


	Air-Cooled Heat Exchanger	 Esfahan Oil Refining Company
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Document Title: Painting Procedure

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CHANGE RECORD SHEET

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1	X				43					85				
2	X				44					86				
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5	X				47					89				
6	X				48					90				
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1 **SCOPE**

The following procedure covers the minimum requirements for all painting activities include surface preparation, paint system, application procedure and inspection tests for air cooler and will be applied to “Esfahan Oil Refinery Company- Air-Cooled Heat Exchanger”, with the following content.

2 **DEFINITIONS**

PROJECT: Air-Cooled Heat Exchanger

OWNER/CLIENT: Esfahan Oil Refinery Company

Vendor: Aban Air Cooler

3 **REQUIREMENT**

3.1) Coating for the protection of air cooler shall be designed and applied; for the application over the specified minimum surface preparation standards detailed in this procedure.

3.2) The paint system shall generally be based on the operating temperature of the equipment and reference specification.

4 **GENERAL**

4.1) The manufacturer shall provide and maintain in good condition all plant, equipment and tools necessary to carry out the work in and tools necessary to carry out the work in an efficient manner.

4.2) The manufacturer shall provide, unless otherwise instructed, all paints and thinners necessary to carry out the work. The contractor shall purchase such paint from approved manufacturers.

4.3) The manufacturer shall provide skilled and experienced personnel to carry out the work together with competent and qualified supervision.

4.4) The manufacturer shall comply fully with this specification unless otherwise approved by the contractor. Additionally, the work will be subject to continuous inspection by the inspector who will be at liberty to check at every stage that the work is being carried out in accordance with all aspects of this specification.

4.5) Prior to the commencement of work, the manufacturer shall submit for the approval of company, fully detailed procedure as to how he intends to carry out the work within the frame work of this specification & Document.

4.6) The equipment listed below shall be shielded to prevent: damage during surface preparation and painting operations. All opening, including those which are flanged or threaded. Shall be sealed to prevent entry of sand, dust, or coating materials

- Name plates and notices
- Packing glands
- Packing seal
- Pressure gauges
- Gauges glasses
- Instrument dials



4.7) All equipment which should be heat treated, shall be painted after heat treatment. Machined and threaded surfaces shall be protected with temporary rust preventative paint.

4.8) The following surfaces and materials shall require painting:

a) All un-insulated and insulated carbon and low alloy piping, fittings and valves including painting of identification marks.

4.9) The following surfaces and materials shall not require painting:

a) Copper, brass, aluminum or glass surfaces, plastic or plastic coated materials, insulated surface pipes except color coding wherever required.

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- b) Galvanized surfaces are not to be painted except in acid areas and for the purpose of safety.
- c) Finished machine parts of machinery and gasket surfaces.
- d) Concrete, cast iron, PVC and vitrified clay underground piping.
- e) Stainless steel surface
- f) Valve stem

5 SURFACE PREPARATION

5.1) Paint life depends primarily on surface preparation. surface preparation should remove foreign bodies to allow the type of priming paint used to wet the surface thoroughly and develop adequate adhesion.

5.2) All rough-edged cuts & welds, weld spatters, indentations, all surfaces & protrusion must be ground to smooth out the contour before the surface is prepared for painting. Any grinding performed after blast cleaning, must be re-blast to required roughness.

5.3) All bolt holes shall be drilled and blunted before blasting.

5.4) Prior to surface preparation, the surface shall be inspected for spotting oil and grease deposits or pollution on the surface. If any, the deposits of oil or grease shall be removed from the surface by solvent cleaning prior to further surface preparation.

5.5) Required Cleanliness

All surfaces prepared for coatings shall satisfy:

- SA 2 1/2 for temperature up to 120 and SA 3 for above 120 °C according to Swedish Standard SIS 05 5900 or,
- Near White Metal Blast Cleaning of the surface preparation specification SP-10-63 T of the Steel Structures Painting Council or,
- NACE No. 2 Near White Blast Cleaned Surface Finish in accordance with the NACE STANDARD TM-01-70.

