MATERIAL AND EQUIPMENT STANDARD

FOR

SILICONE ALKYD PAINT (WHITE OR COLORED)

AS

TOP COAT (FINISH)

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1. SCOPE

This Standard specification which is generated from SSPC paint No. 21 covers the minimum requirements for the composition, analysis, properties, storage life and packaging, inspection and labeling of silicone alkyd paint as top coat (finish).

2. REFERENCES

Throughout this Standard the following standards and codes are referred to. The editions of these standards and codes that are in effet 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) VOL. 2

SSPC No. 21	"White or Colored Silicane Alkyd Paint High Glass"
SSPC-PA Guide 3,	"A Guide to Safety in Paint Application"

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

(Specification for Ingredients)

D235	"Petroleum Spirits (Mineral Spirits)"
D476	"Titanium dioxide Pigments"
D600	"Liquid Paint Dryers"

(Specification for Packaging)

D3951-88	"Standard Practice for Commercial Packaging"

(Test Methods for Properties)

D93	"Flash Point by Pensky-Martens Closed Tester"
D95	"Water in Petroleum Products and Bituminous Materials by Distillation"
D185	"Coarse Particles in Pigments, Pastes, and Paints"
D562	"Consistency of Paints Using the Stormer Viscometer"
D1210	"Fineness of Dispersion of Pigment-Vehicle Systems"
D1296	"Odors of Volatile Solvents and Diluents"
D1306	"Phthalic Anhydride Content of Alkyd Resins and Esters Containing Other Dibasic Acids (Gravimetric)"
D1398	"Fatty Acid Content of Alkyd Resins and Alkyd Resin Solutions"
D1640	"Drying, Curing, or Film Formation of Organic Coatings at Room Temperature"

D1729	"Visual Evaluation of Color Differences of Opaque Materials"
D1849	"Package Stability of Paint"
D2244	"Instrument Evaluation of Color Differences of Opaque Materials"
D2369	"Volatile Content of Paints"
D2371	"Pigment Content of Paints"
D2698	"Determination of Pigment Content of Solvent Type Paints by High-Speed Centrifuge"
D2800	"Preparation of Methyl Esters from Oils for Determination of Fatty Acid Composition by Gas Chromatography"
D2805	"Hiding Power of Paints"
D3335	"Low Concentrations of Lead, Cadmium, and Cobalt in Paint by Atomic Absorption Spectroscopy"

UFS (US FEDERAL STANDARDS)

(Standard Specifications for Ingredients)

PPP-T-60	"Tape, Packaging, Waterproof"
TT-E-490	"Enamel, Silicone Alkyd Copolymer, Semigloss (For Exterior and Interior Use)"
TT-E-1593	"Enamel, Silicone Alkyd Copolymer Gloss (For Exterior and Interior Use)"
TT-T-291	"Thinner, Paint, Mineral Spirits, Regular And Odorless"

(Federal Test Method Standard No. 141)

Section 9	"Routine and Referee Testing Conditions"
Method 2011	"Preparation of Steel Panels"
Method 3011	"Condition in Container"
Method 3021	"Skinning (Partially Filled Container)"
Method 4061	"Drying Time"
Method 4081	"Water Content (Reflux Method)"
Method 4092	"Coarse Particles and Skins"
Method 4203	"Reducibility and Dilution Stability"
Method 4321	"Brushing Properties"
Method 4331	"Spraying Properties"
Method 6221	"Flexibility"
Method 7014	"Analysis of Unsaponified Matter, Oil, Acids, and Phthalic Anhydride in Alkyd Vehicles"

(US Federal Standard No. 595 Color)

ANSI (AMERICAN NATIONAL STANDARDS INSTITUTE)

ANSI Z129-1 "Precautionary Labeling of Hazardous Industrial Chemicals"

BSI (BRITISH STANDARD INSTITUTION)

BS 381C-88 "Colors for Identification, Coding and Special Purposes"

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-E-TP-100 "Paints"

3. UNITS

International System of Units (SI) in accordance with IPS-E-GN-100 shall be used.

4. COMPOSITION

4.1 Ingredients and Proportions

Ingredients and proportions shall be as specified in Table 1 and sections 4.2 through 4.6.

4.2 Percentage

This paint shall contain a minimum of 60-67% by volume of nonvolatile film forming solids (pigments and binder).

4.3 Pigments

The main pigment for white shall consist of titanium dioxide conforming to ASTM-D-476, Type IV, or any combination of colored pigments to obtain the color specified, provided the paint complies with the requirements of this specification.

