Painting and Galvanizing Procedure

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1. Scope

This procedure covers the minimum requirement for material, surface preparation and application of above ground protective painting for piping, equipment and steel structures for IGAT VIII Compressor stations, in case of any conflict between this procedure, relevant data sheet and related documents and standards, supplier shall consider the stricter standard and shall confirm with the CLIENT.

2. Definitions

Project: Three Gas Compressor Stations Project on IGAT X

Client: Iranian Gas Engineering & Development Company hereafter named I.G.E.D.C.

Consultant: Farayand Sazan Energy Consultant Company hereafter named as FSEC

Purchaser/EPC Contractor: Party which carries out all or part of procurement for the project which to be specified later. Here is Hirgan Energy.

Vendor: Party which manufactures or supplies equipments & performs the services & duties specified by purchaser. Here is Aban Air Cooler (AAC).

3. Standard

This specification is based on IPS standards as mentioned below:

SSPC	Steel structures painting manual volume 1 & 2(1991)
BS 5493	Protective coating of iron and steel structure against corrosion
ASTM A123-82	Specification for zinc (Hot-Dip galvanized) coatings on iron and steel products

ASTM A53-82	Specification for pipe, steel, black and Hot-Dipped, Zinc coated welded and seamless
IPS-E-TP-100	Engineering standard for paint
IPS-M-TP-202	Two-pack amine-adduct cured epoxy paint as primer, intermediate and top coat
IPS-C-TP-101	Surface preparation
IPS-C-TP-102	Painting
IPS-M-TP-215	Epoxy-polyamide primer
IPS-M-TP-220	Epoxy polyamide intermediate paint
IPS-M-TP-235	Two pack aliphatic polyurethane paint as top-coat (finish)
IPS-M-TP-250	Amine-cured epoxy resin as primer, intermediate, and top-coat for atmospheric environment
IGS-M-TP-027	External Liquid Epoxy Coating for Rehabilitation and Repair of Buried Steel Pipelines, Bends, Field Joints, Valves and Fittings

4. General Requirements

The blasting, painting, coating and wrapping procedures shall be submitted for Client's approval.

4.1.The following items shall generally not be painted:

 Stainless steel, Aluminum, Nickel, Brass, Copper, Glass.

 Any equipment furnished completely primed and finish painted by the manufacturer (e.g. instruments, instrument boards, motors) unless specifically required to repair paint damage or to match a color scheme.

- Surfaces to be protected by wrapping.
- Surfaces to be galvanized.

4.2. Machined and treated surfaces shall be protected with a temporary rust preventive before apply the painting.

4.3. All uninsulated portions of insulated equipment comprising vessel nozzles, man way covers, valves, relief valves, etc., shall be painted to suit temperature conditions involved.

4.4. The painting system for external application to internally lined items shall be based on the outside wall temperature.

4.5. All supports, including skirts, legs, saddles, etc., shall be coated with the paint system for uninsulated surfaces as appropriate to the metal temperature of the equipment or piping being supported.

4.6. The paint system shall generally be based on the maximum operating items temperature of the in Cyclic equipment and pipe work, this being with the steam exception of where higher temperatures are involved or intermittent operation including steam out, startup, regeneration and etc.

4.7. Where indicated on piping, exchanger, vessel or any other relevant data sheets that piping or items or equipment's are to be subjected to a recommissioning steam cleaning process, the paint system employed shall take into account the designated steam out temperature and shall be suitable for temperature range 94°C to 200°C.

4.8. In the event of a field directive being issued to extend steam cleaning to other items of equipment and pipe work, the paint system shall, where necessary, be upgraded to reflect the requirements of paragraph 3.7

4.9. Where field shop priming of straight pipe lengths or pipe spools is required, the priming coat may be either applied overall or omitted at each pipe end by the employment of 50 mm wide masking tape; this being applied immediately following blast cleaning operations. The tape shall be sufficiently durable to remain in position during transit and storage.

4.10. The applicator may be required, under a contract, to provide, erect and move scaffolding. All scaffoldings shall be subject to the approval of the CLIENT.

4.11. Where necessary, the applicator shall provide the required illumination of an appropriate type, to meet the electrical classification for work area.

4.12. On completion of the works, the applicator shall without delay clear away and remove all surplus materials, scaffolding, plant and equipment, and leave all areas in a clean and tidy condition to the satisfaction of the CLIENT.

