MATERIAL AND EQUIPMENT STANDARD

FOR

EPOXY POLYAMIDE PAINT

AS

TOP COAT (FINISH)

ORIGINAL EDITION

MAY 1993

This standard specification is reviewed and updated by the relevant technical committee on Dec. 1998(1) and Mar. 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 Standard Specification which is mainly derived from SSPC Paint No. 22 covers the minimum requirements for the composition, analysis, properties, storage life and packaging, inspection and labeling of Epoxy Polyamide paint as top coat (finish).

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on Dec. 1998. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No. 59 on Dec. 1998. 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 Mar. 2012. The approved modifications by T.C. were sent to IPS users as amendment No. 2 by circular No. 333 on Mar. 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.

BSI (BRITISH STANDARDS INSTITUTION)

BS381 C	"Colors for Identification Coding and Special Purposes"

IPS (IRANIAN PETROLEUM STANDARDS)

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

2.2 References

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effect at the time of publication of this Standard shall, to the extent specified herein, form a part of this Standard. The applicability of changes in standards and codes that occur after the date of this Standard shall be mutually agreed upon by the Company and the Vendor.

SSPC (STEEL STRUCTURES PAINTING COUNCIL) Volume 2

SSPC Paint No. 22	"Epoxy-Polyamide Paint" (Primer-Intermediate, and Top coat)
SSPC-PA Guide 3	"A Guide to Safety in Paint Application"
SSPC-PS Guide 22	"Paint System Guide No 22 Guide for Selecting one-Coat Preconstruction or Prefabrication Painting systems"

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

ISO 8501-1	"Preparation of Steel Substrates before Application of Paints and Related Products-Visual Assessment of Surface Cleanliness."

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

Specification for Ingredients

D209	"Lampblack"
D331	"2-Ethoxy Ethanol"
D364	"Industrial Grade Xylene"
D476	"Titanium Dioxide Pigments"
D605	"Magnesium Silicate Pigments"
D607	"Wet Ground Mica Pigment"
D1153	"Methyl Isobutyl Ketone"
D3722	"Standard specification for Natural Red and brown iron Oxide Pigments"

Specification for Packaging

D3951	"Standard Practice for Commercial Packaging"

Test Methods for Properties

B117	"Salt Spray (Fog) Testing"
D522	"Elongation of Attached Organic Coatings with Conical Mandrel Apparatus"
D562	"Consistency of Paints Using the Stormer Viscometer"
D610	"Evaluating Degree of Rusting on Painting Steel Surfaces"
D714	"Evaluating Degree of Blistering of Paints"
D1210	"Fineness of Dispersion of Pigment Vehicle Systems"
D1310	"Flash Point of Liquids by Tag Open Cup Apparatus"
D1475	"Density of Paint, Varnish, Lacquer, and Related Products"
D1544	"Color of Transparent Liquids (Gardner Color Scale)"
D1640	"Drying, Curing, or Film Formation of organic Coatings at Room Temperature"
D1652	"Epoxy Content of Epoxy Resins"
D1654	"Evaluating Painted or Coated Specimens Subjected to Corrosive Environments"
D2369	"Volatile Content of Paints"

US FEDERAL STANDARDS

MIL-P-24441	"General Specification for Paint, Epoxy Polyamide"
USF 141	"Test Method 3011"

ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

ANSI Z400.1/Z129.1	"Hazard Evaluation and Safety Data Sheet and Precautionary Labeling Preparation"

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 of the reference formulations shall be as specified in Table 1.

4.2 Percentage

4.2.1 This paint contains approximately 60% by volume of nonvolatile film forming solids (pigment and binder).

4.2.2 The curing agent component of the paint shall contain a liquid type polyamide resin and volatile solvent. The polyamide resin shall be a condensation product of dimerized fatty acids and polyamines.

4.2.3 The base component of the paint shall contain an epoxy resin together with anti-corrosion pigments, color pigments, mineral fillers, gellant, leveling agent, and volatile solvents. The epoxy resin shall be a di-epoxide condensation product of bisphenol A and epichorohydrin with terminal epoxide group.

