

MATERIAL AND EQUIPMENT STANDARD

FOR

TWO PACK ALIPHATIC POLYURETHANE PAINT

AS TOP-COAT (FINISH)

ORIGINAL EDITION

JULY 1994

This standard specification is reviewed and updated by the relevant technical committee on July 1999(1) and Oct. 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 covers the minimum requirements for the composition analysis, properties, storage life, packaging, inspection and labeling of Two Pack Aliphatic Polyurethane Paint.

Note 1:

This standard specification is reviewed and updated by the relevant technical committee on July 1999. The approved modifications by T.C. were sent to IPS users as amendment No. 1 by circular No. 102 on July 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 Oct. 2012. The approved modifications by T.C. were sent to IPS users as amendment No. 2 by circular No. 360 on Oct. 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.

ANSI (AMERICAN NATIONAL STANDARD INSTITUTE)

ANSI Z400.1/Z129.1 "Hazard Evaluating and Safety Datasheet and Precautionary Labeling Preparation"

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

Specification for Packaging

D 3951 (88) "Standard Practice for Commercial Packaging"

Test Methods for Properties

D 126 "Standard Test Method for Analysis of Yellow, Orange and Green Pigments Containing Lead Chrome and Chromium Oxide Green"

D 523 "Specular Gloss"

D 562 "Standard Test Method for Consistency of Paints Measuring Krebs Unit (UK) Viscosity Using a Stormer-Type Viscometer"

D 1210 "Standard Test Method for Fineness of Dispersion of Pigment-Vehicle System by Hegman Type gage"

D 1364 "Standard Test Method for Water in Volatile Solvents (Karl Fischer Reagent Titration Method)"

D 1475 "Standard Test Method for Density of Liquid Coatings, Inks and Related Products"

D 1544 "Color of Transparent Liquids (Gardener Color Scale)"

D 2396	"Standard Test Method for Volatile Content of Coatings"
D 2572	"Test Method for Isocyanate Groups in Urethane Materials or Prepolymers"
D3925	"Practice for Sampling Liquid Paints and Related Pigmented Coatings"

BSI (BRITISH STANDARD INSTITUTION)

381C	"Colours for Identification, Coding and Special Purpose"
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IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-GN-100	"Engineering Standard for Units"
IPS-E-TP-100	"Engineering Standard for Painting"
IPS-C-TP-101	"Construction Standard for Surface Preparation"
IPS-E-TP-270	"Engineering Standard for Coatings"

SSPC (STEEL STRUCTURES PAINTING COUNCIL)

SSPC PA Guide 3	"A Guide to Safety in Paint Application System"
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US FEDERAL STANDARDS

US Federal Test Method Standard No. 141

Method 3011	"Gelling & Caking of Paints"
Method 4021.1	"Pigment Content (Ordinary Centrifuge)"
Method 4041.1	"Volatile and Nonvolatile Content (Ordinary Laboratory Oven)"
Method 4042	"Volatile and Nonvolatile Content (Vacuum Oven)"
Method 4061.1	"Drying Time of Coatings"
Method 4184	"Weight per Gallon"
Method 4281	"Viscosity"
Method 4401	"Odor Test"
Method 4411.1	"Fineness of Grind"
Method 4541	"Working Properties and Appearance of Dried Film"
Method 7381	"Hydroxyl Number"

US MILITARY STANDARD

MIL 85295

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

The aliphatic polyurethane paint shall consist of two components. Components A shall be pigmented and contain the polyester resins. Component B shall contain the clear prepolymers aliphatic isocyanate resin and act as the hardener or curing agent for component A. It shall contain no toluene diisocyanate and no aromatic substituted isocyanate. Component A and B shall be packaged separately and furnished in kit form (see 7.2).

The ingredients used in the manufacture of these products shall conform to applicable US Federal and Military Specifications.

4.2 Percentage

The total nonvolatile solids for the admixed components of gloss colors shall be a minimum of 52 percent except black, insignia red, insignia blue and clear which shall be a minimum of 35 percent. The total nonvolatile solids content for the admixed components of camouflage and semigloss colors shall be 45 percent except black, insignia red, insignia blue and clear which shall be a minimum of 35 percent.

5. ANALYSIS

The paint shall conform to the composition (analysis) requirements of Table 1.

