



Petrochemical Industries
Design & Engineering Co.

PROJ. NO. : 1203

SABALAN METHANOL PROJECT

COVER SHEET



OWNER :

SABALAN PETROCHEMICAL
INDUSTRIES CO.

PROJ. NO. : 89/S-G/102

ENGINEERING STANDARD SPECIFICATION FOR

PAINTS

**APPROVED
FOR CONSTRUCTION**
SABALAN METHANOL PROJECT / 1203

DOCUMENT NO : **1203-00-PI-ESS-406**

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ESS FOR PAINTS

DOC. NO. : 1203-00-PI-ESS-406

Rev.: 03



**SABALAN PETROCHEMICAL
INDUSTRIES CO.**

PROJ. NO. : 89/S-G/102

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1. GENERAL

1.1 Scope

This General Specification has been issued to form the basis for surface preparation and application of the selected painting system in chemical process plants.

This General Specification is intended to serve as a guide and promote uniformity in matters of painting and inspection. It shall be used together with the relevant information contained in the particular specification issued for the project. This specification is based on the protective paint systems for corrosion category C4 as indicated in the DS/EN ISO 12944 series.

1.2 Codes and Standards

The vendor shall at the minimum meet the requirements of this specification and the International Standard DS/EN ISO 8501-1: Preparation of Steel Substrates before Application of Paints and the DS/EN ISO 12944 series.

2. ASSUMPTIONS

This specification only comprises process components such as vessels, steel structures, piping, ladders, stairs, platforms and other auxiliary equipment.

The specification covers both equipment which will be delivered on site, finally painted from workshop, and equipment which is partly prepared and primed in the workshop, for later assembly on site and there to receive the final coats of paint.

All equipment such as motors, pumps, compressors, etc. will arrive finally painted from the manufacturers. However, all such equipment may receive a finishing coat of paint according to the code colour scheme.

3. SURFACE PREPARATION

All surfaces to be painted shall be cleaned and prepared before paint is applied. Surfaces shall be examined for traces of oil, grease or smudges. Any such traces must be removed by use of solvent.



Sharp edges, fillets, corners, and welds shall be rounded or smoothened by grinding (minimum radius 2 mm)

Hard surface layers (e.g. resulting from flame cutting) shall be removed by grinding prior to blast cleaning.

Normally all surfaces shall be blast cleaned according to DS/EN ISO 8501-1 to a preparation degree of "SA 2.5", i.e. clean to near white metal.

After blast cleaning the surface shall be completely cleaned by means of vacuum and/or compressed oil and moisture free air.

Blast cleaned surfaces shall be thoroughly inspected and primed within 8 hours after blasting and always before re-rusting starts and before they become contaminated.

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Blast cleaning operations shall not be carried out on surfaces when surface temperatures are less than 3°C above the dew point of the surrounding air, or when the relative humidity of the air exceeds 95%.



Blasting operations shall never be allowed in the vicinity of painting work or near to a wet paint surface or anywhere that blast abrasive, grit or fall-out shall impinge on a freshly painted surface, or on any uncovered primed surface

The maximum particle size of the abrasives used in blast cleaning shall not be larger than that passing through a 14-mesh screen B.S. Sieve Series. All abrasives shall be free from dust, moisture and salt. Blasting shall be continued till a uniform white metal surface is achieved

Blast cleaning is permitted only during the day light

Surfaces which are not suitable for blast cleaning shall be wire brushed according to DS/EN ISO 8501-1 to a preparation degree of "St 3", i.e. the surface shall have a pronounced metallic sheen, and be finally cleaned and inspected as prescribed above before being primed.

4. APPLICATION OF PAINT

All surfaces to be painted shall receive a surface preparation as prescribed under article 3. The painting procedure will be as follows:

4.1 Painting in Shop

Finally Shop-Painted Equipment

The prepared surface shall generally receive a coat of primer, an intermediate and a finishing coat.

