EQUIPMENTNAME:	Air Cooler
ITEM NO.:	E-400-102/202 E-400-108/208 E-450-101/201 E-460-110/210
CONTRACT NO.:	NGWK-0400-ENME-ORPU-1115-A00
MR'S No. :	NGWK-0400-ENME-RQMA-1115-D00

Code1	☐ (Approved) Vendor to submit " For Final" (No comment & release for manufacturing)
Code2	☐ (Approved with comments) : Vendor shall correct / revise & resubmit it as " For Final " (Released for manufacturing if change incorporated as indicated)
Code3	☐ (Commented) : Vendor shall correct / revise & resubmit it as " For Approval" of the date specified : (Corrected documents to be resubmitted before starting manufacturing)
Code4	☐ Not Acceptable quality (Reject)

Above checking results by SADAF shall in no way relieve Vendor of any liability, obligation and responsibility out of the purchase order and the mutual agreement in writing.

Date:

Dept:

Signature:

Only for internal review

CV	**PI**	**EL**	**IN**	**ME**	**MA**
ST	**BU**	**PR**	**SA**	**HV**	**TL**

Project No: 17153

Rev.	*Date*	*Class*	*POI*	*Prepared By*	*Checked By*	*Approved By*	*Purchaser's Approval*
04	*Aug.22.2016*	*2*	*IFA*	*Y. Negahdari*	*F. Shahvaran*	*B. Sheikhbeigi*	
03	*Aug.13.2016*	*2*	*IFA*	*Y. Negahdari*	*F. Shahvaran*	*B. Sheikhbeigi*	
02	*Mar.12.2016*	*2*	*IFA*	*Y. Negahdari*	*F. Shahvaran*	*B. Sheikhbeigi*	
01	*Feb.10.2016*	*2*	*IFA*	*Y. Negahdari*	*F. Shahvaran*	*B. Sheikhbeigi*	
00	*Nov.28.2015*	*2*	*IFA*	*A. Khajeh*	*F. Shahvaran*	*B. Sheikhbeigi*	
				Vendor			

Tabulation of Revised Page

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1. SCOPE

The following procedures covers the minimum requirements for surface preparation and paint application for air cooler headers , etc., which will be exposed to salty and corrosive environment In accordance with project paint specification (NGWK-0001-ENPI-SPPA-2308-D08) for West Karoun Area NGL 3200 Project.

2. DEFENITION

OWNER :	N.I.O.C
CLIENT :	Petroleum Engineering and Development Company (PEDEC)
CONSULTANT :	Energy industries Engineering & Design (EIED)
CONTRACTOR :	Lead organization that is selected for completing of the project from design to start up. All other organizations that perform a part of the project on behalf of this lead organization shall be called as sub-contractor (SADAF Co.)
PLANT :	Shall mean permanent facilities designed, constructed and completed as a result of execution of the WORK.
PURCHASER :	Organization that release an inquiry for material or equipment for use in Project as a legal representative of Client. In this case PURCHASER means Joint Venture of Sazeh Consultants
SITE :	Shall mean the premises and places on, under, in, over or through which the WORK is to be executed or carried out including Contractor's engineering office and the PLANT.
SUPPLIER :	Any organization which will be selected to supply the equipment or/and materials from one or more vendors.
SUB-VENDOR :	Any organization which will be selected by vendor and approved by purchaser to produce and supply the equipment or/and materials to vendor.

3. PAINT MANUFACTURERS OBLIGATIONS

a. The vendor shall requested paint supplier to send technical data sheet and test and analysis certificates and submitted to purchaser inspector for verification and approval.

b. The paint manufacturer shall state shelf life of all paints and protective coating and shall

provide recommendations for storage.

All product containers shall be marked with their batch number and initial manufacture date.

Painting Contractor and Paint Manufacturer shall jointly guarantee the coating system applied for a period of five years from the date of application.

c. The latest available issue of paint data sheets for the particular batch shall be supplied by paint manufacturer.