TABLE 1- ANALYSIS

CHARACTERISTICS	REQUIREMENTS		US FEDERAL STD. No. 141	ASTM STANDARD
	Min.	Max.		
COMPONENT A: TOTAL SOLIDS (VOL%) (RESIN AND PIGMENT) WATER CONTENT (VOL%)	70-35-45*		4021.1-4042	
HYDROXYL NUMBER (BASED ON 100% RESIN SOLIDS)	---	0.5 (GLOSS)	7381	D1364
COMPONENT B: TOTAL SOLIDS (VOL%) AVAILABLE ISOCYANATE- CONTENT (VOL%) TOTAL FREE ISOCYANATE-	35.0 7.0	0.75 (SEMIGLOSS AND CAMOUFLAGE) 233 ---	4042	D2572
TOLUENE DIISOCYANATE (SPOT TEST) ADMIXED PAINT: VOLATILES		0.64 NEGATIVE	(Mil-C-83286 B (USAF) ---	
NONVOLATILES (CALCULATED BY DIFFERENCE)	48-55-65 (see 4.2) 52-45-35		4041.1	D2369

* 70% for gloss colors-35% for gloss and semigloss black, insignia red insignia blue and clear-45% for camouflage and semigloss colors.

Note:

The solvents contained in the packaged paint shall be urethane grade, and contain minimum of alcohol in accordance with the best commercial practice.

6. PROPERTIES

6.1 Requirements

The components A and B shall meet the requirements of Table 2 and mixed paint shall meet requirements of paragraphs 6.2 through 6.11.

6.2 Odor

The odor of the paint material shall not be obnoxious, when tested in accordance with US Federal Standard No. 141 Test Method 4401.

6.3 Color

The color shall be as specified in procurement documents with reference to Table 3 and clause 4.2 if required.

6.4 Working Properties and Surface Appearance

Spray coats of the mixed coating, comprising the two components mixed in the ratio of one part by volume of component A, to one part by volume of component B, and thinned, if required, to meet viscosity as specified in 6.6 with thinner shall be smooth, uniform and free of bubbles, pinholes, holidays, and other film irregularities. The spray applied films, dried under the standard conditions ($25 \pm 2^\circ\text{C}$ and relative humidity of 50 ± 5 percent) shall provide a hard surface, free from grit, seeds, streaks, orange-peel, blisters, or other surface defects when tested in accordance with US Federal Standard No. 141 Test Method 4541.

6.5 Drying Time

The drying time of the paint shall not exceed 2 hours for the set-to-touch condition, one hour for the dry-to-recoat condition, nor 6 hours for the dry-hard condition when tested in accordance with US Federal Standard No. 141 Test Method 4061.1.

6.6 Viscosity

The viscosity of the freshly mixed material shall be 17 to 23 seconds in a number 2 Zhan cup. After standing for 6 hours the viscosity shall not increase greater than 20 percent from the original viscosity.

6.7 Setting

When tested in accordance with US Federal Standard No. 141 after standing undisturbed for 6 hours, the mixed and reduced paint material shall be free of curdling, precipitation and separation which cannot be easily redispersed by shaking on a mechanical paint mixer.

6.8 Free Diisocyanate

The free diisocyanate in the mixed paint shall not exceed 1 percent when tested in accordance with Appendix I of Mil- C-83286 B (USAF).

6.9 Pot Life

The paint material after mixing and reducing for spray application shall have a minimum pot life of 6 hours. After standing for 6 hours in a full, closed container at standard conditions ($25 \pm 2^\circ\text{C}$ and relative humidity of 25 ± 5 percent).

6.10 Fineness of Grind

The fineness of grind of the mixed paint shall not be less than 7 for the gloss paints and not less than 5 for the camouflage paints. The tests shall be made 1 hour after mixing, in accordance with US Federal Standard No. 141 Test Method 4411.1.

6.11 Applied Film Property Requirements

The applied film of the paint shall meet the requirements of Mil-C-83286 B (USAF) for applied film paint.

