

Steel Structures Painting Council

PAINT SPECIFICATION NO. 20

Zinc-Rich Primers (Type I, "Inorganic," and Type II, "Organic")

1. Scope

1.1 This specification covers one group of highly pigmented zinc-rich coatings that are uniquely defined by their capability of galvanically protecting steel exposed at discontinuities such as narrow scratches and holidays. While the major pigment component in this coating is zinc dust, the vehicle may be inorganic (Type I) or organic (Type II).

1.2 This specification does not cover all types of zinc-rich coatings. For example, it is not a straight performance specification, nor does it pertain to extended zinc-rich coatings, nor to weldable pre-fabrication zinc-rich primers, which are applied at low thicknesses (approximately one mil [25 microns] or less). Further information regarding these and other zinc-rich coatings can be found in SSPC-PS Guide 12.00, "Guide to Zinc-Rich Painting Systems," and other SSPC specifications.

1.3 This specification defines the minimum compositional and laboratory performance requirements for identifying a group of zinc-rich paints. It is to be used in conjunction with SSPC-PS Guide 12.00, "Guide to Zinc-Rich Painting Systems"; and with other SSPC specifications covering surface preparation, applications, thickness, inspection, and safety.

1.4 This primer, when applied over properly prepared steel surfaces is suitable for use on parts or structures exposed in Environmental Zones 1A (interior, normally dry), 1B (exterior, normally dry), 2A (frequently wet by fresh water), and 2C (fresh water immersion). They may be used in Environmental Zones 2B (frequently wet by salt water), 2D (salt water immersion), 3A (chemical, acidic), and 3C (chemical, alkaline) with proper top-coating.

1.5 This primer is intended for application by spray and is to be applied in accordance with SSPC-PA 1, "Shop, Field, and Maintenance Painting."

2. Description

2.1 The zinc-rich coatings described in this specification consist of zinc dust, an organic or inorganic vehicle, and selected additives as required.

2.2 PIGMENTATION:

2.2.1 The major pigment component in these coatings is zinc dust of the type described in ASTM D 520, "Zinc Dust (Metallic Zinc Powder)."

2.2.2 Other pigment components may include curing aids, tinting colors, suspension and pot life control agents, but should constitute only a minor part of the total pigment portion so as not to detract from the ability of these coatings to protect galvanically.

2.3 VEHICLE TYPES:

2.3.1 Type I-A, inorganic post-curing vehicles—water soluble, include alkali metal silicates, phosphates, and modifications thereof which must be subsequently cured by application of heat or a solution of a curing compound.

2.3.2 Type I-B, inorganic self-curing vehicles—water reducible, include water soluble alkali metal silicates, quaternary ammonium silicates, phosphates, and modifications thereof. These coatings cure by crystallization after evaporation of water from the coating.

2.3.3 Type I-C, inorganic self-curing vehicles—solvent reducible, include titanates, organic silicates, and polymeric modifications of these silicates. These systems are dependent upon moisture in the atmosphere to complete hydrolysis, forming the polysilicate.

2.3.4 Type II, organic vehicles—include phenoxies, catalyzed epoxies, urethanes, chlorinated rubbers, styrenes, silicones, vinyls, and other suitable resinous binders. The organic vehicles covered by this specification may be chemically cured or may dry by solvent evaporation. Under certain conditions heat may be used to facilitate or accelerate hardening.

3. Reference Standards

3.1 The standards referenced in this specification are listed in Sections 3.4 through 3.7 and form a part of this specification.

3.2 The latest issue, revision, or amendment of the referenced standards in effect on the date of invitation to bid shall govern unless otherwise specified.

3.3 If there is a conflict between the requirements of any of the cited reference standards and this specification, the requirements of this specification shall prevail.

3.4 STEEL STRUCTURES PAINTING COUNCIL (SSPC) SPECIFICATIONS:

PA 1	Shop, Field, and Maintenance Painting
PA Guide 3	A Guide to Safety in Paint Application
SP 5	White Metal Blast Cleaning

TABLE 1
 REQUIREMENTS

CHARACTERISTICS ¹	MINIMUM REQUIREMENTS		STANDARDS ASTM
	Inorganic	Organic	
Total Solids, % by weight of paint	78	70	D 2369
Pigment, % by weight of total solids	85	83	D 2371
Total zinc dust ² , % by weight of pigment	87	93	D 521
Total zinc dust ² , % by weight of total solids	74	77	—

1 The minimum composition requirements of a zinc-rich paint is controversial. It is recognized that zinc-rich primers containing extenders, although having less total zinc dust than specified, may be able to pass all other requirements of this specification. However, these compositional requirements are necessary, as certain non-zinc containing coatings may also be able to pass all other requirements of this specification.