4. REFERENCE

All standards/codes which mentioned here are applicable as their latest editions:

Project painting specification Doc. Number : NGWK-0001-ENPI-SPPA-2308-D08

- ASTM D4752: Standard Practice for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub

- ISO 8501-1: Preparation of steel substrates before application of paints and related products

- GS COR 350: External protection of offshore and related structures and equipment by paintings

- ASTM D 3359 : Standard Test Methods for. Measuring Adhesion by Tape Test

SSPC STANDARDS: Surface Preparation

SIS-055900 Surface: Preparation

IPS-C-TP-101: Construction Standard for Surface Preparation

IPS-C-TP-102: Construction Standard for Surface Painting

IPS-E-TP-100: Engineering Standard for Paints

IPS-M-TP-235: Material & Equipment Standard for Asphalt Mastic (cold applied)

IPS-M-TP-115: Material & Equipment Standard for Red Lead, Iron Oxide and Alkyd Intermediate Paint

IPS-M-TP-130: Material & Equipment Standard for Colored Alkyd Paint for Top Coat (finish) Except White

IPS-M-TP-168: Material & Equipment Standard for Acrylic Silicon Finish Paint for

Temperature Applications Up to 230°C

IPS-M-TP-175: Material & Equipment Standard for Silicone Alkyd Paint (white or colored) as Top Coat (finish)

IPS-M-TP-190: Material & Equipment Standard for Coal Tar Epoxy Polyamide Paint as Primer, Intermediate and Top Coat

IPS-M-TP-205: Material & Equipment Standard for Zinc-Rich Epoxy Paint (Organic

Zinc-Rich) As Primer, Intermediate and Top Coat

IPS-M-TP-210: Material & Equipment Standard for Zinc Silicate (Inorganic

Zinc Rich) Paint as Primer, Intermediate and Top Coat

IPS-M-TP-215: Material & Equipment Standard for Epoxy Polyamide Primer

IPS-M-TP-220: Material & Equipment Standard for Epoxy Polyamide Intermediate Paint

5. DESIGN REQUIRMENT

a. Coating for the protection of Air Cooler headers and steel structure shall be designed and applied ; for the application over the specified minimum surface preparation standards detailed in this procedure.

b. All coating shall be suitable for application and serviced in salty and corrosive environment conditions.

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

6. GENERAL

-All work carried out by the vendor shall be subject to the approval of Purchaser/Client representative. The inspector shall have the right to reject any of the performed work which in his opinion does not conform to project paint specification (NGWK-0001-ENPI-SPPA-2308-D08)

-All coating materials shall be furnished in unopened containers and shall be labeled as to identify them as material specified for the job.

-All coating material shall be boxed and vigorously stirred for a time sufficient to thoroughly mix again the pigments and vehicles.

-Thinners shall be supplied from the paint manufacturer.

-If coating material requires the addition of a catalyst, the pot life under application conditions shall be clearly stated on the label.

a. The manufacturer shall provide and maintain in good condition all plant, equipment in an efficient manner.

b. The manufacturer shall provide, unless other wise instructed, all paints and thinners necessary to carry out the work . The VENDOR shall purchase such paint from approved manufacturers.

c. VENDOR DATA

Vendor shall provide 6 sets of coating and paint materials method of preparation, mixing and application procedures and data in the following manner:

- Two sets with proposal
- Four sets with each consignment

In case some coating and paint materials require special chemicals and/or thinners, sufficient amount shall be provided with each consignment. The required amount of such chemicals, additives, agents or thinners shall be clearly stated in vendor's proposal.

Each coating and paint material container, in addition to paint manufacturer's standard commercial information, shall bear the Owner's reference number as stated in this specification, date of manufacture,

shelf life and pot life.

All paints, primers and solvents (when recommended by paint vendor) shall be supplied in 20 lit. Containers unless manufacturer recommends otherwise.

d. The vendor shall provide skilled and experienced personnel to carry out the work together with competent andqualified supervision.

e. The vendor shall comply fully with this specification unless otherwise approved by the PURCHASER/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.

f. 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.

g. The items listed below shall be shielded & protected to prevent damage during surface preparation & paint material applications. Unless otherwise specified, the following surfaces shall not be painted:

• Concrete structures

• Plastic materials or materials coated with ultra violet ray resistant plastic.

• Non-ferrous materials (90-10 and 70-30 Copper-Nickel, Monel, Aluminium Bronze), high grade stainless steels.

h. 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

- Couplings, shafts, valve stems, bearings, control valves, moving parts and other machined surfaces

i. 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.