TABLE 2

CHARACTERISTICS	REQUIREMENTS		US FEDERAL STD. No. 141	ASTM STANDARD
	Min.	Max.		
COMPONENT A:				
VISCOSITY (STORMER),			4281	D562
KREBS UNITS (FOR GLOSS COLORS)	85	95		
KREBS UNITS (FOR CAMOUFLAGE COLORS)	95	110		
DENSITY kg/Lit*	REPORT		4184	D1475
FINENESS OF GRIND (HEGMAN UNITS)	3	5	4411.1	D1210
COMPONENT B:				
DENSITY kg/Lit*	REPORT		4184	D1475
COLOR (GARDENER)	3		---	D1544

*** Density of the quality conformance sample shall not deviate by more than 10 percent from that of the qualification sample.**

TABLE 3 - REFERENCE COLORS

PAINT COLOR	COLOR No. TO BS 381 C
ARCTIC BLUE	112
SEA GREEN	217
BRILLIANT GREEN	221
CANNARY YELLOW	309
LIGHT STRAW	384
MIDDLE BROWN	411
SINGLE RED	537
LIGHT ORANGE	567
LIGHT GRAY	631

7. STORAGE LIFE AND PACKAGING

7.1 Condition in Container

The paint (both component A and B) shall show no thickening, curdling, 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. The container shall not show evidence of excessive pressure or be deformed by gassing.

7.2 Packaging and Packing

The polyurethane paint shall be supplied in a kit, packaged as a unit consisting of pigmented compound marked "Component A" and the unpigmented (or clear) hardener marked "Component B". The quantity of each component in the kit shall be in the proportions: 1 to 1 by volume, respectively. Component B shall be packed in full containers. The containers shall be thoroughly dry and filled in a dry atmosphere. The packaging shall also meet the relevant requirements of ASTM D3951.

8. INSPECTION

8.1 All work and materials supplied under this specification shall be subject to timely inspection by the purchaser or his authorized representative. The contractor shall correct such work or replace such material as is found 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 paints used under this painting system should 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 Federal Test Method Standard No. 141, or applicable methods of the American Society for Testing and Materials (ASTM 3925).

9. LABELING

9.1 Refer to ANSI standard Z400.1/Z129.1 "Hazard Evaluating and Safety Datasheet and Precautionary Labeling Preparation.

9.2 Marking of Containers

Each container shall be legibly marked with the following information: Name: Two pack Aliphatic Polyurethane Paint Top coat, (Finish)

Specification: [IPS-M-TP-235](#):

MESC No.:

No. of components:

Component:.....A (or B)

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:

Color:.....according to BS 381 C No.

Lot Number:

Stock Number:

Date of Manufacture:

Storage Temperature.....

Shelf Life.....

Quantity of Paint in container:

Information and Warnings, (if needed):

Manufacture's Name and Address:

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-270](#).

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 homogeneous mixture. Then the proper amount of components A and B, as recommended by the manufacturer, should be added together and mixed thoroughly.

Coating Thickness

The paint film thickness per coat shall be specified by manufacturer.

9.4 Direction 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 SSPCPA Guide 3, "A Guide to Safety in Paint Application."

The paints specified herein may not comply with some air pollution regulations because of their hydrocarbon solvent content.

Ingredients in urethane paints which may pose a hazard include isocyanates and solvents. Applicable regulations governing safe handling practices shall apply to the use of urethane coatings.

The main items to consider and keep in mind when working with urethane paint systems are as follows:

- Become informed and aware of the hazards and appropriate control procedures. This can be done by reading the label, the material safety data sheet, if available, or by contacting the supplier of the paint system for other literature and information.
- Follow the recommendations prescribed for use during handling and application as set forth by the supplier.
- Follow all applicable local, regulations.

COMMENT

Toxicological research as well as practical experience has shown that diisocyanates can cause irritation of the skin, respiratory tract, eyes, nose and throat. In addition, sensitization resulting in allergic dermatitis or asthmatic symptoms can occur following overexposure to diisocyanates. Toxicological research has shown that polyisocyanates have a reduced potential to cause irritation

and sensitization relative to their monomeric precursors.

Irritation is an acute response which results from the direct contact of isocyanates on the body surface, i.e., skin, mucous membranes of the nasal passages, throat and respiratory tract, eyes, etc. Symptoms usually include watering of the eyes, and a burning sensation in the nose and throat. The amount of irritation is dependent upon the dose, tissue exposed and individual susceptibility, but it is generally independent of the individual's exposure history. These acute symptoms are generally reversible soon after the individual is removed from the contaminated area or removal of the material from the skin in cases of skin contact.