The selection of painting system depends, e.g. on the working temperature of the surface and the kind of chemical environment to which the surface will be exposed.

The selected painting system for the various components is mentioned in article 8. recapitulatory table and the colour of the finishing coat will also figure in this scheme.

Each coat shall have a colour different to the preceding one, for easy inspection. Application of paint must not take place at temperatures lower than +5°C and shall follow article 3. with respect to humidity restrictions.

Equipment - Shop-Primed only

Equipment to be assembled on site shall only receive a primer coat in the shop according to what is mentioned in article 8.

Finishing coats will be applied on site.

Painting Procedure

Paint shall be applied only to dry, clean, adequately prepared surfaces under favorable conditions, and in accordance with the paint manufacturer's instructions.

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The paint manufacturer's recommendations on pot life, thinners, recommended spray guns, tips, needles, safety and other directions for use and application of primers and succeeding coats, shall be considered part of the specification.

Overspray and drip shall be kept to an absolute minimum, on surrounding painted surfaces, consistent with good workmanship practices. All overspray and drip shall be removed by vendor and, if necessary, the surfaces on the over sprayed objects shall be brought back to the original standard at vendor's expense.

Unless otherwise specified, the paints shall be applied by airless spray.

In all cases, the first layer preferably by airless spray or alternatively by brush.

03

Painting shall not take place in the following conditions:

- In particular rain, fog, snow, or when such conditions are likely to occur before the paint has become dry.
- At temperatures below 5°C (41°F).
- When the relative humidity is greater than 85%.
- When the metal surface temperature is less than 3°C (5°F) above the ambient dew point.
- In the case of exterior locations, painting may also be suspended due to wind speed at the discretion of owner. In cases where moisture tolerant coatings are used, painting may proceed on damp surfaces within the limits recommended by the manufacturer of the particular coating being applied.
- Painting shall not be carried out outside daylight hours on exterior locations. Painting may also be suspended due to dusty conditions.

The coats shall be uniform without holidays, pinholes, runs, etc., and they shall reach a final thickness as specified for each type of coat.

Brush application may be used for applications on piping and for touching up in small and complicated areas. Each coat shall be examined for signs of improper application, such as holidays, pinholes, runs, roughness and overspray, and if such shortcomings occur, the coat shall be repaired at vendor's expense in order to bring it into accordance with conditions.

To attain the required dry film thickness for intermediate coats and finishing coats, a number of consecutive coats may be used.

4.2 Painting on Site

All vessels and equipment arriving pre-primed, shall be examined for damage to the primer coat and be repaired according to the paint manufacturer's priming standard specification. Equipment to be assembled on site shall at site receive an additional coat of primer followed by intermediate binding coat and one or more finishing coats. All vessels and piping for cold services or where condensation can take place, shall be primed before being insulated.

Each coat shall have a colour clearly different from the prior coating. (Except heat resistant paint).

4.3 Equipment not to be Painted

Galvanized surfaces and equipment of stainless steel shall not be painted.

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5. THERMOINDICATIVE PAINT

Thermocolour paint is used on reactors and heaters with internal pressure and with internal insulation like refractory lining. The vessel surface coated with thermo indicative paint will, by changing colour, expose a failure in the refractory lining.

The present article gives special recommendations for surface preparation and method of application of thermocolour paint.

Surfaces to be Painted

All metallic outside parts of the vessel covering refractory lining on the other side of the shell.

Surface Preparation

Sharp edges, fillets, corners, and welds shall be rounded or smoothened by grinding (minimum radius 2 mm)

As prescribed under Article 3 i.e.: Blast cleaning to degree Sa 2.5 (DS/EN ISO 8501-1).

Wire brushing to degree St 3 (DS/EN ISO 8501-1) where blast cleaning is not possible. Surfaces must be free from grease, dirt, and mill-scale.

The primer coat shall be applied immediately afterwards and during the same day. However, some manufacturers do not prescribe priming before applying the thermocolour paint.

The paint manufacturer's recommendations shall be followed carefully.