7. SURFACE PREPARATION

a. 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.

b. All rough edged cuts & welds,weld sptters,indentations,all surfaces & protrusionmust be ground to smooth out the contour before thesurface is prepared for painting .Any grinding performed after blast cleaning ,must be re-blast to required roughness.

c. All oil and grease, dirt, welding slag and fume deposit, rust and loose mill scale, prevent good adhesion and should be removed.

Particular care should be taken to prevent rusting and/or contamination of cleaned or primed surfaces.

d. All bolt holes shall be drilled and blunted before blasting.

e. 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.

f. No acid washes or other cleaning solutions or solvents shall be used on metal surfaces that have been blasted. This includes inhibitive washes intended to prevent rusting.

g. Required Cleanliness

All surfaces prepared for coatings shall satisfy according to painting system.

h. Required Roughness

i. All surfaces shall be blast cleaned to obtain a total angular roughness Rt included :

- Between 30 and 50 microns when total thickness of the coats of paint applied is less than 400 microns,

- Between 50 and 80 microns when total thickness of the coats of the paint applied is greater than 400 microns.

7.8.2) - Only dry blasting techniques are allowed. Compressed air for abrasive blasting shall not contain any trace of oil or water. Blasting nozzle pressure shall not be less than 6.2 bar g (90 psi g). The use of SPONGEJET process with the proper equipment is approved.

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

a- At temperature below 10 ^{o} 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 with TPI approval 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 ^{o} C above the ambient dew point or in excess of 38 ^{o} C.

Measurement with appropriate equipment controlled by inspector. Frequency shall be twice a day at beginning of each shift & when adversalty condition may occure.

d- Outside daylight hours on exterior locations.

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

f- Paint material shall not be applied to steel when ambient temperature are excepted to fall to 5 ^{o} C before the paint has dried.

i. Surface preparation on new steel surface shall remove all surface irregularities and mill-scale, together with all rust and surface contamination such as grease, dirt and solid pollution.

j. All abrasives shall be free of dust, dirt and other foreign matter. They shall be of a reusable type & to be kept dry all time.

k. The abrasive used in installations as wheel abrators or manual blast cubicles in which the abrasive is recovered and re-used shall be mixture of chilled iron or steel grit and steel shot able to produce the required surface profile.

The abrasive mixture shall be replenished using new and worn abrasive, so as to produce a consistent profile height and standard of surface cleanliness. The abrasive mixture shall be kept free of dust (including metallic particles) and debris. Abrasive cleaning employing sand shall not be permitted.

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.

NOTE: for stainless steel, Befor painting stainless steel surfaces shall be cleaned ,degreased A non metallic blast abrasive i.e. aluminum oxide, shall be used when abrading stainless steel surfaces. Sand shall not be used. Iron abrasive, iron oxide abrasive or non free chloride/chlorine/halide abrasive shall not be allowed for stainless steel blast cleaning. (The use of copper slag is not allowed).Total roughness shall be in the 25 micron range.

l. Surface preparation for steelwork (C.S) shall result clean surface compatible to SA-2 ½ (Sa 3 for inorganic zinc silicate) as per Swedish standard 055900 and sspc . vis-1 degree SP 10 and degree SP 5 (for inorganic zinc silicate), but main reference is ISO 8501-1

m. 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 Client/Purchaser authorized inspector.

n. During surface preparation, care shall be taken not be damaged or alter identification plates, machined surface and parts coated in the factory, these parts shall be properly

protected.

Any oil, grease, dust or foreign body shall be removed prior to blasting.if oil or grease needs to be removed again,the surface shall be reblasted.

o. The frequency of profile measurement shall be in accordance with ISO 8503-2.

8. STORAGE, MIXING AND THINNING OF PRODUCTS

a. STORAGE CONDITION

i. All paints and thinner containers shall be kept closed before use and stored under shelter.

ii. 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.

iii. 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.

iv. 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 oC and 27 oC .open air srorage shall be avoided particularly of heavy paints such as primers and undercoats.