TABLE 1 - COMPOSITION OF REFERENCE FORMULATIONS

	PRIMER				INTERMEDIATE				TOPCOAT				STANDARDS
INGREDIENTS	**Lb.**	**(kg)**	**Gals.**	**(L)**	**Lb.**	**(kg)**	**Gals.**	**(L)**	**Lb.**	**(kg)**	**Gals.**	**(L)**	**ASTM**
BASE COMPONENT:													
Red Iron Oxide	17	(7.7)	0.46	(1.7)	68	(30.9)	1.83	(6.9)	----	----	----	(12.5)	D3722
Rutile Titanium Dioxide	----		----		----		----		115	(52.2)	3.29	(5.5)	D476
Magnesium Silicate	85	(38.6)	3.58	(13.6)	68	(30.9)	2.86	(10.8)	55	(25.0)	2.32	(8.8)	
Mica	28	(12.7)	1.19	(4.5)	23	(10.4)	0.98	(3.7)	18	(8.2)	0.77	(2.9)	D605
Lampblack	----		----		----		----		2	(0.9)	0.13	(0.5)	D607
Organo Montmorillonite[1]	8	(3.6)	0.56	(2.1)	8	(3.6)	0.56	(2.1)	8	(3.6)	0.56	(2.1)	D209
95/5 Methanol/Water	3	(1.4)	0.40	(1.5)	3	(1.4)	0.40	(1.5)	3	(1.4)	0.40	(1.5)	----
Epoxy Resin[2]	199	(90.3)	20.10	(76.1)	201	(91.3)	20.30	(76.9)	212	(96.2)	21.41	(81.1)	----
Leveling Agent[3]	10	(4.5)	1.18	(4.5)	10	(4.5)	1.18	(4.5)	11	(5.0)	1.29	(4.9)	----
Methyl Isobutyl Ketone	43	(19.5)	6.44	(24.4)	44	(20.0)	6.59	(25.0)	46	(20.9)	6.89	(26.1)	----
Xylene	126	(57.2)	17.36	(65.7)	150	(68.1)	20.64	(78.1)	111	(50.4)	15.28	(57.8)	D1153
2-Ethoxy Ethanol	67	(30.4)	8.66	(32.8)	65	(29.5)	8.40	(31.8)	69	(31.1)	8.91	(33.7)	D364
TOTALS (Base Component)	586	(266)	59.93	(226.9)	640	(290.6)	63.70	(241.3)	713	(324.7)	62.70	(237.4)	D331
CURING AGENT COMPONENT:													
Polyamide Resin[4]	107	(48.6)	13.20	(50.0)	108	(49.0)	13.33	(50.5)	114	(51.0)	14.07	(53.3)	----
Xylene	104	(47.2)	14.32	(54.2)	109	(49.5)	15.02	(56.7)	142	(64.5)	19.56	(74.0)	----
TOTALS (Curing Agent Comp.)	211	(95.8)	27.52	(104.2)	217	(98.5)	28.35	(107.2)	256	(116.3)	33.63	(127.3)	
TOTALS (Formulation)	797	(361.7)	87.45	(331.0)	857	(389.1)	92.09	(348.5)	969	(440.0)	96.30	(364.7)	

[1]NL Industries Bentone 27 or equivalent
[2]Epon Resin 1001, Shell Chemical Company or equivalent
[3]Beetle 216-8, American Cyanamid Company or equivalent
[4]Versamid 115 (Henkel), Uni-Rez 2115 (Union Camp) or equivalent

5. ANALYSIS

The paint shall conform to the composition (analysis) requirements of Table 2.

TABLE 2 – ANALYSIS

CHARACTERISTICS	REQUIREMENTS Min.	Max.	STANDARDS ASTM METHOD
NONVOLTILES, % BY WEIGHT	60	--	D2369

TABLE 3 - PROPERTIES EPOXY RESIN

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

TABLE 4 - PROPERTIES POLYAMIDE RESIN

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

1 PERCHLORIC ACID TITRATION

6. PROPERTIES

6.1 Requirements

6.1.1 The epoxy resin shall meet the requirements of Table 3.

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

6.1.3 The paint supplied under this specification shall be comparable in performance to the reference formulation of Table 1. It need not be composed of the quantities and type of ingredients given in Table 1. However, if substitutions of other ingredients are made, the paint shall meet the performance requirements of this specification, and when incorporated into a painting system.

6.1.4 Each component of this paint based on the specified ingredients shall be uniform, stable in storage, and free from grit and coarse particles.

6.1.5 After combining the base and curing agent components, the paint shall conform to the requirements of Table 5 and Section 6.2 through 6.6.

6.2 Color

The color shall be as specified in procurement documents with reference to Table 6.

6.3 Solvent Resistance

The development of solvent (methyl ethyl ketone) resistance is required as an indication of satisfactory cure and subsequent chemical resistance. Apply the paint by spray or brush to a clean test panel so that a dry film thickness of 50-75 microns per coat is obtained. Air dry the panel for five days at 25±2°C and relative humidity of 40%-50%. Following the curing period, saturate a small cotton ball with methyl ethyl ketone and place on the test panel under a watch glass for 30 minutes. After a ten minute recovery period, determine the pencil hardness of the coating. The minimum allowable rating is "7B".Determine pencil hardness as follows: Using a series of drawing leads (either wood clinched or secured in a mechanical holder), expose approximately 6 mm of lead. With a rotary motion square the point of the lead against No. 400 grit paper. Hold the lead at approximately 45° and push forward against the film using a pressure just short of breaking the lead. If penetration is not made, repeat using the next harder lead until penetration is made. Rate the film by indicating the hardest lead that does not penetrate.

6.4 Test Panels

Test panels shall be carbon steel minimum size 10.2 cm × 20.3 cm × 0.3 cm unless otherwise specified. They shall be blast cleaned to ISO 8501-1 a2½ . Air drying and test conditions shall be at 25±2°C and 40%-50% relative humidity.

