

ANNEXURE –AA TO SCOPE OF WORK

**TECHNICAL SPECIFICATION FOR PAINTING
OF PIPELINES/STRUCTURES/VESSELS
AND
HIGH TEMPERATURE STACKS**

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1.0 GENERAL:

This technical specification covers the minimum requirements of Surface preparation, Application of coating systems recommended paint materials and manufacturers and Quality inspection requirements for maintenance painting activities of vessels, drums , piping, stack etc. The areas of painting broadly include the full painting of carbon steel surfaces. This list of items described in this specification is only indicative and the contractor shall survey all the items to be painted as per the total scope of contract and carryout the complete painting job without any exception

2.0 SCOPE OF WORK & SUPPLY:

The scope of work and supply shall be strictly as per **Appendix-I of SCC & Appendix –II of SCC** respectively.

3.0 REFERENCE CODES AND STANDARDS

Without prejudice to the provision in the other section of the contract, and the detailed specifications of the contract, latest editions of the following codes and standards are applicable for the work covered by this contract.

IS-5	: Colour coding.
RAL DUTCH	: International Standard for colour shade (Dutch Standard)
IS-101	: Methods of test for ready mixed paints and enamels.
IS-2379	: Indian Standard for Pipe line identification-colour code.
ASTM-Vol 6.01 & 6.03	: American standard test methods for Paints and Coatings.
ASA A 13.1-1981	: Scheme for identification of piping systems: American national Standards Institution.

Surface Preparation Standards

The latest editions of any of the following standards shall be followed for surface preparation:
ISO 8501-1 / SIS-05 59 00: ISO standard for Preparation of steel substrates before application of paints and related products. This standard contains photographs of the various standards on four different degrees of rusted steel and as such is preferable for inspection purpose by the Engineer-In- Charge.

Steel Structures Painting Council, U.S.A. (Surface Preparation Specifications (SSPC-SP).
National Association of Corrosion Engineers, U.S.A., (NACE).

The contractor shall arrange, at his own cost, to keep a set of latest edition of above standards and codes at site.

The paint manufacturer's instructions shall be followed as far as practicable at all times for best results. Particular attention shall be paid to the following:

- a. Instructions for storage to avoid exposure as well as extremes of temperature.
- b. Surface preparation prior to painting
- c. Mixing and thinning.
- d. Application of paints and recommended limit on time intervals in between coats.

4.0 EQUIPMENT

- 4.1 All required power and hand tools, brushes, rollers, spray guns, scaffolding materials & air compressors etc. required to be used shall be suitable for the work and all in good order and shall

be arranged by the contractor at site and in sufficient quantity. The manufacturer's test certificates / data sheets for all the above items shall be reviewed by Engineer-in-charge at site before start of work.

- 4.2 Mechanical mixer shall be used for paint mixing operations in case of two pack systems except that the Engineer-In-Charge may allow the hand mixing of small quantities at his discretion in case of specific requirement for touch up work only.

5.0 SURFACE PREPARATION PROCEDURE

Manual or Hand tool cleaning conforming to SSPC-SP-2

Hand tool cleaning normally consists of the following:

- a. Hand de-scaling and/or hammering
- b. Hand scraping
- c. Hand wire brushing

Rust, mill scale spatters, old loose and failed coatings and other foreign matter, shall be removed by hammering, scraping tools, emery paper cleaning, wire brushing or combination of the above methods. Old adherent intact coating shall not be removed, only emery paper roughening shall be done. On completion of cleaning, loose material shall be removed from the surface by clean rags and the surface shall be brushed, swept, dusted and blow off with compressed air/steam to remove all loose matter. Finally the surface may be washed with water and dried for effective cleaning.

The blast cleaned surface shall be inspected for salt/chloride test by KTA Tator testing kit / Chloride Testing kit. The salt/chloride content shall not be more than 10 micrograms/cm². In case of excessive salt/chlorine deposit, the salt/chlorine shall be removed by water jet followed by mopping before application of paint.

6.0 PAINT MATERIALS:

Paint manufacturers shall furnish the characteristics of all material in original printed literature, along with test certificates for all specified characteristics given in the specification.