-The maximum storage time for paints shall be in accordance with the manufacturer's instructions

-Paints shall not be used if it has gelled, or if it has thickened to such an extent that more than 5% by volume (10% by volume for priming paints) of the correct thinners is required to bring it to brushing consistency.

b. MIXING

i. Painting material shall be thoroughly mixed immediately prior to application .Mixing shall be by means of mechanical stirrers, paddle mixers , can vibrators or can shakers.

ii. All the ingredients in each container shall be thoroughly mixed and homogenized. Mechanical mixing shall be such that all pigments or other agents are held in solution during application.

Manual mixers are not authorized except for small quantities.

iii. Paint mixed in the original container shall not be transferred until all settled particles have been remixed with the medium to facilitate mixing.

iv. Paint shall not mixed or held in solution with air bobbles.

v. Paints shall not be used if it has gelled or if it has thickened to more than 5% by volume (10% by volume for priming paints).

vi. All the pigmented products shall be strained after mixing unless applicator equipment is provide with adequate strainers.

Strainers must allow all pigments to pass through, but not any skin.

vii. paint component shall be mixed in the proper ratio as supply by paint manufacturer in containers.Mixing of “guessed“ quantities is not permitted .where required , the paint manufacturer indication time shall be observed .Mixed paint exceeding the pot life shall nor be used.

c. THINNING

i. No thinners are to be added unless necessary for proper application, thinning must never exceed manufacture recommendations. If thickening of paint prevents proper application by brush , not more than 51% by volume of the correct thinner may be added.

ii. Thinners used must be those suggested by the paint manufacturer.

iii. When use of thinner is authorized by the manufacture, it shall be added during mixing. Applicators shall not be add consistency. Thinners must be added under the guidance of the specialist who is thoroughly familiar with the quantity and type of

added thinner.

d. FILM THICKNESS

i. The applied DFT shall not be less than the specified minimum.The DFT shall be measured in accordance with SSPC-PA2.DFT measurement shall be made of each coat & of the total system.

ii. The total dry film thickness for a multicoat system shall not be less than the added total specified dry film thicknesses.

iii. Inadequate film thickness shall require the further application of an additional complete coat over the hole area until the dry film thickness is sufficient to meet the specified minimum.excessive thick coat shall be removed completely by blast cleaning , & shall be re-coated according to this project specification.

iv. The dry film thickness of each coating applied coating applied shall be checked by means of an elcometer or micro tester dry film gauge.

9. PRIMING

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

b. 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.

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

10. PAINTING APPLICATION

a. Procurement and storage

The quantities of paint and thinners required to perform the entire job shall be 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 (controlled temperature, etc.). The packaging shall be clearly marked with the product description, the batch number, the fabrication date and the expiry date.

The expiry dates from the fabrication dates are:

- For zinc ethyl silicate: 6 months
- For other products: 1 year
- Specific cases: according to manufacturer's recommendation with PURCHASER approval.

b. APPLICATION

i. General

All painting shall be carried out in conformity with project paint specification (NGWK-0001-ENPI-SPPA-2308-D08) and with the paint manufacturer's recommendation.

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

Painting works shall not proceed if:

- Temperature of the substrate is less than 3°C above the dew point,

• The relative humidity is more than 85% RH (90% RH for inorganic zinc silicates),

• The weather is rainy or foggy, except under shelter, and subject to verification of the atmospheric conditions,

• The minimum or maximum temperature of the ambient atmosphere and the substrate are outwith the limits given in the product data sheets (usually 10 °C for epoxy based paint and 5 °C for acryl-polyurethane topcoat.

VENDOR 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 INSPECTOR.

Application shall be by airless spray.

Stripe coats shall be applied by brush to all angles, corners, sharp edges, bolt or rivet heads, etc. with the same product than this to be applied on the surface to be painted. The only exception is inorganic zinc silicates where stripe coats shall be applied using the repair system primer i.e. zinc rich epoxy.

Different colours shall be used for all successive coats of the paint system. The finishing coat of the required colour shall be sufficiently opaque to cover the shade of the undercoat.

The thickness of each coat, including frequency and tolerance shall be checked by the

INSPECTOR according to ISO 19840. The values shall be recorded and made available to INSPECTOR.

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

- Brushes shall be of a style and quality that will permit proper application of paint. Round or oval brushes generally are considered most suitable for rivets, bolts, irregular surfaces and rough or pitted steel. Wide flat brushes are suitable for large flat areas, but they should not have a width of over 125mm.

