

SSPC: The Society for Protective Coatings

COATING SYSTEM GUIDE 12.00

Guide to Zinc-Rich Coating Systems

1. Scope

1.1 This guide provides general information on the description, selection, and application of zinc-rich coatings as well as the selection and application (including surface preparation) of topcoats.

1.2 Zinc-rich coatings as referenced in this Guide are broadly defined as coatings containing high levels of zinc such as SSPC-Paint 20 or SSPC-Paint 29.

1.3 Zinc-rich coatings are classified as follows:

- Type IA Inorganic - post-cured, water-borne, alkali silicates
- Type IB Inorganic - self-cured, water-borne, alkali silicates
- Type IC Inorganic - self-cured, solvent-borne, alkyl silicates
- Type IIA Organic - thermoplastic binders
- Type IIB Organic - thermoset binders

1.4 Zinc-rich coatings, both topcoated and untopcoated, have been used successfully in a wide variety of environmental zones. For a detailed breakdown of applicability of various types of zinc-rich coatings in different environmental zones, see Table 1.

2. Description

The guide describes two types of zinc-rich coatings; how to select zinc rich coating systems for either topcoated or untopcoated service; and requirements for surface preparation, application, and inspection and repair of zinc rich coatings.

3. Referenced Standards

3.1 SSPC STANDARDS AND JOINT STANDARDS:

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| Guide 9 | Guide for Atmospheric Testing of Coatings in the Field |
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Guide 15

PA 1

PA 2

Paint 20

Paint 27¹

Paint 29

Paint 30

PS 12.01

PS Guide 22.00

SP 1

SP 5/NACE No. 1

SP 6/NACE No. 3

SP 10/NACE No. 2

SP 12/NACE No. 5

Field Methods for Retrieval and Analysis of Soluble Salts on Steel and other Nonporous Substrates
Shop, Field, and Maintenance Painting of Steel
Measurement of Dry Coating Thickness With Magnetic Gages
Zinc-Rich Coatings (Type I - Inorganic and Type II - Organic)
Basic Zinc Chromate-Vinyl Butyral Wash Primer
Zinc Dust Sacrificial Primer, Performance-Based
Weld-Through Inorganic Zinc Primer
One-Coat Zinc-Rich Painting System
Guide for Selecting One-Coat Preconstruction or Prefabrication Painting Systems
Solvent Cleaning
White Metal Blast Cleaning
Commercial Blast Cleaning
Near-White Blast Cleaning
Surface Preparation and Cleaning of Metals by Waterjetting Prior to Recoating

3.2 ASTM INTERNATIONAL STANDARDS²:

- | | |
|---------------|---|
| D 520 | Standard Specification for Zinc Dust Pigment |
| D 3359 | Test Methods for Measuring Adhesion by Tape Test |
| D 3363 | Standard Test Method for Film Hardness by Pencil Test |
| D 4541 | Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers |
| D 4752 | Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub |

¹ This paint contains chromate pigments. Users are urged to follow all health, safety, and environmental requirements in applying, handling, or disposing of these materials.

² ASTM International 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959. Standards are available online at <http://www.astm.org>.

TABLE 1
Guidelines for Surface Preparation and Topcoating
of Zinc-Rich Primers in Various Environments

Note: This table provides general guidelines only. Its use should be limited to determination of generic suitability and minimum surface preparation requirements. There are substantial differences in performance between the various types of zinc-rich coatings in a given environment. These recommendations provide minimum acceptable surface preparation, primer, and topcoating requirements for the designated environmental zones. However, recommendations do not imply equivalent system performance. For specific conditions, the coating manufacturer should be consulted.