All the paint material shall be of first quality and conform to the general characteristics as per the table 6.1, 6.2 & 6.3 attached with this specification.

7.0 COATING PROCEDURE & APPLICATION

- 7.1 Surface shall not be coated in rain, wind or in environment where injurious airborne elements exist, when the steel surface temperature is less than 5°F above dew point when the relative humidity is greater than 85% or when the temperature is below 40°F and when the ambient/substrate temp is below the paint manufacturer's recommended temperature of application and curing. De-humidifier equipment shall be used to control RH and Dew point. The paint application shall not be done when the wind speed exceeds 20KM per hour.
- 7.2 Cleaned surface shall be coated with primer as soon as practicable but in no case later than 4 hrs of the same day.
- 7.3 To the maximum extent practicable, each coat of material shall be applied as a continuous film. Any spots or areas missed in application shall be recoated and permitted to dry before the next coat is applied. Applied paint should have the desired wet film thickness (WFT).
- 7.4 Each coat shall be in proper state of cure or dryness before the application of succeeding coat. Material shall be considered dry for recoating when an additional coat can be applied without

the development of any detrimental film irregularities, such as lifting or loss of adhesion of the under coat. Manufacturer instruction shall be followed for inter- coat interval.

7.5 When the successive coat of the same colour have been specified, alternate coat shall be tinted, when practical, sufficiently to produce enough contrast to indicate complete coverage of the surface. The tinting material shall be compatible with the material and not detrimental to its service life and shall be recommended by the original paint manufacturer.

7.6 Air spray application shall be in accordance with the following:

- a. The equipment used shall be suitable for the intended purpose, shall be capable of properly atomizing the paint to be applied, and shall be equipped with suitable pressure regulators and gauges. The air caps, nozzles, and needles shall be those recommended by the manufacturer of the equipment for the material being sprayed. The equipment shall be kept in satisfactory condition to permit proper paint application.
- b. Traps or separators shall be provided to remove oil and condensed water from the air. These traps or separators must be of adequate size and must be drained periodically during operations. The air from the spray gun impinging against the surface shall show no condensed water or oil.
- c. **Ingredients shall be kept properly mixed in the spray pots or containers during application by continuous mechanical agitation.**
- d. The pressure on the material in the pot and of the air at the gun shall be adjusted for optimum spraying effectiveness. The pressure on the material in the pot shall be adjusted when necessary for changes in elevation of the gun above the pot. The atomizing air pressure at the gun shall be high enough to properly atomize the paint but not so high as to cause excessive fogging of paint, excessive evaporation of solvent, or less by over spray
- e. Spray equipment shall be kept sufficiently clean so that dirt, dried paint, and other foreign materials are not deposited in the paint film. Any solvents left in the equipment shall be completely removed before applying paint to the surface being painted.
- f. Paint shall be applied in a uniform layer, with overlapping at the edge of the spray pattern. The spray patterns shall be adjusted so that the paint is deposited uniformly. During application, the gun shall be held perpendicular to the surface and at a distance which will ensure that a wet layer of paint is deposited on the surface. The trigger of the gun should be released at the end of each stroke.
- g. All runs and sags shall be brushed out immediately or the paint shall be removed and the surface repainted.
- h. Areas inaccessible to the spray gun shall be painted by brush; if not accessible by brush, daubers or sheepskins shall be used.
- i. All nameplates, manufacturer's identification tags, machined surfaces, instrument glass, finished flange faces, control valve items and similar items shall be masked to prohibit coating deposition. If these surfaces are coated, the component shall be cleaned and resorted to its original condition.
- j. Edges of structural shapes and irregular coated surfaces shall be coated first and an extra pass made later.
- k. If spray gun shows choking, immediately de-choking procedure shall be followed.\