- The brush shall not be dipped more than one-third of bristle length into the paint to avoid overloading the bristles and filling the "heel" with paint. The brush shall be held at an angle of about 45° to the work.

- The brushing shall be done so that a smooth coat, as mealy uniform in thickness as possible is obtained. There should not be deep or detrimental brush marks.

- Excessive pressure shall not be applied to the brush. When the surface has been completely covered with paint, the wet area shall be brushed cross-wise to ensure uniformity, and finally brushed lightly to smooth out brush marks and laps. On large areas this final light brushing shall be in vertical direction.

iii. Airless spray application shall be in accordance with the following:

- Since very high pressure is involved in this method, caution shall be exercised in the handling of airless spray equipment; in particular, the spray gun shall never be pointed towards any part of body whilst the equipment is in operation.
- Fluid tips shall be of proper orifice size and fan angle, and the fluid control gun of proper construction, as recommended by the manufacturer of the material being sprayed and the equipment being used. Fluid tips shall be of the safety type with shields to prevent penetration of the skins by the high pressure stream of paint.
- For good results the gun shall be held at right angle to the work and about 300mm away and the operator should start at the bottom and work upwards. The speed of the operating strokes should be much faster than for normal spraying. Successive passes of the gun shall overlap only slightly since the spray pattern is of uniform thickness throughout its width. Paint must never be allowed to dry in the gun. Cleaning instructions must be strictly followed.
- Airless paint spray equipment shall always be provided with an electric ground wire in the high pressure line between the gun and the pumping equipment.
- Further, the pumping equipment shall be suitably grounded to avoid the build-up of any electrostatic charge on the gun. The manufacturer's instructions shall be followed properly in this respect.
- Inorganic zinc rich paints shall be applied by airless spray method.
-To ensure that the minimum thickness is achieved on all angles, corners, bulkheads, welds, etc., such edges shall be stripe painted separately before applying the main system. Holding primers shall only be permitted where they are obtained from the same manufacturing source as the main priming coats, and where the manufacturer is able to provide a full guarantee that satisfactory intercoat adhesion will occur.
- No coating shall be put on edges prepared for field welds or within six inches of these edges.

- Where further painting is to be carried out, Zinc Silicate primers shall be sealed with a tie coat as soon as practical after complete curing has taken place, to avoid salt or chemical contamination and to seal the porous nature of the primer. The tie coat shall be selected to ensure sound adhesion to the Zinc Silicate primer and be compatible with the finishing coat process.

- Overspray and dry spray of inorganic Zinc Silicate primers shall be removed prior to application of subsequent tie coats or top coats.

- In all instances where two or more coats of the same paint are specified, such coatings shall be of contrasting colors so that each stage of the work can be readily identified and film thickness determined accordingly.

- Intervals between coats shall comply with manufacturer's recommendations and should generally be kept to the absolute minimum in order to prevent contamination between coats. Where contamination occurs between coats, this shall be completely removed, generally by washing with a suitable detergent solution and rinsing with clean fresh water.

- All points of damage to paintwork incurred at any stage of the work, including shop welding operations, shall be re-prepared by blast cleaning to the original standard and recoating with the specified priming coat to restore the film thickness. In all such instances preparation shall extend 25 mm into the sound paintwork and a further 25mm of sound paintwork shall be lightly blasted to etch the surface. Repainting shall then cover the prepared surface and the etched paintwork. Where blast cleaning cannot be carried out, surface preparation of points of damage by scraping and power wire brushing is acceptable provided specific approval is given by PURCHASER/CLIENT. In such instances, modification of the originally specified primer may be necessary to suit the changed method of surface protection.

- Preparation of weld margins shall be preceded by the removal of masking tape where fitted and shall involve the removal of all flux, welding spatter and other foreign matter. Where blast cleaning is used, this may be by means of portable vacuum blast apparatus. Where power wire brushing is used, excessive cleaning to the extent this is liable to produce a polished surface shall be avoided.