ZINC-RICH BINDER TYPES

Environmental Zones	IA		IB		IC		IIA		IIB	
	Untopcoated	Topcoated	Untopcoated	Topcoated	Untopcoated	Topcoated	Untopcoated	Topcoated	Untopcoated	Topcoated
1A Interior, Normally Dry	R-SP 10	R-SP 10	R-SP 10	R-SP 10	R-SP 6	R-SP 6	R-SP 6	R-SP 6	R-SP 6	R-SP 6
1B Exterior, Normally Dry	R-SP 10	R-SP 10	R-SP 10	R-SP 10	R-SP 6	R-SP 6	R-SP 6	R-SP 6	R-SP 6	R-SP 6
2A Frequently Wet, Fresh Water	R-SP 10	R-SP 10	R-SP 10	R-SP 10	R-SP 10	R-SP 10	R-SP 10	R-SP 10	R-SP 10	R-SP 10
2B Frequently Wet, Salt Water	R-SP 10	R-SP 10	R-SP 10	R-SP 10	R-SP 10	R-SP 10	NR	R-SP 10	NR	R-SP 10
2C Fresh Water Immersion	Q-SP 5	Q-SP 5	Q-SP 5	Q-SP 5	Q-SP 10	Q-SP 10	NR	Q-SP 10	Q-SP 10	Q-SP 10
2D Salt Water Immersion	Q-SP 10	Q-SP 10	Q-SP 10	Q-SP 10	Q-SP 10	Q-SP 10	NR	Q-SP 10	NR	Q-SP 10
3A Chemical Exposure, Acidic (pH 2 to 5)	NR	Q-SP 10	NR	Q-SP 10	NR	Q-SP 10	NR	Q-SP 6	NR	Q-SP 6
3B Chemical Exposure, Neutral (pH 5 to 10)	R-SP 10	R-SP 10	R-SP 10	R-SP 10	R-SP 6	R-SP 6	R-SP 6	R-SP 6	R-SP 6	R-SP 6
3C Chemical Exposure, Alkaline (pH 10 to 12)	NR	R-SP 10	NR	R-SP 10	NR	R-SP 6	NR	R-SP 6	NR	R-SP 6
3D Chemical Exposure, Solvent	R-SP 10	Q-SP 10	R-SP 10	Q-SP 10	R-SP 6	Q-SP 6	NR	NR	NR	Q-SP 6
3E Chemical Exposure, Severe	NR	NR	NR	NR	NR	NR	NR	NR	NR	NR

BINDER TYPES:

IA = Inorganic; post-cured, waterborne alkali silicates

IB = Inorganic; self-cured, waterborne alkali silicates

IC = Inorganic; self-cured, solvent-borne alkyl silicates

IIA = Organic; thermoplastic binders (e.g., phenoxy)

IIB = Organic; thermoset binders (e.g., epoxy polyamide, moisture-cured polyurethane)

RECOMMENDED USAGE:

R = Recommend

NR = Not Recommended

Q = Some products recommended, others not recommended. (See Sections 5.2, 5.3, 5.4, and 5.5.)

RECOMMENDED SURFACE PREPARATION:

The number refers to the minimum SSPC blast cleaning surface preparations as follows:

SP 5 = SSPC-SP 5, White Metal Blast Cleaning

SP 6 = SSPC-SP 6, Commercial Blast Cleaning

SP 10 = SSPC-SP 10, Near-White Blast Cleaning

NOTE: For pitted old steel, the blast cleaning requirement should be the next higher degree of cleanliness.

i.e., the SP 10 shown above should be SP 5, the SP 6 shown above should be SP 10.



4. Types of Zinc-Rich Coatings

4.1.1 A zinc-rich coating is an anticorrosive coating for iron and steel incorporating zinc dust in a concentration sufficient to enable the zinc metal in the dried film to corrode preferentially to the ferrous substrate, i.e., to give galvanic protection. Note that SSPC-Paint 20 and SSPC-Paint 29 require 65% minimum zinc loading in the dry film. Galvanic action is not universally accepted as the primary method by which these coatings protect the substrate.

4.1.2 Some zinc-rich coatings are used as prefabrication primers or shop primers, where they are applied to freshly blast cleaned steel plates and sections. The prefabrication primers, often at a lesser thickness, are intended to protect the steel throughout the fabrication period until the final painting system can be applied to the finished structure. At that juncture, the pre-fabrication primer may be incorporated into the final system or removed. SSPC-PS Guide 22.00 and SSPC-Paint 30 discuss the use of zinc-rich coatings as prefabrication primers.

