MATERIAL AND EQUIPMENT STANDARD

FOR

ZINC-RICH EPOXY PAINT (ORGANIC ZINC-RICH)

AS

PRIMER, INTERMEDIATE

AND

TOP COAT (FINISH)

ORIGINAL EDITION

AUG. 1993

This standard specification is reviewed and updated by the relevant technical committee on May 1999(1) and July 2012(2). The approved modifications are included in the present issue of IPS.

FOREWORD

The Iranian Petroleum Standards (IPS) reflect the views of the Iranian Ministry of Petroleum and are intended for use in the oil and gas production facilities, oil refineries, chemical and petrochemical plants, gas handling and processing installations and other such facilities.

IPS are based on internationally acceptable standards and include selections from the items stipulated in the referenced standards. They are also supplemented by additional requirements and/or modifications based on the experience acquired by the Iranian Petroleum Industry and the local market availability. The options which are not specified in the text of the standards are itemized in data sheet/s, so that, the user can select his appropriate preferences therein.

The IPS standards are therefore expected to be sufficiently flexible so that the users can adapt these standards to their requirements. However, they may not cover every requirement of each project. For such cases, an addendum to IPS Standard shall be prepared by the user which elaborates the particular requirements of the user. This addendum together with the relevant IPS shall form the job specification for the specific project or work.

The IPS is reviewed and up-dated approximately every five years. Each standards are subject to amendment or withdrawal, if required, thus the latest edition of IPS shall be applicable

The users of IPS are therefore requested to send their views and comments, including any addendum prepared for particular cases to the following address. These comments and recommendations will be reviewed by the relevant technical committee and in case of approval will be incorporated in the next revision of the standard.

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GENERAL DEFINITIONS

Throughout this Standard the following definitions shall apply.

COMPANY :

Refers to one of the related and/or affiliated companies of the Iranian Ministry of Petroleum such as National Iranian Oil Company, National Iranian Gas Company, National Petrochemical Company and National Iranian Oil Refinery And Distribution Company.

PURCHASER :

Means the “Company" where this standard is a part of direct purchaser order by the “Company”, and the “Contractor” where this Standard is a part of contract document.

VENDOR AND SUPPLIER:

Refers to firm or person who will supply and/or fabricate the equipment or material.

CONTRACTOR:

Refers to the persons, firm or company whose tender has been accepted by the company.

EXECUTOR :

Executor is the party which carries out all or part of construction and/or commissioning for the project.

INSPECTOR :

The Inspector referred to in this Standard is a person/persons or a body appointed in writing by the company for the inspection of fabrication and installation work.

SHALL:

Is used where a provision is mandatory.

SHOULD:

Is used where a provision is advisory only.

WILL:

Is normally used in connection with the action by the “Company” rather than by a contractor, supplier or vendor.

MAY:

Is used where a provision is completely discretionary.

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1. SCOPE

This is Standard specification which is mainly generated from SSPC-20 covers the minimum requirements for the composition, analysis, properties, storage life and packaging, inspection and labeling of zinc rich epoxy paint (organic zinc-rich) to be used as primer, intermediate and top coat.

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on May 1999. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No. 84 on May 1999. These modifications are included in the present issue of IPS.

Note 2:

This standard specification is reviewed and updated by the relevant technical committee on July 2012. The approved modifications by T.C. were sent to IPS users as amendment No. 2 by circular No. 349 on July 2012. These modifications are included in the present issue of IPS.

2. REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

SSPC (STEEL STRUCTURES PAINTING COUNCIL) VOL. 2

SSPC 20	"Zinc-Rich Primer (Type I, “Inorganic” and Type II, “Organic”)"
SSPC-PA Guide 3	"A Guide to Safety in Paint Application"
SSPC SP 5	“White Metal Blast Cleaning”
SSPC-PA 1	“Shop, Field and Maintenance Painting”
SSPC Guide 12	“Guide to Zinc-rich Painting System”

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

(Specification for Ingredients)

D520	"Standard Specification for Zinc Dust Pigment "

(Test Methods for Properties)

A36	"Standard Specification for Carbon Structural Steel"
B117	"Standard Practice for Operating Salt Spray (Fog) Apparatus"
D56	"Standard Test Method for Flash Point by Tag Closed Cup Tester"
D521	"Chemical Analysis of Zinc Dust (Metallic Zinc Powder)"
D562	“Standard Test Method for Consistency of Paints Measuring Krebs Unit (KU) Viscosity Using a Stormer –Type Viscometer”