5. Surface Preparation

5.1. All surfaces to be painted shall be cleaned and prepared in accordance with the steel structures painting manual, SSPC volume 2, chapter 2 (surface preparation specification)

5.2. Surface preparation shall not take place in the following conditions:

- At temperatures below 5°C (41° F)
- When relative humidity is greater than 85%
- When mean surface temperature is less than 3°C (38°F) above the ambient dew point
- Outside day light hours on exterior locations

5.3. Surface preparation may also be suspended at the direction of the CLIENT'S inspector, when adverse weather conditions are likely to develop before painting could be carried out.

5.4. Surface preparation of new steel surfaces shall remove all surface irregularities and mill scale, together with all rust and surface contaminants, such as grease, dirt and solid pollution.

5.5. Surface irregularities including weld spatter, rough capping, undercut and slag together with sharp or rough edges and burrs, surface laminations and laps shall be removed or made smooth prior to commencement of surface preparation.

5.6. Such irregularities that become apparent after surface preparation by blast cleaning or hot acid pickling shall be similarly treated.

5.7. Grease or oil contamination shall be removed by either wiping or scrubbing the surface with rags or brushes wetted with spirit and then wiping down with clean dry cloths. Alternatively proprietary-emulsifying agents may be used for this purpose and the surface then washed down with clean water. The surface shall be allowed to dry out before proceeding with further preparation and painting.

5.8. Selection of abrasives for blast cleaning shall be in accordance with the recommendations given in SSPC-SP COM and the recommendations agreed with the individual paint manufacturer for each type of paint used subject to Client's approval. Generally, this shall give a surface profile or anchor pattern within the range 50-75 microns with rogue peaks of maximum amplitude 100 microns. Spent abrasives shall be completely removed from the prepared surface by either vacuum cleaning or stiff brushing.

5.9. For inorganic zinc primed surfaces the abrasive shall be hard sharp and angular, for which reason shot shall not be acceptable. The surface profile shall be checked in conjunction with an approved roughens comparator.

5.10. All abrasives shall be free of all dust, dirt and other foreign matter. They shall be kept dry at all times and shall not be recycled specifically permitted by the Client.

5.11. The pressure and volume of the compressed air supply for blast cleaning shall meet the work requirement and shall be sufficiently free from oil and water contamination to ensure that the cleaning process is not impaired. Traps, separators and filters shall be emptied and cleaned regularly.

5.12. Chipping, scraping and steel wire brushing using manual or power-driven tools cannot remove firmly adherent mill scale and shall only be use where blast cleaning is impractical and with the approval of the Client's inspector. Such preparation shall be in accordance with the photographic illustrations in SSPC 1991 grade SP 2 or 3 as specified in the schedule.

5.13. All bolt holes shall be drilled and smoothed before blast cleaning.

5.14. Cleaning shall be discontinued each day in sufficient time to permit the cleaned surfaces to be primed before the end of the working day.

5.15. Extreme care shall be exercised to prevent damage when blasting near instruments, nameplates, machined surface and factory coated items. These priming shall be carried out within 4 hours of blasting and before any visible deterioration of the surface occurs.

5.16. The surface shall be cleaned as specified in the documents. In the event that no cleaning method has been specified, the surface preparation shall not be less than the paint manufacturer's recommendations for the intended service environment.

6. Mixing, Thinning and Storage

6.1. All ingredients in any container shall be thoroughly mixed before use and shall be agitated often enough during application to deep the paint uniform. Paint shall be carefully examined after mixing for uniformity and to verify that no unmixed pigment remains in the bottom of the container.

6.2. All containers of coating material shall remain unopened until required for use.

6.3. Coating material mixed in container shall not be transferred until all settled pigment is incorporated in the vehicle. This does not imply that part of the vehicle may not be poured off temporarily to simplify the mixing.

6.4. Mixing in open containers shall be done in a well-ventilated area away from sparks or flames.

6.5. Coating material shall not be mixed or kept in suspension by means of an air stream bubbling under the paint surfaces.

6.6. Where a skin has formed in the container, the skin shall be cut loose from the sides of the container removed and discarded. If the volume of such skins is more than 2% of the remaining paint, the paint shall not be used.