7.7 Airless spray application shall be in accordance with the following procedure: as per steel structure paint Manual Vol.1 & Vol.2 by SSPC, USA, Air less spray relies on hydraulic pressure rather than air atomization to produce the desired spray. An air compressor or electric motor is used to operate a pump to produce pressures of 1000 to 6000 psi. Paint is delivered to the spray gun at this pressure through a single hose within the gun, a single paint stream is divided into separate streams, which are forced through a small orifice resulting in atomization of paint without the use of air. This results in more rapid coverage with less over spray. Airless spray usually is faster, cleaner, more economical and easier to use than conventional air spray. Airless spray equipment is mounted on wheels, and paint is aspirated in a hose that sucks paint from any container, including drums. The unit shall have in built agitator that keep the paint uniformly mixed during the spraying. The unit shall consist of in built strainer. Usually very small quantity of thinning is required before spray. In case of high build epoxy coating (two pack). 30:1 pump ratio and 0.020-0.023" tip size will provide a good spray pattern. Ideally fluid hoses should not be less than 3/8" ID and not longer than 50 ft to obtain optimum results. In case of gun choking, de-choking steps shall be followed immediately.

7.8 Brush application of paint shall be in accordance with the following:

- a. Brushes shall be of a style and quality that will enable proper application of paint.
- b. Round or oval brushes are most suitable for rivets, bolts, irregular surface, and rough or pitted steel. Wide flat brushes are suitable for large flat areas, but they shall not have width over five inches.
- c. Paint shall be applied into all corners.
- d. Any runs or sags shall be brushed out.
- e. There shall be a minimum of brush marks left in the applied paint.
- f. Surfaces not accessible to brushes shall be painted by spray, doublers, or sheepskin.

7.9 Manual application by sling (where 6 O' clock position of pipe is not approachable) A canvas strip (alternatively a tinplate strip) about 450 mm wide and 1.5m long is hold under the pipe by two men holding this sling move it up and down and walk slowly forward while fresh coating is poured on the pipe and they manipulate the sling so that an even coating is obtained all-round the bottom. This work shall be done very carefully and by experienced personnel. There shall not be any formation of "Whiskers" and holes in the coating. The coating film shall be inspected by mirror. For each coat the painter should know the WFT corresponding to the specified DFT and standardize the paint application technique to achieve the desired WFT. This has to be ensured in the qualification trial.

Drying of coated surfaces

No coat shall be applied until the preceding coat has dried. The material shall be considered dry for re-coating when another coat can be applied without the development of any film irregularities such as lifting or loss of adhesion of undercoats. Drying time of the applied coat should not exceed maximum specified for it as a first coat; if it exceeds the paint material has possibly deteriorated or maxing is faulty. No paint shall be force dried under conditions which will cause chacking, wrinkling, blistering formation of pores, or detrimentally affect the conditions of the paint.

No drier shall be added to a paint on the job unless specifically called for in the manufacturer's specification for the paint. Paint shall be protected from rain, condensation, contamination, snow and freezing until dry to the fullest extent practicable.

Repair of damaged paint surface

Where paint has been damaged during application/handling the repair of damaged coating shall be as given below.

Repair of damaged primer/coating during maintenance Painting.

Quickly remove the primer from damaged area by mechanical scraping and emery paper to expose the white metal. Feather the primer over the intact adjacent surface surrounding the damaged area by emery paper. Repair of damaged primer/coating as per the same primer/coating in the design temperature as per the relevant Paint system of specific unit area given in this specification.

8.0 RECORDS & DOCUMENTATION

- 8.1 A written quality plan with procedure for qualification trials and for the actual work.
- 8.2 Daily progress report with details of weather conditions, particular of applications, no of coats and type of materials applied, anomalies, progress of work versus program.
- 8.3 Results of measurement of temperatures relative humidity, surface profile, film thickness, Holiday detection, adhesion tests with signature of appropriate authority.
- 8.4 Particulars of surface preparation and paint application during trials and during the work.
- 8.5 Details of non-compliance, rejects and repairs.
- 8.6 Type of testing equipments and calibration.
- 8.7 Code and batch numbers of paint materials used.

9.0 COATING SYSTEM & COLOUR CODE.

Coating system for all application under this contract shall be as per table – 9.1 attached with this specification. This is to be read in conjunction with the material specification indicated in tables in section -6 of the specification.