2 Zinc dust shall meet ASTM Standard D 520.

PS Guide	
12.00	Guide for Selecting Zinc-Rich Painting Systems
PS 12.01	One-Coat Zinc-Rich Painting System
3.5 AMERICAN SOCIETY FOR TESTING AND MATERIALS (ASTM) STANDARDS:	
3.5.1 Specification for Ingredients:	
D 520	Zinc Dust (Metallic Zinc Powder)
3.5.2 Test Methods for Properties:	
A 36	Structural Steel
B 117	Salt Spray (Fog) Testing
D 56	Flash Point by Tag Closed Tester
D 185	Coarse Particles in Pigments, Pastes, and Paints
D 521	Chemical Analysis of Zinc Dust (Metallic Zinc Powder)
D 562	Consistency of Paints Using the Stormer Viscometer
D 1200	Viscosity of Paints, Varnishes, and Lacquers by Ford Viscosity Cup
D 1308	Effect of Household Chemicals on Clear and Pigmented Organic Finishes
D 1475	Density of Paint, Varnish, Lacquer, and Related Products
D 2369	Volatile Content of Paints
D 2371	Pigment Content of Solvent-Type Paints
D 3359	Measuring Adhesion by Tape Test

3.6 FEDERAL STANDARDS:

3.6.1 Standard Specifications:

PPP-P-1892 Paint, Varnish, Lacquer, And Related Materials; Packaging And Marketing Of

3.6.2 Federal Test Method Standard No. 141

Method 4331 Spraying Properties

Method 4541 Working Properties and Appearance of Dried Film

3.7 AMERICAN NATIONAL STANDARDS INSTITUTE (ANSI) STANDARD:

Z129.1 Precautionary Labeling of Hazardous Industrial Chemicals

4. Composition

4.1 The paint shall conform to the composition (analysis) requirements of Table 1. This table defines the minimum compositional requirements of these zinc-rich paints without specifying the vehicle.

5. Qualitative Requirements

5.1 The paint shall meet the qualitative requirements of Sections 5.2 through 5.10.

5.2 **MIXING:** The raw materials of the liquid portion of either the inorganic or organic multi-component paints shall be mixed and dispersed as required to produce a product which is uniform, stable, free from grit, and conforms to the requirements of this specification.

The pigment portion of multi-component paints, prior to mixing, shall be dry and loosely packed.

The ready-mixed paint shall be capable of being broken up with a paddle to a smooth, uniform consistency and shall not liver, thicken, curdle, gel, or hard settle, nor show any other objectionable properties in a mixed, freshly opened container.

After mixing, all types of coarse particles and skins as residue retained on a standard 60 mesh screen shall be no more than 0.5% by weight of total paint, regardless of type, in accordance with ASTM D 185.

5.3 **POT LIFE:** The pot life of the zinc-rich paint, when mixed and ready for application in accordance with manufacturer's instructions, shall be a minimum of four hours at 70°F (21°C) and 50% relative humidity. Although physical properties (viscosity, etc.) may not change, loss of pot life is indicated by lack of adhesion when tested in accordance with Section 5.8. Good practice has been that multicomponent zinc-rich paint be used within 12 hours after mixing.

5.4 STORAGE LIFE: Neither the vehicle of the multi-component paint nor the ready-mixed paint shall show thickening, curdling, gelling, gassing, or hard caking after being stored unmixed for six months from date of delivery in a tightly covered unopened container at a temperature of 50-90 °F (10-32 °C).

5.5 WORKING PROPERTIES: The mixed paint shall spray easily, and show no streaking, running, sagging, or other objectionable features when tested in accordance with Federal Standard No. 141, Methods 4331 and 4541.

5.6 TEST PANEL PREPARATION: Steel test panels (ASTM A 36 hot rolled steel or equivalent), measuring 4" x 6" x 1/16" (10 cm x 15 cm x 1.5 mm) or greater, shall be white metal blast cleaned (SSPC-SP 5) with a nominal anchor profile from 1.5-3.5 mils (38-88 microns) (Section 10.4) and coated with the zinc-rich paint. The panels shall be blast cleaned and coated on both sides and all edges. The paint shall be spray applied and hardened in accordance with manufacturer's recommendations. The dry film thickness shall be 2.5-3.5 mils (64-88 microns) unless otherwise designated. Prior to any exposure testing, all panels shall be aged for 14 days at 75-79 °F (24-26 °C) and 45-55% relative humidity.