6.7. All pigmented paint shall be strained after mixing except where application equipment is provided with strainers. Strainers shall be of a type to remove only skins and undesirable matter but not to remove the pigment.

6.8. Material which does not have a limited pot life, or does not deteriorate on standing may be mixed immediately before using. Coating material shall not remain in spray pots or buckets overnight but shall be gathered into a closed container and remixed before use.

6.9. No thinner shall be added unless necessary for proper application. Thinning shall not exceed the limitations established by vendor & approved by the CLIENT.

6.10. Type of thinner shall comply with vendor's instruction.

6.11. When use of thinner is permissible, it shall be added during the mixing process. Painters shall not add thinner after it has been thinned to the proper consistency. All thinning shall be done under supervision.

7. Material Handling and Use

7.1. All coating material shall be delivered to the shop or jobsite in original, unopened containers with labels intact. Minor damage to containers is acceptable provided the container has not been punctured or the lid seal broken.

7.2. Each container of coating material shall be clearly marked or labeled to show paint identification, date of manufacture, batch number, analysis of contents, identification of all toxic substances, and special instructions.

7.3. All containers of coating material shall remain unopened until required for use. Those containers, which have been previously opened, shall be used first. The label information shall be legible and checked at the time of use.

7.4. Coating material, which has livened, gelled, or otherwise deteriorated during storage shall not be used; however, thixotropic materials which can be stirred to attain normal consistency may be used.

7.5. The oldest paint of each kind shall be used first in every case, paint is to be used before its shelf life has expired. In order to use paints which have exceeded their shelf life or have no

stated shelf life and are more than one year old, the specified manufacture must certify that the paint is still suitable for use.

8. Application

8.1. All coating shall be carried out in conformity both with this specification and with the coat manufacturer's recommendation. Coat application shall also follow the procedures covered in SSPC-AP-1 shop, field and maintenance painting.

8.2. Surfaces shall not be coated in rain, dusty wind, fog, mist or in areas where injurious airborne elements exist; when the steel surface temperature is less than 3ºC(38ºF) above dew point, when the relative humidity is greater than 80% or when the temperature is below 5ºC (41ºF) or temperature above 40ºC.

8.3. Blast cleaned surfaces shall be coated with a complete application of primer as soon as practicable but in no case later than the same day as sandblasting in order for the blasted area not to be affected by weathering.

8.4. To the maximum extent practicable, each coat of material shall be applied as a continuous film of uniform thickness free of pores. Any thin spots or areas missed in the application shall be re-coated and permitted to dry before the next coat is applied.

8.5. Each coat shall be in a proper state of cure or dryness before the application of the succeeding coat. Material shall be considered dry for re-coating when an additional coat can be applied without the development of any detrimental film, irregularities, such as lifting blistering, crocodilian, paint running, sagging, etc. or loss of adhesion of the undercoat. The time interval between coating applications shall be in compliance with vendor's instructions.

8.6. When successive coats of the same color have been specified, alternate coats shall be tinted, when practical, sufficiently to produce enough contrast to indicate complete coverage of the surface. When the paint is of the color of the steel, the first coat to be applied shall be tinted. The tinting material shall be compatible with the paint and not detrimental to its service life.

8.7. All nameplates, vendor's identification tags, machined surfaces, instrument glass; finished flange faces, control valve stems and similar items shall be marked to prohibit coating deposition. If these surfaces are coated, the component shall be cleaned and restored to its original condition. Edges of structural shapes and irregular surfaces shall be coated first and an extra pass made later. Contact surfaces for all components (bottom of skid mounting surfaces of equipment... etc.) are included in the scope of work to be coated. Wet paint shall be protected against contamination from dust or other foreign matter.

9. Galvanizing

9.1. Galvanizing shall be in accordance with ASTM A123 on products fabricated from rolled, pressed and forged steel snaps, plates, bars and strips except that pipes for hand railing shall meet ASTM A-53. The weight of zinc coating shall be average not less than 765 grams per square meter (average thickness of zinc 107 microns).

Galvanized surfaces shall not normally be painted.

9.2. Galvanized members other than grating which are to be permanently fixed to the structure by welding, shall be attached after the supporting members are primed, but before top coats are applied.