6.5 Elcometer Adhesion Test

Prepare test panels as in Section 6.4 using 6 mm thick steel plate. Apply the paint at 50-75 microns dry film thickness per coat in accordance with the following schedule.

COATING	SUBSTRATE	DRYING TIMES
Primer	Steel	5 days
Intermediate	Primer	72 hours for primer
		72 hours for intermediate
Top Coat	Primer and	72 hours for primer
	Intermediate	72 hours for intermediate
		5 days for top coat

The adhesion of the prime coat to the substrate, intercoat adhesion, or cohesion of any coat of the painting system shall be determined by the adhesion tester 156 Kg. Prepare test panels as described above Lightly sand the coating surface and aluminum Dolly, and apply a quick set adhesive containing Alpha Cyanoacrylate. Allow the adhesive to cure overnight. Scribe the Coating and adhesive around the dolly prior to testing. Make a minimum of three trials and report the average. An average of 28 kg/square centimeter is considered acceptable.

6.6 Pot Life

Determine pot life of the individual coatings as follows. Thoroughly mix a one-pint sample of the finished coating and let stand at 77 ± 3°F (25 ± 2°C) for eight hours. At the end of this time there shall be no evidence of gelation. The coatings shall be in a free-flowing condition and brushable without thinning. NOTE: When mixing larger volumes, more heat will develop with a resultant shortening of the pot life.

TABLE 5 - PROPERTIES COMBINED PAINT

CHARACTERISTICS	TOPCOAT Min.	TOPCOAT Max.	STANDARD ASTM
PAINT CONSISTENCY VISCOSITY SHEAR RATE 200 rpm			
GRAMS	95	190	D562
KREB UNIT	60	80	D1475
DENSITY kg/Lit	1.2	1.3	D1210
FINENESS OF GRIND, MICRON	65	--	D1475
DRYING TIME ((23±2)°C, 45% R.H.)			D1640
TACK FREE, HOURS	--	2	
DRY HARD, HOURS	--	5	
DRY THROUGH, HOURS		8	
FLASH POINT, °C	27	--	D1310

TABLE 6 - REFERENCE COLORS

PAINT COLOR	COLOR No. to BS 381 C
ARCTIC BLUE	112
SEA GREEN	217
BRILLIANT GREEN	221
CANARY YELLOW	309
LIGHT STRAW	384
MIDDLE BROWN	411
SIGNAL RED	537
LIGHT ORANGE	557
LIGHT GREY	631
WHITE	595

7. STORAGE LIFE AND PACKAGING

7.1 Condition in Container

The paint (both base component and curing agent) shall show no thickening, curding, gelling, or hard caking when tested as specified in US Federal Standard No. 141, method 3011 after storage for 12 months from date of delivery in a full tightly covered container at a temperature of 10°C up to 43°C.

7.2 Packaging

The packaging shall meet the relevant requirement of ASTM D3951.

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.

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 US Federal Test Method Standard No. 141, or applicable methods of the American Society for Testing and Materials (ASTM).

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

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 Containers

Each container of each component shall be legibly marked with the following information:

Name: Epoxy-Polyamide Paint (Topcoat)

Specification: IPS-M-TP-225.....

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 overcoating: .....

Kind of thinner: .....

Color: (As specified in procurement documents according to Table 6 of this standard)

Lot Number: .....

Stock Number: .....

Quantity of Paint in Container: .....

Information and Warnings, if needed: .....

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

Date of Manufacture: .....

Temperature of Storage: .....

Shelf life: .....

Design Guide: For guidance on the usage of this paint for various application/environment and temperature range reference shall be made to IPS-E-TP-100

9.3 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 time, etc. with each container of paint.

The following are guidelines for the instructions required:

- Mixing and Thinning

Each coating component should be stirred to a smooth homogenous mixture. Then the proper amount of base and curing agent components, as recommended by the manufacturer, should be added together and mixed thoroughly. After allowing to stand for 30 minutes at 25±2°C the paint may be thinned up to 12% by volume of the total paint for spraying. The paint should be applied within the manufacturer's pot life limitations.

- Coating Thickness

The paint is usually applied by spray to a dry film thickness of 50-75 microns per coat.

- Cure Time between Coats

Under normal conditions, each coat should be air dried a minimum of four hours, but no more than 72 hours between application coats. In very hot weather with surfaces exposed to direct sunlight, it may be necessary to limit the intercoat drying period to 24 hours or less. Long drying time between coats may cause poor intercoat adhesion. These coatings shall not be applied at temperatures below 10°C.

9.4 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 following:

- 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 breating 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, which may pose a hazard include lead and chromate containing pigments, hydrocarbon solvents, and plasticizers. Applicable regulations governing safe handling practices shall apply to the use of this paint.

- During surface preparation that involves the removal of an old film of this paint, care shall be taken to minimize dusting, to protect workers from the dust, and to properly dispose of coating residues.