorinated Rubber	B	B	A	A	A
Polyurethane[4]	B	B	B	B	B
Phenolic	D	D	D	D	D
Silicone	A	B	A	B	B
Alkyd	D	D	D	D	D
Epoxy Ester	D	D	D	D	D
Silicone Alkyd	D	D	D	D	D
Oil Urethane	D	D	D	D	D
Oil Phenolic	D	D	D	D	D
Linseed Oil	D	D	D	D	D
Coal Tar Epoxy	B	B	B	E	A
Vinyl Alkyd	D	D	D	D	D

A Generally used directly on zinc with no difficulties.
B Some formulations can be used directly; others require a tie-coat.
C Lifting of zinc-rich primer is likely to occur unless well-aged or the primer is vinyl.
D Not recommended unless tie coat is added.
E Not recommended.

[1] These are general guidelines, not hard-and-fast rules. This list is not exhaustive. Always consult the manufacturer's recommendations.
[2] See SSPC-Paint 20 (Section 2.3).
[3] Chemical cure such as epoxy amine, epoxy polyamide, epoxy polyamine, or epoxy phenolic.
[4] Must be oil-free and alkali-resistant.

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