4.4 Vehicle

The vehicle shall consist of silicon-modified medium oil soya alkyd copolymer of the air-drying type, together with suitable thinners, driers, anti-skinning agents, wetting agents, dispersing agents, and stabilizers combined, producing a material conforming to all requirements specified herein. The silicone intermediate used in the preparation of the copolymerized resin shall be hydroxy functional. The vehicle shall conform to the composition (analysis) requirements of Table 2.

4.5 Solvent

The solvent shall be mineral spirits conforming to ASTM-D 235 or US Federal Specification TT-T-291.

4.6 Driers

The driers shall conform to ASTM-D 600.

TABLE 1 - COMPOSITION

COMPOSITION (DIFFERENT COLORS EXCEPT BLACK)		
INGREDIENTS	**Wt. %**	**INGREDIENT STANDARDS**
TOTAL SOLIDS	50-70	ASTM D2369
VEHICLE SOLIDS	30-40	---
SOLVENTS	30-40	---

Note:

Vehicle Solids

Place a portion (approximately 10 grams) of the vehicle (Separated as in ASTM Standard D2698) in a dropping bottle and weigh to the nearest 0.1 mg. Weigh one of the 60 mm aluminum dishes with fourth decimal-place accuracy. Transfer a small sample that does not exceed 0.3 grams to the dish, and determine its exact weight by loss of weight of the bottle. Dissolve the sample in 2 ml of reagent grade toluene and dry in a gravity convection oven at 105 ±2°C for three hours. After cooling for 30 minutes, weigh the dish to the nearest 0.1 mg. From the weight of residue in the dish and the weight of the sample taken, calculate the percent vehicle solids.

TABLE 2 - VEHICLE CHARACTERISTICS

CHARACTERISTICS	REQUIREMENTS Min.	Max.	ASTM METHOD	US FEDERAL STD. No. 141
COPOLYMER RESIN SOLIDS, PERCENT BY WEIGHT OF EXTRACTED VEHICLE SOLIDS **1**	50.0	---	---	---
SILICA (SiO_2), PERCENT BY WEIGHT OF COPOLYMER RESIN SOLIDS**2**	14.0	---	---	---
PHTHALIC ANHYDRIDE, PERCENT BY WEIGHT OF COPOLYMER RESIN SOLIDS	14.0	17.0	D1306	7014[3]
SOYA OIL ACID CONTENT (BASED ON SOLIDS)	41.0	55.0	D1398	7014[3]
SOYA OIL	POSITIVE		D2800	---

1) Copolymer resin content of nonvolatile vehicle isopropanol extraction: Weigh five grams (to the nearest 0.1 mg) of vehicle (separated as in ASTM D2698) into a tared centrifuge bottle or tube fitted with a cap. Add 50 ml of isopropanol (technical grade), cap the bottle or tube, and shake vigorously for two minutes. Centrifuge for 15 minutes at a minimum of 2,000 rpm. Decant the isopropanol extract and repeat the extraction and condition the bottle or tube in 135°C oven for three hours. Remove the bottle or tube, cool for 30 minutes at room temprature, and weigh. Calculate the copolymer resin solids using the following formula.

$$\text{Percent copolymer resin solids} = \frac{R \times 100}{S \times D}$$

Where:

R **= Weight of residue (in the bottle or tube)**
S **= Weight of sample (vehicle)**
D **= Percent of vehicle solids (see Note, Table 1)**

2) Silica Content of Vehicle: From a stoppered bottle or weighing pipet, weigh accurately by difference, about 3 grams of the vehicle into a properly ignited and weighed 75 mm porcelain evaporating dish. Dry at 105°C in an oven for 3 hours Place the dried sample in a cold muffle furnace and gradually increase the temperature over a period of 3 hours to 800°C. Then maintain this temperature for an additional hour. After cooling in a dessicator, weigh the dish and contents and calculate the percent of silica as follows:

$$\text{Percent Silica} = \frac{A \times 100}{S \times D}$$

Where:

A **= Weight of ash**
S **= Weight of sample (vehicle)**
D **= Percent of vehicle solids (see note, Table 1)**

3) Altered by the substitution of petroleum ether for chloroform.

5. ANALYSIS

The high gloss white paint shall conform to the composition (analysis) requirement of Table 3.

TABLE 3 - ANALYSIS FOR WHITE

CHARACTERISTICS	REQUIREMENTS Min. Wt. %	Max. Wt. %	ASTM METHOD
TOTAL SOLIDS	64	---	D2369
PIGMENT SOLIDS	31	35	D2371
VEHICLE SOLIDS	37	---	SEE NOTE, TABLE 1

6. PROPERTIES

6.1 The paint shall meet the requirements of Table 5 and sections 6.2 through 6.9.

6.2 Odor

The odor shall be normal for the materials permitted (ASTM Standard D1296) The odor of the wet enamel and of the film at any interval of drying shall not be obnoxious or objectional.