Function of the System

The function of high temperature service coating is that the coat passes through three colour phases to give warning of insulation failure:

Original colour:	- Green
180 to 220°C	- Colour change green to blue
310 - 350°C	- Colour change blue to white -

Appearance: Semi-gloss

Typical service life of coating is 18-24 months.

Method of Application

Paint manufacturer's instructions to be followed, however, if no requirement, the following shall be applied to:

Conventional or airless spray, preferably roller or brush on small surfaces.

Dry film thickness, drying time, painting interval, thinning, etc., according to paint manufacturer's recommendation.

6. INSPECTION AND TESTING

Vendor shall ensure that the paint application is carried out according to this specification, paint manufacturer's instructions and in accordance with first class workmanship.

If work preparation or paint application does not fulfill the conditions in the above-mentioned specification, vendor shall, at his expense, correct the errors.

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The thickness of each coat shall be regularly checked by means of an Elcometer dry thickness gauge, or a similar instrument. The paint coat build-up shall be checked in dry condition.

Vendor shall make periodic and continual field checks on workmen to ensure that the correct procedure and paint is applied according to the specification prescribed.

7. GUARANTEE

Jointly with his tender the painting manufacturer shall deliver a specification stating the duration and extent of the guarantee given on the various paints.

8. PAINT AVAILABLE

Following primers and finish coats are covered in table-2 to table-7. (For details see table-1)

a) Primers

- P1 : Inorganic zinc silicate.
- P2 : Zinc chromate etch primer.
- P3 : Rust inhibitive, organic resin (unpigmented)
- P4 : Rust inhibitive, organic resin (red oxide pigmented)
- P5 : Zinc Rich Epoxy Primer

b) Finish Coats

- F1 : Epoxy polyamide.
- F2 : High build epoxy polyamide.
- F3 : Silicone and acrylic resin.
- F4 : Silicone resin or modified aluminum.
- F5 : Modified inorganic coating. Silicone resin. Methoxy and silica & Iron oxide.
- F6 : Aliphatic acrylic polyurethane.
- F7 : Epoxy phenolic.
- F8 : Aliphatic polyurethane resin.
- F9 : High build coal tar epoxy
- F10 : High build / High solids epoxy
- F11 : Inorganic silicate.
- F12 : Thermo-color paint.

9. STORAGE LIFE AND PACKAGING

9.1 All paint materials shall show no thickening, curdling, gelling or hard cracking when tested during its shelf life in a full tightly covered container.

9.2 The packaging shall meet the relevant requirements of ASTM D3951.

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10. LABELING

- 10.1 Labeling shall be as per ANSI Z129.1, precautionary labeling of hazardous industrial chemicals.
- 10.2 Each container shall be legibly marked with the following information:
- Name of paint
 - Specification no.
 - No. of component
 - Colour
 - Method of application
 - Kind and size of spray nozzle tip
 - Cleaning materials
 - Maximum temperature resistance
 - Flash point (°C)
 - Pot life (hours)
 - Dry time for over coating
 - Kind of thinner
 - Lot number
 - Stock number
 - Manufacturer's name and address
 - Date of manufacture
 - Shelf life
 - Quality of paint in container
 - Information and warnings (if needed)