5.6) Required Roughness

5.6.1) - All surfaces shall be blast cleaned to obtain a total angular roughness included:

- between 30 and 50 microns when total thickness of the coats of paint applied is less than 400 microns,
- between 50 and 75 microns when total thickness of the coats of the paint applied is greater than 400 microns.

5.6.2) The prepared surfaces should be cleaned using dry air or clean brush.

5.7) Surface preparation shall not take place in the following conditions:

- a- At temperature below 5 °C
- b- When the relative humidity is greater than 85%

If the air's relative humidity exceeds 80 %, the Applicator must obtain permission from the Company to proceed with or continue with surface preparation. The applicator must provide a hygrometer to measure the air's relative humidity.

c- When the metal surface temperature is less than 3 °C above the ambient dew point or in excess of 38 °C.

d- Paint material shall not be applied in rain, snow, fog or mist, nor to wet damp surfaces or to frosted or ice coated surfaces.



5.8) All abrasives shall be free of dust, dirt and other foreign matter. They shall be of a reusable type and to be kept dry at all times.

Abrasive material for blast cleaning, consisting solely of steel shot shall not be used. A mixture consisting of steel shot and at least 25% by weight steel grit is acceptable.

5.9) Chipping, scraping and steel wire brushing using manual or power driven tools shall only be used where blast cleaning is impractical, with the approval of owner authorized inspector.

6 STORAGE, MIXING AND THINNING OF PRODUCTS

6.1) STORAGE CONDITION

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6.1.1)-All paints and thinner containers shall be kept closed before use and stored under shelter.

6.1.2)-The settlement of heavy paints shall be lessened by rolling the drums in which they are stored every six weeks. Turning the drums on their ends is not allowed. The normal finishing paints & drum paints do not require rolling during the storage period.

6.1.3)-Any paint for which the shelf life is expired shall not be used. The maximum storage time for paints shall be in accordance with manufacturer's recommendations. paints shall not be stored in open containers, even for a short time.

6.1.4)-Paint shall be stored in a well ventilated room, free from excessive heat or direct rays of the sun & maintained at a temperature of between 4 °C and 27 °C. Open air storage shall be avoided particularly of heavy paints such as primers and undercoats.

6.2) Mixing

6.2.1) Before opening the can, the paint should be checked if it complies with the specification.

6.2.2) Material inspection should be conducted on real paint, and when the contractor opens the can for the first time, the client's inspector should witness it as a rule. Client will inspect the batch.

6.2.3) Paint-can should be opened just before using as a rule: the paint-can once opened, should be securely closed for storage, and better finished early.

6.2.4) Any paint skin, which has formed in the container, shall be cut and removed, if the skin is thicker than 2 mm the paint shall not be used.

6.2.5) The paint in opened can should be stirred sufficiently until it becomes uniform. Up to 20 liters of paint should be stirred manually, and over 20 liters use a machine. No stirring is allowed with compressed air.

6.2.6) Special paints, such as "epoxy resin paint" and "zinc rich paint", which are supplied as two or more components in separate containers shall be mixed together immediately before their use. The mixed paints shall be applied within their pot life.

6.2.7) When thinner is necessary, unspecified thinner should not be used. Also, the amount should not be exceeded.

6.2.8) For color, it is necessary to use paints mixed to the specified color at the production plant.

6.3) Thinning

6.3.1) No thinners are to be added unless necessary for proper application, thinning must never exceed manufacture recommendations.

6.3.2) Thinners used must be those suggested by the manufacturer.

6.3.3) When use of thinner is authorized by the manufacture, it shall be added during mixing. Thinners must be added under the guidance of the specialist who is thoroughly familiar with the quantity and type of added thinner.

7 **PRIMING**

7.1) Prepared surface should be primed generally within four hours or before visible re-rusting occurs. Cleaned surface shall never be left overnight prior to coating, in such case re-blasting or re-cleaning is necessary.