Colour code of finished paint and colour band and identification lettering on the pipeline shall be as per clause No. 18 of **EIL's standard Specification No. 6-44-0004 Rev 03 for painting of Shop & Field painting**. The specification is available in GAIL, USAR. Bidder can refer the code during its site visit.

However, in case of discrepancy in the above regard, decision of EIC shall be final and binding to the contractor.

10.0 QUALITY ASSURANCE INSPECTION & TESTING REQUIREMENTS:

- 10.1 All painting materials including primers and thinners brought to site by contractor for application shall be procured directly from manufactures as per specifications and shall be accompanied by manufacturer's test certificates. Paint formulations without certificates are not acceptable.
- 10.3 Engineer-In-Charge at his discretion, may call for tests for paint formulations. Contractor shall arrange to have such tests performed including batch-wise test of wet paints for physical chemical analysis as per relevant ASTM test methods. All costs there shall be borne by the contractor. The contractor shall produce test reports from manufacturer regarding the quality of the particular batch of paint supplied. The Engineer-in-Charge shall have the right to test wet

samples of paint at random for quality of same. Batch test reports of the manufacturer's for each batch of paints supplied shall be made available by the contractor.

- 10.4 The painting work shall be subject to inspection by Engineer-In-Charge at all times. In particular, following stage-wise inspection will be performed and contractor shall offer the work for inspection and approval of every stage before proceeding with the next stage. The record of inspection shall be maintained in the registers. Stages of inspection are as follows:

- (a) Surface preparation
- (b) Primer application
- (c) Each coat of paint

Any defect noticed during the various stages of inspection shall be rectified by the contractor to the entire satisfaction of Engineer-In-Charge before proceeding further. Irrespective of the inspection, repair and approval at intermediate stages of work, contractor shall be responsible for making good any defects found during final inspection/guarantee period/defect liability period as defined in general condition of contract. Dry film thickness (DFT)) shall be checked and recorded after application of each coat and extra coat of paint should be applied to makeup the DFT specified without any extra cost to owner, the extra coat should have prior approval of Engineer-in-charge.

10.5 Primer and Paint Application

After surface preparation, the primer should be applied to cover the crevices, corners, sharp edges etc. in the presence of inspector nominated by Engineer-In-Charge.

- 10.6 The shades of successive coats should be slightly different in colour in order to ensure application of individual coats, the thickness of each coat and complete coverage should be checked as per provision of this specification. This should be approved by Engineer-In-Charge before application of successive coats.
- 10.7 The contractor shall provide standard thickness measurement instrument with appropriate range(s) for measuring. Dry film thickness of each coat, surface profile gauge for checking of surface profile in case of sand blasting. Holiday detectors and pinhole detector and protector whenever required for checking in case of immersion conditions.
- 10.8 Prior to application of paints on surfaces of chimneys, the thickness of the individual coat shall be checked by application of each coat of same paint on M.S.test panel. The thickness of paint on test panels shall be determined by using gauge such as 'Elkometer'.The thickness of each coat shall be checked as per provision of this specification. This shall be approved by Engineer-In-Charge before application of paints on surface of chimney.
- 10.9 At the discretion of Engineer-In-Charge, the paint manufacturer must provide the expert technical service at site as and when required. This service should be free of cost and without any obligation to the owner, as it would be in the interest of the manufacturer to ensure that both surface preparation and application are carried out as per their recommendations. The contractor is responsible to arrange the same.
- 10.10 Final inspection shall include measurement of paint dry film thickness, Adhesion, Holiday detection check of finish and workmanship. The thickness should be measured at as many points/ locations as decided by Engineer-In-Charge and shall be within + 10% of the dry film thickness, specified in the specifications.
- 10.11 The contractor shall arrange for spot checking of paint materials for Sp.gr., glow time (ford cup)and spreading rate.

The following checking/ testing shall be carried out in various stages of painting job.