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TABLE -1

PRIMERS AND FINISHING

- P1: One coat of two pack inorganic zinc silicate primer. vehicle is Inorganic ethyl silicate (self- curing), pigmented with zinc dust plus trace colorant. Solvent used alcohols, glycol ether (no organic binders).Volume solids approximately 60% (volatiles measurement method)SSPS requirements : conformity with sspc-paint 20-89 except that leaving a minimum of 85% metallic zinc by weight in dry film. Minimum finished dry film thickness 75 microns (3 mils). Temperature resistance up to 400°C.
- P2: Two pack polyvinyl-butyril resin zinc chromate etch primer or chemical treatment mordant solution. The coating used shall be as recommended for the treatment of new galvanized surface by the manufacturer of the top coating system to be subsequently applied.
- P3: One coat of single pack rust inhibitive coating, (clear lacquer).vehicle are organic resins(unpigmented).Volume solids 45%. Dry film thickness 15 microns. Temperature resistance -55 to 180°C.
- P4: One coat of Single pack rust inhibitive coatings(pigmented lacquer).vehicle are organic resins. Pigment is red oxide. Dry film thickness 20 microns. Temperature resistance up to 180°C.
- P5: A two component, metallic zinc rich epoxy primer which complies with the composition and performance requirement of SSPC paint 20 volume solid percentage of 59%. Dry film thickness 50-75 microns.
- F1: One coat of two pack epoxy. Vehicle is epoxy resin and polyamide curing agent. pigmented with inert light fast non-toxic. Dry film thickness 25-50 microns (1 to 2 mils). Volume solids 35-48%. Temperature resistance up to 120°C.
- F2: One coat of two pack epoxy .vehicle is epoxy resin and polyamide curing agent (chemical curing). Pigmented with inert light fast non-toxic pigments. Volume solids %55-66. Minimum dry film thickness 125 microns. Temperature resistance up to 90°C.
- F3: Single pack silicon acrylic. vehicle are silicon and acrylic resins . Pigmented with titanium dioxide and heat resistant colourant. Volume solids 31 to 37%. Dry film thickness 25-40 microns(1-1 1/2 mils).Temperature resistance 200°C.

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- F4: One coat of single pack pure silicon or silicon modified. Heat resisting paint (Aluminum). vehicle is Silicon resin-pure or suitably modified pigmented with aluminum. Volume solids 30-40%. Minimum dry film thickness 25 microns (1 mil).. Temperature resistance 400°C to 538°C.
- F5: One coat of two pack modified inorganic. liquid containing silicon resin and methoxy and powder containing silica & iron oxide. Volume solids 62-68%. Dry film thickness 125/250 microns. Temperature resistance up to 982°C.
- F6: Aliphatic acrylic polyurethane and curing agent. Pigment inert light fast pigments. Volume solids 48-56%. Dry film thickness 40 microns (1 ½ mils). Temperature resistance 90 C. Minimum pot life 4 hours at 20°C.
- F7: Two pack epoxy phenolic with alkaline curing agent. Pigment titanium dioxide, zinc dust, inerts, tinting colours and special abrasion resistance pigments. (4/5 mils) 100/125 microns dry film thickness. Volume solids percentage of 48-52. Curing in accordance with manufacturing recommendation. Temperature resistance 120°C.
- F8: One coat of two pack aliphatic polyurethane glass- high build/high solids . Vehicle is aliphatic polyurethane resin. Chemical resistant pigments. Volume solids 73%. Dry film thickness 75 microns (brush application). Temperature resistance 90°C.
- F9: One coat of two pack high build coal tar epoxy coating. Vehicles are catalyzed epoxy coal tar and polyamide or polyamine curing agent embodying the use of high temperature resistant epoxy resin along with high melting point pitch. Pigmented with inert extends . Dry film thickness 125-150 microns . Volume solids 62-76%. Temperature resistance . Dry 163°C with surges to 204°C for 72 hours . Requirements for application over austenitic stainless steel as per paragraph 11-17.
- F10: One coat of two pack high build/high solids epoxy surface tolerant coating . Vehicles are epoxy resin and aromatic amine or other suitable curing agent . (chemical curing) . Pigmented with chemical and corrosion resistant pigments temperature resistance 120°C. Dry film thickness 125 microns . Volume solids 65-85%.
- F11: One coat of single pack inorganic silicate top coat. Vehicle is inorganic silicate (self-curing) Pigmented with inert light fast non-toxic pigments. Temperature resistance up to 400°C. Dry film thickness 50-75 microns . Volume solids 42-43%.