5.7 MUDCRACKING: The coating when applied in accordance with Section 5.6 to a five to six mil (127-162 microns) dry film thickness, shall show no mudcracking when viewed under 10X magnifications.

5.8 ADHESION: The coating when applied and hardened in accordance with Section 5.6, shall adhere to the steel substrate when subjected to the "Cross-Cut/Tape Test" (ASTM D 3359, Method B).

There shall be no separation of the paint film, or delamination of an entire square. Spalling loss of adhesion around the perimeter due to cutting of each square is acceptable.

Adhesion rating should be no less than 4B grading when evaluated according to the procedure of ASTM D 3359, Method B.

5.9 SALT FOG RESISTANCE: The coating, when applied and hardened in accordance with Section 5.6 and scribed as described below, shall pass 1,000 hours minimum exposure to salt fog (ASTM B 117) without any blistering or rusting of the coated portion, with no undercutting from the scribe. (Slight rusting in the scribe mark will be permissible and resulting staining should be ignored.) Strips 1/4" (6 mm) wide along the edges of the panel may be ignored. Testing shall be done in triplicate.

The scribe mark shall be centrally positioned in the lower half of the panel and shall consist of an "X" comprising the diagonals of a 2" x 2" (5 x 5 cm) square. To insure proper positioning, cleanliness and depth of scribe mark, a template and scriber or cutting tool having a cutting edge at least 1/32" (0.8 mm) wide shall be used. The operator shall bear down hard and go over each arm of the cut twice to insure a clean scribe of sufficient depth to remove any zinc particles from the scribe and to expose clean steel.

5.10 ADDITIONAL RESISTANCE TESTS: Additional screening qualification tests may be required by the user (Section 10.8).

6. Material Quality Assurance

6.1 In order to determine the acceptability of a lot or batch of a qualified product, the paint shall meet the requirements of Sections 6.2 through 6.4.

6.2 Viscosity of the mixed paint shall be determined in accordance with ASTM D 562. Variance shall be within ±5 Krebs Units or equivalent units of another viscometer of the viscosity of the previously qualified paint.

For viscosities lower than 55 K.U., a 4 Ford Cup shall be used in accordance with ASTM D 1200. Variations shall be within ±5 seconds of the viscosity of the previously qualified paint.

6.3 Weight per gallon of the mixed paint shall be determined in accordance with ASTM D 1475. Variance shall be within ±0.4 pounds (180 g) of the nominal weight per gallon of the previously qualified paint.

6.4 Solids percent by weight of the mixed paint shall be determined in accordance with ASTM D 2369. The percent solids by weight shall be no less than that specified in Table 1. Variance shall be within ±2% of the nominal percent solids by weight of the previously qualified paint.

6.5 Other tests may be used to determine the acceptability of a lot or batch of a qualified product at the discretion of the user.

7. Labeling

7.1 Refer to ANSI Standard Z129.1, "Precautionary Labeling of Hazardous Industrial Chemicals." Other guidelines can be found in the National Paint and Coating Association (NPCA) "Paint Industry Labeling Guide."

7.2 MARKING OF CONTAINER: Each container shall be legibly marked with the following information:

- Name: Zinc-Rich Primer
- Specification: SSPC-Paint 20, Type _____
- Component: _____
- Color: _____
- Lot Number: _____
- Stock Number: _____
- Date of Manufacture: _____
- Quantity of Paint in Container: _____
- Information and Warnings as may be required by Federal and State Laws: _____
- Manufacturer's Name and Address: _____

7.3 PACKAGING: The pigment portion of multicomponent zinc-rich paints shall be packaged separately to be mixed with the liquid portion shortly before use. Each container of liquid shall be packaged and labeled in accordance with the re-

quirements of Federal Specification PPP-P-1892 and shall include directions showing correct proportions of liquid to pigment along with necessary mixing instructions. The packaging of single component zinc-rich paints, Types I and II, shall also comply with the above Federal Specification.

7.4 DIRECTIONS FOR USE: The manufacturer shall supply complete instructions covering uses, surface preparation, mixing, thinning, application method, application conditions, pot life, wet and dry film thicknesses, temperature and humidity limitations, drying times, etc. with each container of paint.

8. Inspection

8.1 All materials supplied under this specification shall be subject to timely inspection by the purchaser or his authorized representative. The purchaser shall have the right to reject any material(s) supplied which is (are) found to be defective under this specification. In case of dispute, the arbitration or settlement procedure, if any, established in the procurement documents shall be followed. If no arbitration procedure is established, the procedure specified by the American Arbitration Association shall be used.