Coating Materials

- Check Batch No.: Manufacturing date and expiry date.
 - Check physical condition of material and printed containers
 - Check any hard settling inside the container.
 - Check pot life or mixture mentioned in data sheet/ MTD
 - Covering capacity and hiding power at a specified DFT by chequered plate method.
- Apply a small patch of 1 Sq.M area and check the following properties
- Flow properties(Visual)
 - Uniform hiding and finish (visual)
 - Gloss level (Visual)
 - Curing time/ Drying time (by hand touch)
 - Dry film thickness/ coat
 - Pencil hardness
 - Adhesion test (Cross cut method)
 - Compatibility with the existing base coat and topcoat.

During/ after application

- Whether conditions: Humidity and temperature
- Wet film thickness for each coat
- Dry film thickness
- Finish coat: Sagging and uniform coating
- Curing time
- Pencil hardness
- Adhesion test
- Finish and gloss level (visual)

11.0 GUARANTEE

The contractor shall guarantee that the chemical and physical properties of paint materials used are in accordance with the specifications contained herein/to be provided during execution of work.

TABLE No. 6.1 PRIMERS

Sl. No.	DESCRIPTION	P-2	P-4	P-6	P-7
1	Technical name	Chlorinated rubber Zinc Phosphate primer.	Etch primer/wash primer	Epoxy zinc phosphate primer	ZINGA synthetic zinc primer
2	Type and composition	Single pack, air drying chlorinated rubber based medium plasticised with unsaponifiable plasticizer, pigmented with zinc phosphate.	Two pack polyvinyl butyral resin medium cured with phosphoric acid solution pigmented with zinc tetroxy chromate.	Two component polyamine cured epoxy resin medium, pigmented with zinc phosphate.	One pack Synthetic Resin based zinc primer containing 96% of electrolytic zinc dust of 99.995% purity.
3	Volume Solids (minimum)	40%.	7-8%	40%	37%
4	DFT (Dry Film thickness) per coat (minimum)	30-40 μ	8-10 μ	40-50 μ	40-50 μ
5	Theoretical covering capacity in M ² /coat/litre (minimum)	8-10	8-10	8-10	4m ² /kg
6	Weight per litre in kgs/litre (minimum)	1.3	1.2	1.4	2.67 kg at 15°C
7	Touch dry at 30°C (minimum)	30 minutes	2 hrs.	After 30 min.	10 minutes
8	Hard dry at 30°C (maximum.)	24 hrs.	24 hrs.	24 hrs.	24 hrs.
9	Overcoating interval	Min.: 8 hrs	Min: 4-6 hrs.	Min.:8hrs.	Min.:4 hrs
10	Pot life at 30°C for two component paints (minimum)	Not Applicable	Not applicable	6 - 8 hrs.	Unlimited
11	Temperature (Resistance (minimum)	60 °C	NA	80°C	100°C.

TABLE No. 6.2 FINISH PAINTS

Sl. No	DESCRIPTION	F-2	F-3	F-6A/B	F-7
1	Technical name	Acrylic Polyurethane finish paint	Chlorinated rubber based finish paint	Epoxy-High Build finish paint.	High build coaltar epoxy coating.
2	Type and composition	Two-pack aliphatic isocyanate cured acrylic finish paint.	Single pack plasticised chlorinated rubber based medium with chemical and weather resistant pigments.	F6A: Two-pack polyamine cured epoxy resin medium suitably pigmented. F6B: polyamide cured epoxy resin medium suitably pigmented	Two pack polyamide cured epoxy resin blended with coaltar medium, suitably pigmented
3	Volume Solids (minimum.)	40%.	40%	62%	65%
4	DFT (Dry Film thickness) per coat (minimum)	30-40 μ	30-40 μ	100-125 μ	100-125 μ
5	Theoretical covering capacity in M ² /coat/litre (minimum)	10-13	8-10	5-6	5.2-6.5
6	Weight per liter in kgs/litre(minimum)	1.3	1.2	1.4	1.5
7	Touch dry at 30°C	1 hr.	30 minutes.	3 hrs.	4 hrs.
8	Hard dry at 30°C (max) Full cure at 30°C (for immersion/ high temperature service)	16 hrs 5 days	8 hrs NA	16 hrs 5 days	48 hrs. 5 days
9	Over-coating interval at 30 °C	Min.: 12 hrs.	Min.: Overnight	Min.: Overnight Max.: 5 days	Min.: 24 hrs Max.: 5 days.
10	Pot life (approx.) at 30°C for two component paints (minimum)	6-8 hrs.	Not applicable	4-6 hrs	4-6 hrs.
11	Temperature Resistance (minimum)	80 °C	60 °C	80°C	125°C.