D1308	"Effect of Household Chemicals on Clear and Pigmented Organic Finishes"
D1475	"Standard Test Method for Density of Liquid Coatings, Inks and Related Products"
D1544	"Color of Transparent liquids (Gardner Color Scale)"
D1652	“Epoxy Content of Epoxy Resins”
D2369	"Standard Test Method for Volatile Content of Coating"
D2371	"Standard Test Method for Pigment Content of Solvent – Reducible Paints"
D3359	"Measuring Adhesion by Tape Test"
D3925	“Practice for Sampling Liquid Paints and Related Pigmented Coating

UFS (US FEDERAL STANDARDS)

(Standard Specification)

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

(Federal Test Method Standard No. 141)

Method 4331	"Spraying Properties"
Method 4541	"Working Properties and Appearance of Dried Film"

ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

ANSI Z400.1/Z129.1	"Hazard Evaluation and safety data sheet and precautionary labeling preparation"

BSI (BRITISH STANDARD INSTITUTION)

BS381C	"Colors for Identification on Coding and Special Purposes"

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-GN-100	“Engineering Standard for Units”
IPS-E-TP-100	"Engineering Standard for Paints"

3. UNITS

This Standard is based on International System of Units (SI), as per IPS-E-GN-100 except where otherwise specified.

4. COMPOSITION

4.1 Ingredients and Proportions

Ingredients and proportions of paint shall be as specified in Table 1 and Sections 4.2 through 4.6.

4.2 Percentage

The paint consists of 70% by weight of nonvolatile film forming solids (pigments and binder).

4.3 The zinc rich described in this specification consists of zinc dust, an organic vehicle, and selected additives as required.

4.4 Pigmentation

The major pigment component in paint is zinc dust of either types described in Table 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 this paint to protect galvanically.

4.5 Vehicle

Organic vehicle consists of catalyzed epoxy. The epoxy resin shall be a di-epoxide condensation product of biphenol A and epichlorohydrin with terminal epoxide group with the requirements of Table 3.

4.6 Curing Agent Component

The curing agent consist of a liquid type polyamide resin and volatile solvent.

The undiluted polyamide resin shall meet the requirements of Table 4.

TABLE 1 - COMPOSITION OF PAINT

INGREDIENTS	COMPOSITION Wt. %	INGREDIENT STANDARDS
PIGMENT (83 ±2 Wt. %)	58	ASTM D520
VEHICLE (17 ±2 Wt. %)	12	---
SOLVENT	30	---
SELECTED ADDITIVES	AS REQUIRED	---

TABLE 2 - COMPOSITION OF ZINC DUST PIGMENT

	Type I	Type II	Type III
Total zinc, calculated as Zn, min, %	97.5	98.0	99.0
Metallic zinc, min, %	94.0	94.0	96.0
Material other than metallic zinc, ZnO, and admixed CaO, where applicable max %	0.75	...	...
Calcium, calculated as CaO, max, %	0.7	0.7	...
Lead, calculated as Pb, max, %	...	0.01	0.002
Iron, calculated as Fe, max, %	...	0.02	0.002
Cadmium, calculated as Cd, max, %	...	0.01	0.001
Chlorine, calculated as Cl, max, %	...	0.01	...
Sulfur, calculated as SO2, max, %	...	0.01	...
Moisture and other volatile matter, max, %	0.10	0.10	0.10
Oily or fatty matter, or both, max, %	...	0.05	...
Zinc oxide (ZnO), max, %	6.0	remainder	remainder
Coarse particles, max, %:			
Total residue retained on a 150-µm (No. 100) sieve	none	0.1	0.1
Total residue retained on a 75-µm (No. 200) sieve	...	0.8	0.8
Total residue retained on a 45-µm (No. 325) sieve	4.0	3.0	3.0

Type I General Grade.

Type II High Purity Grade.

TABLE 3 - EPOXY RESIN ANALYSIS

CHARACTERISTICS	REQUIREMENTS Min.	Max.	ASTM METHOD
EPOXIDE EQUIVALENT	450	550	D1652
COLOR, GARDNER (40% IN BUTYL CARBITOL)	---	4	D1544

TABLE 4 - CURING AGENT ANALYSIS

CHARACTERISTICS	REQUIREMENTS Min.	Max.	ASTM METHOD
AMINE VALUE [1]	230	250	---
COLOR GARDNER	---	8	D1544
SPECIFIC GRAVITY	0.96	0.98	D1475
VISCOSITY, AT 75° C POISES,	31	37	---

1) perchloric acid titration

5. ANALYSIS

5.1 The paint shall conform to the composition (analysis) requirements of Table 5.

TABLE 5 - ANALYSIS

CHARACTERISTICS[1]	MINIMUM REQUIREMENTS	STANDARDS ASTM
TOTAL SOLIDS, % BY WEIGHT OF PAINT	70	D2369
PIGMENT, % BY WEIGHT OF TOTAL SOLIDS	83	D2371
TOTAL ZINC DUST[2], % BY WEIGHT OF PIGMENT	93	D521
TOTAL ZINC DUST[2], % BY WEIGHT OF SOLIDS	77	---

1) The minimum composition requirements of zinc-rich paint is controversial. It is recognized that zinc rich primer 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 coating may be able to pass all other requirements of this specification.