8.2 Samples of any or all ingredients used in the manufacture of this paint may be requested by the purchaser and shall be supplied upon request, along with the supplier's name and identification for the material.

8.3 Unless otherwise specified, the methods of sampling and testing should be in accordance with Federal Test Method Standard No. 141, or applicable methods of the American Society for Testing and Materials.

8.4 The procurement documents should establish the responsibility for samples, testing, and any required affidavit certifying full compliance with the specification.

9. Safety

9.1 All safety requirements stated in this specification apply in addition to any applicable federal, state, and local rules and requirements. They also shall be in accord with instructions of the paint manufacturer and requirements of insurance underwriters.

9.2 Paints are hazardous because of their flammability and potential toxicity. Proper safety precautions shall be observed to protect against these recognized hazards. Safe handling practices are required and should include, but not be limited to, the provisions of SSPC-PA Guide 3, "A Guide to Safety in Paint Application" and to the following:

9.2.1 Keep paints away from heat, sparks, and open flame during storage, mixing, and application. Provide sufficient ventilation to maintain vapor concentration at less than 25% of the lower explosive limit.

9.2.2 Avoid prolonged or repeated breathing of vapors or spray mists, and prevent contact of the paint with the eyes or skin.

9.2.3 Clean hands thoroughly after handling paints and before eating or smoking.

9.2.4 Provide sufficient ventilation to insure that vapor concentrations do not exceed the published permissible exposure limits. When necessary, supply appropriate personal protective equipment and enforce its use.

9.3 This paint may not comply with some air pollution regulations because of its hydrocarbon solvent content.

9.4 Ingredients in this paint, if so formulated, and which may pose a hazard include lead and chromate-containing pigments and hydrocarbon solvents. Applicable regulations governing safe handling practices shall apply to the use of this paint.

10. Notes*

10.1 While every precaution is taken to insure that all information furnished in SSPC specifications is as accurate, complete, and useful as possible, SSPC cannot assume responsibility or incur any obligation resulting from the use of any materials, paints, or methods specified therein, or of the specification itself.

10.2 COVERAGE: Except for special cases, most zinc-rich primers are formulated to apply at nominal dry film thicknesses of 2.5-3.5 mils (64-88 microns). In actual practice a coverage of 150 to 300 square feet per gallon (3.7-7.4 square meters per liter) will be expected over flat blast cleaned surfaces.

10.3 FLASH POINT: The minimum flash point, as determined by the Tag closed cup (ASTM D 56) should be "none" for inorganic water base zinc-rich coatings, and a minimum of 55°F (13°C) for solvent base inorganic zincs (Type I-C) and 50°F (10°C) for organic zincs (Type II). Specific applications, such as the interior of tanks, holds, and other confined spaces normally require a minimum flash point of 100°F (38°C).

10.4 A Surface Profile Comparator is available from the Steel Structures Painting Council for sand, grit, and shot blast cleaned surfaces. Alternatively, replica tape, depth micrometer, stylus, microscopic measurement methods, or other suitable techniques may be used.

10.5 Inorganic zinc-rich paints Types I-A and I-B should not be stored at temperatures below 40°F (4°C). Furthermore, storage of all zinc-rich paints above 90°F (32°C) should be avoided.

10.6 Inorganic zinc-rich primers (Types I-A and I-B) should not be applied at surface temperatures below 40°F (4°C). Type I-C should not be applied at relative humidities below 50%, without specific instructions from the paint manufacturer.

10.7 Multiple component zinc-rich paints should be applied within four hours after mixing and should be continuously agitated during application.

10.8 ADDITIONAL RESISTANCE TESTS: Because of the diversity of potential service environments, this specification may require the zinc-rich primer be further exposed and qualified by at least one additional test relating to the intended exposure. For example, if the intended service is a petroleum tanker cargo hold which is ballasted with sea water, appropriate test requirements other than those already specified might be:

- Salt Water Immersion (1,000 hours) ASTM D 1308
- Oil Immersion (1,000 hours) ASTM D 1308 or a cycling combination of both

Comparative testing of all candidate zinc-rich primers will be more meaningful than individual testing of each primer.

Standard tests which may be useful for further qualification are available from a number of organizations, including ASTM, U.S. Government Federal Specifications (TT-P; MIL-P, etc.), Federal Test Method Standards (141), and Canadian Government Specifications Board. A partial listing of public zinc-rich specifications requiring qualification testing is presented in the Notes of SSPC-PS Guide 12.00, "Guide for Selecting Zinc-Rich Painting Systems."

However, it should be emphasized that a well designed non-standard test may often provide more meaningful information for a given service condition than one or more standard tests.

*Notes are not requirements of this specification.