4.1.3 Zinc-rich coatings may be used as a one-coat system or may be overcoated with one or more other coatings. The use of untopcoated zinc-rich systems is discussed in Section 5.3 and the use of topcoated systems is discussed in Section 5.4.

4.2 VEHICLES FOR ZINC-RICH COATINGS: Zinc-rich coatings are available in a number of different commercial types. These coatings may be categorized as having inorganic (Type I) or organic (Type II) vehicles.

4.2.1 Inorganic Vehicles: Type I inorganic vehicles include post-cured water-borne alkali silicates (IA); self-cured, water-borne alkali silicates (IB); and self-cured, solvent-borne alkyl silicates (IC). The vehicles of Types IA and IB may include the alkali metals (commonly sodium, lithium, and potassium), while IC vehicles are alkyl silicates (most commonly ethyl silicates). Type IA vehicles are post-cured with a separate wash solution, usually mildly acidic in nature, applied as an aftercoat. Type IB vehicles are chemically similar to Type IA vehicles, except they are formulated to self-cure upon exposure to moisture and carbon dioxide in the air. Type IC vehicles self-cure upon exposure to atmospheric moisture.

4.2.2 Organic Vehicles: Type II vehicles include those with thermoplastic binders (IIA) and thermoset binders (IIB). Type II thermoplastic vehicles include polymers of chlorinated rubber, styrene, vinyl, and other organic materials that soften upon exposure to heat. Type IIB thermoset vehicles do not soften upon heating, and include polymers of epoxy, polyurethane, polyester, silicone, and other chemically cross-linked materials.

4.3 PIGMENTATION FOR ZINC-RICH COATINGS: The major pigment component in these coatings is zinc dust of

the type described in ASTM D 520. Zinc-rich coatings are successfully formulated with zinc dust levels ranging from 65 to 95 percent by weight in the dried film.

4.4 NUMBER OF COMPONENTS: Inorganic and organic zinc-rich coatings are supplied as a single- or multi-component package. Many multi-component packages separate the zinc pigment and vehicle and provide directions for mixture immediately prior to application. Multi-component coatings have a limited pot life after mixing. Because pot life will vary with vehicle/resin type, the manufacturer's product data sheets should always be consulted.

5. Selection of Coating System

5.1 CLASSIFYING EXPOSURE ZONES: Successful corrosion protection utilizing a zinc-rich coating system is dependent upon the anticipated service in environmental exposure zones. Guidelines for the use of organic and inorganic zinc-rich coatings, either topcoated or untopcoated, are presented below based on the following SSPC classifications of exposure:

- 1A Interior, Normally Dry
- 1B Exterior, Normally Dry
- 2A Frequently Wet-Fresh Water
- 2B Frequently Wet-Salt Water
- 2C Fresh Water Immersion
- 2D Salt Water Immersion
- 3A Atmospheric Chemical Exposures (pH 2 to 5)
- 3B Atmospheric Chemical Exposures (pH 5 to 10)
- 3C Atmospheric Chemical Exposures (pH 10 to 12)
- 3D Chemical Exposure, Solvents
- 3E Chemical Exposure, Severe

5.2 GUIDELINES FOR USAGE: The untopcoated and topcoated inorganic and organic zinc-rich coatings are categorized as suitable (recommended), unsuitable (not recommended), or questionable for the exposure environments listed in Section 5.1. Questionable means that some products may perform satisfactorily, while other products may not, or that the environmental description is too variable to assure satisfactory coating system performance. Guidelines for the use of topcoated and untopcoated zinc-rich coatings in various environments are presented below and in Table 1.

5.3 USE OF UNTOPCOATED ZINC-RICH COATINGS

5.3.1 Untopcoated Inorganic Zinc-Rich Coatings: These coatings may be suitable for use in the following environmental zones: 1A, 1B, 2A, 2B, 3B, and 3D. These coatings are not recommended for the following environmental zones: 3A, 3C, and 3E. These coatings are questionable for use in environmental zones 2C and 2D. These coatings are suitable for application to uninsulated hot equipment with service temperatures up to 400 °C (750 °F).