7.2) In order to minimize contamination between successive coat of paint, over coating of the preceding coat shall be done as soon as it is permitted by the particular specification, and not delayed beyond the period specified.

7.3) The primer to finishing coat paint shall be from the same manufacturer for each system to ensure compatibility.

8 **PAINTING APPLICATION**

8.1) Procurement and storage

The quantities of paint and thinners required to perform the entire job shall be procured before the work the quantities of paint and thinners required to perform the entire job shall be

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procured before the work commences, except in cases where the shelf life of the product is less than the anticipated duration of the work.

Thinners, solvents, etc. shall be stored in a suitably ventilated fireproofed building, separate from other painting consumables.

The products shall be delivered in their original sealed packaging and stored in such conditions as to avoid their degradation. The packaging shall be clearly marked with the product description, the batch number, the fabrication date and the expiry date.

8.2) Application

8.2.1) General

Paint shall always be applied to surfaces that are dry, clean and degreased, for both coating on substrate and previous coat.

In the following cases, no painting work should be done as a rule.

- (1) Humidity: 85% or higher
- (2) Rainy weather
- (3) Temperature: below 5°C
- (4) Strong wind and severe sand dust
- (5) Painted surface temperature: 50°C or higher

CONTRACTOR shall keep a daily record of the dew point, relative humidity, ambient atmosphere and substrate temperatures (all measured before the work commences and twice per shift and when ambient conditions are obviously changing) to ensure that conditions are acceptable. These records shall be kept and made available to COMPANY. Application shall be by airless spray

9 **GALVANIZING**

9.1) Hot -dip 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-153. INSPECTION

10 **INSPECTION**

10.1) Contractor shall advise the owner inspector before commencing specific paint applications.

10.2) Inspector shall have the right to inspect the paint work at all stages and to reject any and all tools, instruments, material, staging or equipment of work which do not conform to the specification.



10.3) Each coat paint shall be free from defects and damage. Finished paint shall have the correct shade, degree of gloss and evens and be free from tackiness after drying/curing and from cracks, holidays, runs, sags, wrinkles, patchiness brush or roller marks or any defects that may be deleterious to the quality of the coating.

10.4) Prior to final acceptance of completed work, a joint inspection shall be made by contractor and owner inspector and an agreed inspection report to be signed by both parties.

10.5) Inspection by the paint manufacture or an independent inspection service shall not relieve the contractor of responsibility for ensuring that the work is carried out in accordance with the specification.

10.6) Before commencement of shop preparation and painting, a meeting between the coating manufacturer, contractor and company's representative shall be convened, to establish and agree, when necessary, visible blast standard, blast profile, satisfactory application the coating and agreement and calibration of inspection equipment.

10.7) Each coat shall be inspected prior to application of the next coat, Areas found to contain runs, over spray, roughness, cracks or other signs of improper application shall be repaired or recoated in accordance with the authorized inspector recommendation.

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11 QUALITY CONTROL AND TESTING

11.1) Contractor shall submit his proposed quality control and testing procedures covering all phases of surface preparation and paint application to company for approval.

11.2) Manufacturers of all materials shall supply test certificates of all tests performed and certificate of compliance stating that the material meets the requirements of the applicable specification.

11.3) Before paint application the prepared surface shall be inspected visually by Quality Control Inspector and if the result is satisfactory the parts can be released for painting.

11.4) After paint application following test shall be performed by Quality Control Departments:

- Visual check
- Thickness check
- Adhesion test

11.5) Visual Check

Coating film should be inspected visually after each application, before application and before application of the next coat in order to verify that the whole surface is free of defect as:

- Mud cracking
- Inclusion and cleanliness
- Holidays
- Bubble
- Mechanical damage
- Runs/Sags
- Over spray

11.6) Thickness Check

Dry film thickness measuring procedure:

(1) Checking equipment:

Micro tester

Electromagnetic film thickness gauge

(2) Checking procedure:

For paint coat accepted in dry-state test, thickness of specified number of coats should be measured in specified places separately. For measuring, the electromagnetic film thickness gauge should be used where applicable. When it is, however, difficult to measure in specific measurement conditions or installation conditions, a micro tester may be used. In any case, the same measuring instrument should be used in the whole process as a rule.