6.3 Color

Draw down a coat of paint on a white opaque glass panel using a doctor blade with a 150 microns gap clearance designed to deposit a wet film thickness of approximately 75 microns. After 48 hours drying at 21-24°C and 50% relative humidity, compare the dried film with the Standard chip (US Federal Standard No. 595) for white and with BS 381C (see Table 4) or other color agreed upon in accordance with ASTM Standard D1729 for compliance. If doubt exists as to the color match, an instrumental referee method may be used (ASTM Standard D2244).

6.4 Dilution Stability

There shall be no evidence of incompatibility of any of the ingredients of the paint when one volume of the paint is slowly mixed with one volume of mineral spirits (US Federal Standard No. 141, Method 4203). However, slight pigment settling shall be permitted.

6.5 Brushing Properties

The paint as packaged, shall be easily applied when tested in accordance with US Federal Standard No. 141, Method 4321. The paint shall dry to a smooth, uniform film, free from seeds, runs, sags, or streaks. The dried film shall show no discernible brush marks.

6.6 Spraying Properties

Prepare a steel panel in accordance with US Federal Standard No. 141, Method 2011 using the petroleum naphtha ethylene glycol monoethyl ether mixture. Spray apply the paint to this panel to a dry film thickness of 23-28 microns. The paint shall be easily applied when tested in accordance with US Federal Standard No. 141, Method 4331. The paint shall show no running, sagging, or streaking. The air dried film shall show no seeding, dusting, floating, fogging mottling, hazing, excessive orange peel, or other film defect.

6.7 Adhesion

Use the panel prepared in 6.6 by air drying for 18 hours, then baking for 2 hours at 105 ±2°C. Condition the panel for one hour under referee testing conditions (see Section 9 of US Federal Standard No. 141). Then score a line through to the metal across the width of the film using a sharp pointed knife. The film shall then be taped perpendicular to and across the score line with waterproof, pressure sensitive tape, 2 cm wide, conforming of US Federal Standard PPP-T-60 Type IV. Press the tape in firm contact with pressure. Allow approximately 10 seconds for the test area to return to room temperature. Grasp the free end of the tape and at a rapid speed strip it from the film by pulling back from the panel at approximately 180° angle. The paint shall show no removal of the film or loosening beyond 2 mm on either side of the score line.

6.8 Flexibility

Determine flexibility in accordance with US Federal Standard No. 141, Method 6221. Apply 5 cm wide film of paint on a smooth finish steel panel, prepared in accordance with Us Federal Standard No. 141, Method 2011 using the petroleum naphtha ethylene glycol monoethyl ether mixture with a suitable film applicator that will give a dry film thickness of 23-28 microns. The panel shall be prepared from new cold rolled rust free carbon steel 250 ±25 microns thick with a Rockwell 15-T maximum hardness of 82 and a finish with surface roughness of 0.2 to 0.3 micron. Air dry in a horizontal position for 18 hours, and then bake for 168 hours at 105 ±2°C. Condition the panel for ½ hour under standard testing conditions (see Section 9 of US Federal Standard No. 141). Bend over a 6 mm mandrel. Examine the coating for cracks over the area of the bend in a strong light at seven diameters magnification. The enamel shall withstand the bending without cracking or flaking.

6.9 Hiding Power (Contrast Ratio)

Determine the hiding power in accordance with ASTM Standard D 2805. Draw down a film using an applicator that will deposit a dry film of (25 microns) maximum thickness. Air dry for 72 hours, measure the thickness of the dried film, then measure the reflectance. Calculate the contrast ratio. A dry film thickness of 25 microns maximum of white enamel (minimum reflectance 84%) shall give a dry film contrast ratio of 0.95.