Sensitization is a systemic response and is not limited to the area of contact. Sensitization usually occurs as a result of numerous over-exposures or one exposure to very high concentrations. Both respiratory and dermal sensitization can occur depending upon the toxicologic properties of the diisocyanate, route of exposure and individual susceptibilities.

Exposures subsequent to the exposure(s) which actually are resulted in sensitization may cause a very strong allergic type of reaction.

In the case of respiratory sensitization the reaction is similar to asthma, i.e., coughing, wheezing, tightness in the chest and shortness of breath. The skin sensitization reaction is allergic dermatitis which may include symptoms such as rash, itching, hives, and swelling of the arms and legs.

If an individual experiences an irritation response while handling an isocyanate it should be determined whether or not the isocyanate was the cause of the irritation. If the isocyanate is the cause, it is an indication that the operation, as performed, allows an overexposure to isocyanates which can result in later sensitization of that worker or others. A careful evaluation of the controls, protective equipment, and work practices, should be made to reduce the exposure. If irritation persists in spite of proper ventilation and protective measures the individual must be removed from areas where isocyanates are being processed or used.

If an individual is sensitized to isocyanates, complete removal from areas of potential exposure is mandated. This is true regardless of whether the isocyanate is present in vapor or mist form. Also, exposure to an isocyanate, other than the one suspected of causing the sensitization, must be avoided.

Solvents are also present in paints. Prolonged or repeated exposure or overexposure to these solvents by either inhalation or direct skin contact may also cause injurious health effects. The effects are dependent upon the solvent, the extent of exposure and the route of exposure.

Protective Measures: Since isocyanates have the potential to irritate and sensitize those working with or around them it is important that proper steps be taken to protect those potentially exposed from excessive contact with vapor, mist or overspray. This includes those actually handling the isocyanate as well as those in the immediate vicinity. Even during brush, roller and curtain paint applications, it is possible to be exposed to airborne concentrations of solvents and isocyanate vapors. During spray application, not only will vapors be present, but also spray mists or aerosolized droplets.

These droplets contain pigments, solvents, resins, additives, and polymeric materials, as well as isocyanate and unreacted polyisocyanate. Each of these will have their own physiological effect on the organism.

Ideally, control of health hazards posed by vapors and spray mist is performed by engineering controls. Effective engineering controls should be used whenever possible to eliminate or reduce workers exposure. There are several engineering controls available to reduce exposure to isocyanate vapors and mists.

The most common is a properly designed and ventilated enclosure. General ventilation, local ventilation, or isolation may prove adequate under certain conditions. Use of alternative application equipment, e.g., airless or electrostatic spray equipment, may help reduce spray mist generation during spray painting.

Brush and roller application of the paint may be feasible in some cases. To reduce environmental contamination, exhausted air may need to be cleaned by means of filters or scrubbers. The final design and combination of these control measures is dependent upon the specific application.

Whenever a paint system is spray-applied it is essential that the applicator be protected from

inhalation of both vapors and spray mists by the best possible respiratory protection. Under certain conditions, a fresh air supplied respirator will be required. In other cases, an air purifying type with a particulate filter may be employed. Applicators are urged to consult with their suppliers concerning the type of respiratory protection appropriate in a given application.

The appropriate selection and use of a respirator is an important part of protection from work-related chemical hazards.

Other things also must be remembered and followed:

- Users of respirators must be properly trained in their use;
- always be sure the respirator is in good working order;
- know its limitations;
- be sure it fits properly;
- clean it after each use.

Respirator manufacturers may be helpful in developing a good respirator program.

In addition to respirators, other forms of recommended personal protective equipment include safety glasses or goggles.

Nevertheless, should spray mist get into the eye, rinse immediately and sufficiently with lukewarm water and consult an eye doctor should irritation persist.

Regarding skin contact, it is suggested that as much of the exposed skin area as possible be covered with clothing or skin creams. Cured coating cannot be removed easily. Application of a protective skin cream to the hands prior to start of work will facilitate the soap and water removal of paint splashes or overspray. Skin areas covered only by protective creams should be kept to an absolute minimum. Aggressive solvents are unsuitable for skin-cleaning as they wash oils out of the skin and can cause secondary reactions.