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TABLE - 2
Vessels, Exchangers, Filters, Silencer
CORROSIVE INDUSTRIAL ENVIRONMENT

EXTERIOR SURFACE	TEMP. RANGE °C	PAINT SYSTEM				DFT(DRY FILM THICKNESS) IN MICRONS			
		SSPC SURFACE PREP.NO.	PRIMER COAT	INTER. COAT	FINISH COAT	PC	IC	FC	TOTAL
STEEL (NOTE-1)	UP TO 90	10	P1	F2	F6	75-90	100-120	30-50	205-260
	91 TO 200	10	P1	F3	F3	75-90	25-40	25-40	125-170
	201 TO 400	10	P1	F4	F4	75-90	25-30	25-30	125-150
	401 TO 760	10	F4	-	F4	25-30	-	25-30	50-60
STEEL TO BE INSULATED (NOTE-1)	UP TO 600	10	P1	-	-	75-90	-	-	75-90
SECONDARY REFORMER AND OTHER REFRACTORY LINED EQUIPMENT SHALL BE PAINTED WITH THERMO-COLOR PAINT	UP TO 180 (Green)	10	F12	F12	F12	25-30	25-30	25-30	75-90
	180 TO 210 (Blue)	10	F12	F12	F12	25-30	25-30	25-30	75-90
	Above 310-350 (White)	10	F12	F12	F12	25-30	25-30	25-30	75-90
SURFACE PROOFED FIRE PROOFED WITH CONCRETE	-	6	F10	-	-	125-150	-	-	125-150
GALVANIZED STEEL UPPER LADDERS HORIZONTAL POLES TOP RAILS , MID RAILS , SAFETY GAGES	UP TO 90	1	P2	-	F8	-	-	75	75

NOTES:

- 1) STAINLESS STEEL, ALUMINIUM AND VINYL COATED JACKETING DO NOT REQUIRE PAINTING.

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TABLE - 3
PIPING
CORROSIVE INDUSTRIAL ENVIRONMENT

EXTERIOR SURFACE	TEMP. RANGE °C	PAINT SYSTEM				DFT(DRY FILM THICKNESS) IN MICRONS			
		SSPC SURFACE PREP.NO.	PRIMER COAT	INTER. COAT	FINISH COAT	PC	IC	FC	TOTAL
STEEL (NOTE-1)	UP TO 90	10	P1	F2	F6	75-90	100-120	30-50	205-260
	91 TO 200	10	P1	F3	F3	75-90	25-40	25-40	125-170
	201 TO 400	10	P1	F4	F4	75-90	25-30	25-30	125-150
	401 TO 760	10	F4	-	F4	25-30	-	25-30	50-60
STEEL TO BE INSULATED (NOTE-1)	UP TO 125	10	P1	-	-	75-90	-	-	75-90

NOTE:

- 1) STAINLESS STEEL, ALUMINIUM AND VINYL COATED JACKETING DO NOT REQUIRE PAINTING. STAINLESS STEEL WHICH IS TO BE INSULATED AND ABOVE 450°C SHALL BE PRIMED WITH F5 (DFT 125 MICRONS)

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**TABLE - 4
STRUCTURAL STEEL
CORROSIVE INDUSTRIAL ENVIRONMENT**

EXTERIOR SURFACE	TEMP. RANGE °C	PAINT SYSTEM				DFT(DRY FILM THICKNESS) IN MICRONS			
		SSPC SURFACE PREP.NO.	PRIMER COAT	INTER. COAT	FINISH COAT	PC	IC	FC	TOTAL
STEEL STRUCTURES, PIPE CLIPS, LADDERS, STAIRWAYS	AMB.	10 (Sa2 ½)	P5	F2	F6	50-75	100- 120	30-50	180-245

**TABLE - 5
TANKAGE (EXTERIOR SURFACES)
CORROSIVE INDUSTRIAL ENVIRONMENT**

EXTERIOR SURFACE	PAINT SYSTEM				DFT(DRY FILM THICKNESS) IN MICRONS			
	SSPC SURFACE PREP. NO.	PRIMER COAT	INTER. COAT	FINISH COAT	PC	IC	FC	TOTAL
SHELL & ROOF (FIXED & FLOATING)	10	P5	F2	F6	50-75	120- 140	30-50	200-265