9.3. The heat-affected area shall be cleaned of all welding flux, sandblasted, and primed with the same coating.

9.4. All grating support members must be finish coated before securing the grating, and then those weld areas shall be white metal blasted, reprimed and coated. New or untreated galvanized surfaces that require painting shall be pretreated with a phosphoric acid base wash coat.

9.5. Degrease according to SSPC-SP1 solvent cleaning, ensure the surface is clean, dry and free from contamination and zinc salts, and abrade if necessary to remove passivation surface. Brush applies the phosphoric acid-based wash coat in an even flowing coat and allows drying. The surface should turn dark grey, any area which fails to turn dark grey should be recleaned and abraded and a further coat of etch solution applied. Alternatively, galvanized surfaces shall be prepared by sweep blasting with fine sand in lieu of phosphoric acid base coat.

9.6. Small areas of galvanized coating damaged by welding, cutting, etc., shall be repaired by using low melting point zinc alloy repair rods or powders made specifically for this purpose. The repair procedure shall be submitted to the Employer for approval. The use of other methods shall be subject to approval by the Employer. Sufficient thickness material shall be applied to provide a zinc coating at least equal to the galvanized layer, major areas of damage shall be re-galvanized.

10. Repair of Damaged Paint Surfaces

When factory painted surfaces have been marred in handling, transportation or storing, the damaged paint and non-adherent paint shall be removed and the surface thoroughly cleaned in accordance with CLIENT instruction.

The edges of the damaged area shall be smoothed. Surface preparation shall extend approximately 5 cm into the sound coat. The primer and finishing coats shall be applied in accordance with paragraph 6.0.

11. Inspection and Test

11.1. All work and materials applied under this specification shall be subject to inspection by the CLIENT.

11.2. All parts of the work shall be readily accessible to the inspector.

11.3. The inspector or resident engineer shall approve all surface preparation prior to application of any coating.

11.4. Each coat shall be inspected prior to application of the next coat. Areas found to contain runs, over spray, roughness, pin holes or other signs of improper application shall be repaired in accordance with the vendor's recommendations at EPC Contractors expense.

11.5. All surfaces to which coatings are applied shall free of dirt, grease, chemicals and other contamination. The CLIENT representative shall have the final determination on suitability of the surface for coating.

11.6. The completed coating shall be inspected for wet and dry film thickness, over spray and roughness and any signs found to show these or other signs of improper application

shall be repaired or recoated in accordance with the vendor's recommendations at the EPC Contractors expense.

11.7. All inspection facilities and equipment shall be provided by EPC Contractor.

11.8. **Surface preparation**

Comparison of cleaned surfaces by visual check with relevant specified photographic standard SIS 055900 will be done.

11.9. **Adhesion**

Verify paint adhesion according to ASTM D 3359 (class 3A or 3B).

11.10. **Film thickness measurement**

In order to achieve the specified dry film thickness frequent checks of wet film thickness shall be carried out during the paint application with film thickness gauges such as the decimeter wheel or comb type.

Dry film thickness (DFT) determinations shall be performed as specified in SSPC-PA2 “Measurement of Dry Paint Thickness with Magnetic Gauges”.

12. Painting Systems

12.1. Painting system has been selected based on IPS-E-TP-100. For details refer to table 1 to 3.

12.2. Unless otherwise noted, surface preparation and priming on vessels, piping, exchangers, equipment and structural steel will be done in the shop, and only touch-up and finish painting will be required in the field.

Paint System Determination

Item No.	*Material*	*Insulation*	*Fireproofed*	*Operating Temperature (°C)*	*Paint System*
	Carbon Steel	No	No	77.6	*A*

*** Steel Structure, Side frame, Plenum, Fan ring, fan guard and grating shall be Hot - dip galvanized.** D01

Table1-Paint System A

Equipment (Gas air cooler)			**uninsulated up to 95°C Operating Temperature**
Minimum surface preparation			SA 2 1/2
Paint and DFT (microns)	Primer	Epoxy polyamide (IPS-M- TP-215)	70
	Intermediate	Epoxy polyamid (IPS-M- TP-220)	100
	Finishing	Two pack poly urethanes (IPS-M-TP-235)	50
Total DFT (microns)			220

Table2- Paint color schedule for Equipment

Item	Color (see note 1)
A) Equipment	
3. Gas air cooler	white (Ral 9010)

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