(3) Checking process and period

The paint coat should be measured when the coating film is in dry-hard state after completion of the undercoating and the final coating.

(4) Judgment method

It should be judged whether the measured film thickness is same to specified film thickness.

(5) Criterion

The average specified film thickness should be obtained.

- On each spot, make 5 measurements by moving the probe a short distance for each new gage reading. Take the average of the five gages reading as the spot measurement. Each coat thickness and total thickness shall be checked. Make five separate spot measurements spaced evenly over each section of the structure 10 m² in area.

NOTE: Average of spot measurements \geq specified DFT

All individual measurements \geq 90% of specified DFT



11.7) Adherence Check

Adhesion test shall be performed according to ASTM D4541 or ASTM D3359.

11.8) Inspection Results

All quality control results shall be written up into reports.

All reports shall be submitted to the authorized inspector for approval.

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Repair of Defects or Damage

Touch up work on damaged surfaces:

Surface is damaged as substrate material is seen:

After surface preparation according to standard ST2, primer layer is applied and after considering required interval for recoating, top coat will be executed.

(2) Surface is scratched:

At first, all oil and grease shall be removed from the surface then top coat will be applied.

(3) Damaged surface touching up could be done with paint brush for small surfaces and spray for large surfaces (in this case, surrounding of damaged surfaces shall be covered to prevent from contacting with intact surfaces).

Where touching up prior to top coating of zinc-based primers is involved, this shall be preceded by thorough cleaning with solvent or an emulsion type cleaner or remove all oil and grease. This shall be followed by thoroughly hosing down with clean potable water which in the case of surfaces that have not been tie coated shall be carried out in conjunction with manual scrubbing with stiff brushes in order to remove all surface dirt and other contaminants, zinc corrosion products (with rust) etc.

12 PAINT SYSTEM

12.1) Organic zinc rich primer: two components epoxy based zinc rich primer. Continuous heat resistance is achieved in the temperature range up to 120 °C. Epoxy: Minimum dry film thickness shall be 100 Mic per coat. Acrylic polyurethane: heat resistant to 120°C. Dry films thickness 50 Mic.

13 PAINTING REPORT

Refer to attachment next page.



Paint System Determination

Item No.	Material	Insulation	Fireproofed	Operating Temperature (°C)	Paint System
Header Box E-72106-9A/B	Carbon Steel	No	No	86	A

* Side Frame, Plenum, Motor Support, Bolt and nuts, Grating, Fan ring and Fan Guard shall be Hot - dip galvanized.

Paint system A:

Item: Header Box E-72106-9A/B	Operating Temperature: Up to 120°C		
Minimum surface preparation			Sa 2 1/2
Paint and DFT (microns)	Primer	Zinc Rich Epoxy	75
	Intermediate	Epoxy polyamide	100
	Finishing	Aliphatic Polyurethane	50
Total DFT (microns)			225
Finishing RAL	Ral 7037		

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Attachment 1

		Quality Control				Report No.:				
		Painting Report				Date of Exam:				
Procedure No.: Document No.: Sand Blast: PRIMER: INTERMEDIATE: FINISHING: FINISH COLOR: Temperature:										
<div> <div>THK:</div> <div>THK:</div> <div>THK:</div> <div>Humidity:</div> </div> <div> <div>TOTAL</div> <div>Dew Point Temp.:</div> </div>										
ITEM No.:										
SR. No.	Description	THK (mic)	Result	Date	TIME	Curing & Adhesion				
1	Sand Blast									
2	Primer									
3	Intermediate									
4	Finish									
Note:										
Inspector		A.A.C Inspector		CLIENT		CONTRACTOR				
NAME & SIGNATURE										
QUALIFICATION										
DATE										