**TABLE - 6
HYDROCARBON TANKAGE (INTERIOR SURFACE)
CORROSIVE INDUSTRIAL ENVIRONMENT**

INTERIOR SURFACE	PAINT SYSTEM				DFT(DRY FILM THICKNESS) IN MICRONS			
	SSPC SURFACE PREP. NO.	PRIMER COAT	INTER. COAT	FINISH COAT	PC	IC	FC	TOTAL
STEEL	Sa 3	F7	F7	F7	100- 110	100- 110	100- 110	300-330

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TABLE - 7
TANKAGE WATER (INTERIOR SURFACE)
CORROSIVE INDUSTRIAL ENVIRONMENT

INTERIOR SURFACE	PAINT SYSTEM				DFT(DRY FILM THICKNESS) IN MICRONS			
	SSPC SURFACE PREP. NO.	PRIMER COAT	INTER. COAT	FINISH COAT	PC	IC	FC	TOTAL
TREATED, FRESH WATER (SHELL, ROOF, BOTTOM & SUPPORTS)	Sa 3	F1	F2	F2	40-60	100- 150	100- 150	240-360
POTABLE WATER (SHELL, BOTTOM, ROOF & SUPPORTS)	5	F1	F9	F9	40-60	100- 150	100- 150	240-360
SEA WATER (SHELL, ROOF BOTTOM SUPPORTS)	5	F7	F7	F7	90- 110	90-110	90-110	270-330

NOTE:

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TABLE - 8
FINISH COLOR SCHEDULE

NO.	ITEM	COLOUR	RAL CODE	BS CODE
1	Main steel structures and pipe racks	Medium Grey	7000	637
2	Equipment structure and supports	Medium Grey	7000	637
3	Platforms, ladders, stairways	Light Orange	2000	557
4	Indoor & outdoor piping (except item No. 10 & 11 mentioned below or systems involving safety precautions).	Aluminum	9006	-
5	Equipment in general, vessels, exchangers, columns, reactors, etc. (except firefighting system or safety precaution)	Aluminum	9006	-
6	Tanks, spheres, etc.	White	9010	-
7	Instrument And electric switchboards control panels, cabling distribution boards.	Green	6021	275
8	Electric static machines : transformers, resistors, etc.	Light Gray	7035	-
9	Machinery : pumps , compressors, turbines, etc.	Light Gray	7035	-
10	Pipes carrying fire fighting water and foam.	Signal Red	3020	537
11	Vessel/Equipment/Piping (except non-prefabricated carbon & low alloy steel valves and standard piping components) containing caustic soda, sulfuric acid, hydrochloric and chromic acid, hydrogen sulphide, sulphur dioxide, liquid ammonia and ammonia gas.	Golden Yellow	1004	356
12	Safety valves on towers, vessels pumps, heat exchangers, including valves prior to and after safety valves.	Golden Yellow	1004	356
13	Wheeled manual fire extinguishers moving and stationary fire fighting equipment.	Signal Red	3020	537
14	Boxes containing breathing apparatus, respirators, masks and other safety equipment.	Emerald Green	6001	221
15	Safety showers, eye wash showers and safety shower cabins.	Green/White in 150mm wide diagonal alternative colors	6024 9002	228 -
16	Fuse boxes, motor switches and electric cable metallic joints.	French Blue	5017	166
17	Guards and safety parts on rotating machinery belts, coupling pumps and motors.	Golden Yellow	1004	356
18	Electric motors	Vendor standard color		
19	Vessels and equipment with operating temperatures in excess of 120°C.	Aluminum	9006	-
20	Pipes, columns, supports and metallic structural parts of equipment representing a hazard in walkway areas.	Golden Yellow/ White in 150mm wide diagonal alternative colors	1004 9002	356 -