2) Zinc dust shall meet requirements for composition of pigment (ASTM 520).

6. PROPERTIES

6.1 The paint shall meet the qualitative requirements of Sections 6.2 through 6.9.

6.2 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 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 6.6.

6.3 Working Properties

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

6.4 Test Panel Preparation

Steel test panels (ASTM-A 36 hot rolled steel or equivalent) measuring 10 cm × 15 cm × 1.5 mm, or greater, shall be blast cleaned to Sa3 (white metal) with a nominal anchor profile from 40-90 microns 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 60-90 microns unless otherwise designated. Prior to any exposure testing, all panels shall be aged for 14 days at 24-26°C and 45-55% relative humidity.

6.5 Mudcracking

The paint when applied in accordance with Section 6.4 to a 125-150 microns dry film thickness, shall show no mudcracking when viewed under 10X magnifications.

6.6 Adhesion

The paint when applied and hardened in accordance with Section 6.4, shall adhere to the steel substrate when subjected to the "Cross-Cut/Tape Test" (ASTM-D3359, 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.

6.7 Salt Fog Resistance

The paint when applied and hardened in accordance with Section 6.4 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 under cutting from the scribe (Slight rusting in the scribe mark will be permissible and resulting staining should be ignored).

Strips 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 5 × 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 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.

6.8 Additional Resistance Tests

Because of the diversity of potential service environments, this specification may require the zinc-rich paint 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 paints will be more meaningful than individual testing of each primer.

Standard test which may be useful for further qualification are available from a number of organizations, including ASTM, US Government Federal Specifications (TT-P, mil-P, etc.), US Federal Test Method Standards (141), and Canadian Government Specifications Board.

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.

6.9 Flash Point

The minimum flash point, as determined by the Tag closed cup (ASTM D56) should be 10°C. Specific applications, such as the interior of tanks, holds, and other confined spaces normally require a minimum flash point of 38°C.

6.10 Color

This paint can be used as top coat only where the finished color is not specific.

7. STORAGE LIFE AND PACKAGING

7.1 Storage Life

The vehicle of the paint shall show no thickening, curdling, gelling, gassing, or hard caking after being stored for 12 months from the date of delivery in a tightly covered unopened container.

7.2 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 requirements of Federal Specification PPP-P-1892 and shall include directions showing correct proportions of liquid to pigment along with necessary mixing instructions.

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 established in the procurement documents shall be followed.

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 materials.

8.3 Unless otherwise specified, the methods of sampling and testing should be in accordance with US Federal Test Method Standard No. 141, applicable method of the American Society for Testing and Materials (ASTM 3925).

9. LABELING

9.1 Refer to ANSI Standard Z400.1/Z129.1 "Hazard Evaluation and safety data sheet and precautionary labeling preparation".

9.2 Marking of Container

Each container shall be legibly marked with the following information:

Name: Zinc Rich Epoxy Paint (Organic Zinc-Rich) as Primer, Intermediate and Top coat (Finish)

Specification: IPS-M-TP-205

MESC No.: .....

No. of Components: .....

Maximum temperature resistance: .....

Type of Spray: .....

Kind and size of spray nozzle tip: .....

Cleaning material: .....

Flash point °C: .....

Pot life (hours): .....

Drying time for over coating: .....

Kind of thinner: .....

With reference to BS381C No. (to be specified by specifier)

Lot Number: .....

Stock Number: .....

Date of Manufacture: .....

Storage temperature: .....

Shelf life: .....

Quantity of Paint in Container: .....

Information and Warnings (if needed): .....

Manufacturer's Name and Address: .....

Design Guide: For guidance on the usage of this paint for various application/environment

and temperature ranges reference shall be made to IPS-E-TP-100

10. 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.

11. DIRECTIONS FOR SAFETY

The following directions for safety shall be supplied with each container of paint:

- 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 followings:
- 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.
- Avoid prolonged or repeated breathing of vapors or spray mists, and prevent contact of the paint with the eyes or skin.
- Clean hands thoroughly after handling paints and before eating or smoking.
- 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.

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

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.

12. MATERIAL QUALITY ASSURANCE

12.1 In order to determine the acceptability of a lot or batch of a qualified product, the paint shall meet the requirements of sections 12.1 through 12.4.

12.2 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.

12.3 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.

12.4 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 5. Variance shall be within ±2% of the nominal percent solids by weight of the previously qualified paint.

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