TABLE 4 - COLOR

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	567
LIGHT GREY	631

TABLE 5 - PROPERTIES

CHARACTERISTICS	REQUIREMENTS Min.	Max.	ASTM METHOD	US FEDERAL STD. No. 141
FLASH POINT, PENSKY-MARTENS, CLOSED CUP, °C	30	---	D93	---
WATER, PERCENT BY WEIGHT OF PAINT	---	0.5	D95	4081
COARSE PARTICLES AND SKINS, 0.044 STANDARD SIEVE OPENING RETAINED ON (No. 325 MESH SIEVE), PERCENT BY WEIGHT OF PIGMENT	---	0.1	D185	4092
VISCOSITY* SHEAR RATE 200 rpm:				
GRAMS	125	175	D562	---
KREB UNITS	67	77.0	D562	---
FINENESS OF GRIND, MICRONS	25		D1210	---
" " " , HEGMAN UNITS	6		D1210	---
DRYING TIME:				
SET TO TOUCH, HOURS	---	2	D1640	4061
DRY HARD, HOURS	---	8	D1640	4061

*** Viscosity 48 hours or more after manufacture.**

7. STORAGE LIFE AND PACKAGING

7.1 Condition in Container

Determine package condition of the paint in accordance with US Federal Standard No.141 Method 3011. The paint shall be free of grit, seeds, skins, lumps, thickening, or livering and shall show no more pigment settling or caking that can be readily re-incorporated to a smooth homogeneous state.

7.2 Storage Stability, Partially Full Container

Determine skinning after 48 hours in accordance with US Federal Standard No. 141, Method 3011 except use ¾ filled, 250 ml multiple friction top can. The paint shall show no skinning. Reseal and store for seven days at 60°C and observe. The paint shall show no livering, curdling, hard caking, or gummy sediment. It shall mix readily to a smooth homogeneous state.

7.3 Storage Stability, Full Container

Determine the storage stability of the package paint in accordance with ASTM Standard D1849 using a standard quart can allowing to stand undisturbed for 24 months. The paint shall show no skinning, livering, curdling hard-dry caking, or tough gummy sediment. Evaluate pigment settling or caking, but agitate the can for five minutes on the paint shaker prior to examination. The paint shall remix readily to a smooth homogeneous state and must be useable. The consistency of the paint after storage shall be 62-82 Krebs Units (ASTM Standard D562).

Reseal and then agitate the can for three minutes on a paint shaker. On re-examination of the contents, the disclosure of gel bodies, undispersed pigment, or unsatisfactory settling properties is cause for rejection.

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 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).

9. LABELING

9.1 Refer to ANSI Standard Z129.1 "Precautionary Labeling of Hazardous Industrial Chemicals".

9.2 Marking of Containers

Each container shall be legibly marked with the following information:

Name: Silicone Alkyd Paint as Top coat (Finish)
Specification: IPS-M-TP-175
Color: ..... according to BS381C No. .....
High gloss white according to US Federal Standard 595 No. 17886. .....
according to .....
MESC No. : .....
No of components .....
Maximum temperature resistance .....
Type of spray .....

Kind and size of spray nozzletip .....
Cleaning material.....
Flash point °C .....
Pot life (hours) .....
Drying time for overcoating .....
Kind of thinner .....
Lot Number: .....
Stock Number: .....
Date of Manufacture: .....
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 range reference shall be made to IPS-E-TP-100 "Paints"

9.3 Directions for Use

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

Directions for Use of Silicone Alkyd Paint as Top coat (Finish)

This paint is intended for use as a finish coat over a rust inhibitive primer (or other suitable primers) and an intermediate coat on structural steel. Before applying, remove all moisture, oil, grease, dirt, and loose or nonadhering paint.Sound old coatings that are compatible with this silicon alkyd paint may remain, but damaged areas or areas of poor adhesion must be spot-cleaned and spot-primed.

Mix paint thoroughly before use.

If simple stirring is inadequate, pour off most of the liquid into a clean container. Thoroughly mix the pigment with the remaining liquid, taking care to scrape all the pigment off the bottom of the can. Gradually add the poured-off liquid and mix thoroughly. Mixing may be made easier by transferring contents to a larger container or by pouring the paint to-and-from another container. Examine the bottom of the container for unmixed pigment. Screen paint before applying.

Thin paint only if necessary, using only mineral spirits. For brush application under normal conditions, no thinning should be necessary. For spray applications, add up to one liter of thinner per eight liters of unthinned paint when necessary.

Apply by brush or spray to the specified film thickness or, if none is specified, to at least 38 microns, dry or approximately 63 microns, wet. The surface to be painted shall be dry; the surface temperature shall be at least 3°C above the dew point; and the temperature of the air shall be over 4°C. Do not paint outdoors in rainy weather or if freezing temperatures are expected before the paint dries.

The thinner shall be mineral spirits conforming to ASTM-D235 or US Federal Specification TT-T-291 up to one liter of thinner may be added per eight litres of unthinned paint.

Allow paint at least 24 hours drying time in good weather before recoating.

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 breathing of vapors or spray mists, and prevent contact of the paint with 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 and hydrocarbon solvents. Applicable regulations governing safe handling practices shall apply to the use of this paint.