TABLE No. 6.3 FINISH PAINTS

Sl. No	DESCRIPTION	F-8	F-9	F-11	F-12
1	Technical name	Self priming type surface tolerant high build epoxy coating (complete rust control coating).	Inorganic zinc silicate coating	Heat resistant synthetic medium based two pack Aluminium paint suitable upto 250°C dry temp.	Heat resistant silicone Aluminium paint suitable upto 500°C dry temp.
2	Type & composition	Two pack epoxy resin based suitable pigmented and capable of adhering to manually prepared surface and old coating.	A two pack air drying self curing solvent based inorganic zinc silicate coating with minimum 80% zinc content on dry film. The final cure of the dry film shall pass the MEK rub test.	Heat resistant synthetic medium based two pack Aluminium paint suitable upto 250°C.	Single pack silicone resin based medium with Aluminium flakes.
3	Volume Solids (minimum)	72%.	60%	25%	20%
4	DFT (Dry Film thickness) per coat (minimum)	100-125μ	65-75μ	20-25μ	20-25μ
5	Theoretical covering capacity in M ² /coat/ litre (minimum)	6.0-7.2	8-9	10-12	8-10
6	Weight per liter in kgs/litre (minimum)	1.4	2.3	1.2	1.1
7	Touch dry at 30°C (maximum)	3 hrs.	30 minutes.	3 hrs.	30 minutes.
8	Hard dry at 30°C (maximum) Full cure 30°C (for immersion /high temperature service)	24 hrs 5days	24 hrs NA	24 hrs NA	24 hrs NA
9	Over-coating interval	Min.: 10 hrs	Min.: 12 hrs.at 20°C & 50% RH	Min.: 24 hrs	Min.: 24 hrs
10	Pot life at 30°C for two component paints (minimum.)	90 minutes.	4-6 hrs.	Not applicable	Not applicable
11	Temperature Resistance (min)	80 °C	400 °C	250°C	500°C.

PAINTING SYSTEM

Table – 9

SN	Design Temperature	Surface preparation	Painting System (Field)	Total DFT in Microns	Remark
1.0	Upto 80 Deg. C for Pipeline, equipments, structures.	As per clause 5.0	<p>1X100 Mic. Self-Priming type, Surface Tolerant High Build Epoxy Coating; EIL Spec Code : F - 8 +</p> <p>1X100 Mic. Epoxy High Build Finish Coating ; EIL Spec Code : F – 6A +</p> <p>2X35 Mic. Acrylic Polyurethane Finish Paint; EIL Spec Code: F – 2.</p>	270 Microns	
2.0	Sweating Lines and Vessels.	As per clause 5.0	<p>2 coats of surface tolerant, low temperature curing Epoxy primer, Each coat@ 125 microns +</p> <p>1 coat of acrylic polyurethane finish coating @ 65-70 microns, EIL Spec Code: F – 2.</p>	315 microns	Epoxy primer and intermediate shall be suitable for application on hand tool cleaned surfaces Primer and top coats shall be capable of curing at very low temperatures up to -5 Deg. C and on the damp surfaces (sweating surfaces)
3.0	Design temperature 350 deg. C or above	As per clause 5.0	3 coats of Heat Resistance silicone Aluminium coating @ 25 microns / Coat; EIL Spec Code : F - 11	75 microns minimum	HR Silicon Aluminium coating shall be suitable for application on Hand tool cleaned surfaces and shall be capable of cure at higher operating temperatures
4.0	Carbon Steel Fences/ Wire messes at ambient temp.	As per clause 5.0	<p>1 X30 Micron Red Oxide Zinc Chromate/Phosphate Primer +</p> <p>1X30 Micron Synthetic Enamel / Aluminium Paint</p>	60 Microns	