- Where touching up prior to top coating of Zinc based primers involved, this shall be preceded by thorough cleaning with solvent or an emulsion type cleaner to 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 (white rust), etc. After the preparation as described in specification, the surfaces shall be allowed to thoroughly dry out and shall be subjected to a thorough inspection to establish effectiveness of the cleaning operations.

iv. Drying Painted Surfaces:

An additional coat of paint shall not be applied until the previous coat is dry.

Read Manufacturer‘s instructions for drying times with respect to ambient temperature and humidity.

Paint shall not be dried under conditions that may cause wrinkling, blistering, pore formation or other injurious defects.

No drier shall be added to paint.

Paint shall be protected from rain, condensation, snow or freezing until it is completely dry (refer to Manufacturer’s technical data sheet).

11. SAFETY REQUIREMENTS

The Painting Contractor shall adhere strictly to the safety requirements stated in the following paragraphs and shall also comply with any additional safety requirements furnished by the PURCHASER/CLIENT Representative.

Scaffolding shall be completely rigid and stable. High scaffolding shall be tied to the structure being painted. Scaffolding shall be so placed that it will not interfere with the work of other crafts or the operation of the operating systems. The scaffolding shall be such that workers will be able to stand up with body and arms free of scaffolding or staging and structure being worked on.

Containers used on scaffolds shall be securely fastened to prevent them from being knocked off.

Where there is possibility of flammable gas in the atmosphere, all tools such as brushes, scrapers and chisels used to clean steel surfaces shall be of the non-sparking type.

All oil or paint-soaked rags shall be stored in closed containers. Clothes, overalls, etc. shall be stored to prevent fire from spontaneous combustion.

Sand to blast hose shall be kept grounded to prevent static electricity buildup.

Paint products shall be stored in a place specified by the PURCHASER/CLIENT and in accordance with the paint manufacturer's instructions.

Positive ventilation shall be provided in areas where paints are mixed and thinned, and where painting is being done. Solvent drums shall be grounded, and containers receiving solvents shall be electrically bonded to the drums by a suitable cable and clamp.

In no case shall sandblast cleaning be done on surfaces of hydrocarbon containing tanks, vessels and equipment that are in service. In this case surface cleaning shall be performed by water blasting with fresh water.

Sand blasting shall be done only if and when it has first been determined that the atmosphere is gas free.

12. GALVANIZING

a. Hot -dip galvanizing shall be in accordance with ASTM A123 on products fabricated from rolled , pressed & forged steel snaps , plates , bars & strips except that pipes for hand railing shall meet ASTM A-153 .

13. INSPECTION

a. Vendor shall advise the PURCHASER/CLIENT inspector before commencing specific paint applications.

b. 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.

c. Each coat paint shall be free from defects and damage.Finished paint shall have the correct shade, degree of gloss and evens and be tree 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.

d. Prior final acceptance of completed work, a joint inspection shall be made by VENDOR and PURCHASER/CLIENT inspector and an agreed inspection report to be signed by both parties.

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

the specification.

f. Before commencement of shop preparation and painting, a meeting between the coating manufacturer, VENDOR and PURCHASER representative shall be convended, to establish and agree, when necessary, visible blast standard, blast profile, satisfactory application the coating and agreement and calibration of inspection equipment.

g. 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.

14. QUALITY CONTROL AND TESTING

a. VENDOR shall submit painting contractor to PURCHASER for approval, his proposed quality control and testing procedures covering all phases of surface preparation and paint application.

b. 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.

c. 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.

Surface preparation and/or paint application operations shall not commence until relative humidity is less than the limits set. Moisture on the surface being prepared or painted shall be measured every day with a surface moisture indicator before beginning surface preparation operations or applying a coat of paint.

d. After paint application following test shall be performed by Quality control departments:

- Visual check

- Thickness check

- Adhesion test

- MEK test

e. EQUIPMENT CALLIBRATION

All dry film thickness given in project specification shall be strictly adhered to and shall be measured in accordance with SSPC-PA2. The maximum tolerance on dry film thickness for each coat shall be in accordance with recommendations of the paint manufacturer, which once established shall not be exceeded. The film thickness shall be checked with calibrated film thickness gauges, using the magnetic resistance or eddy currents principle, such as Elcometer, Micro test, Tinsley, etc., and following the procedures covered in SSPC-PA2. The equipment shall be calibrated at least twice daily in accordance with the manufacturer's recommendations.

f. VISUAL CHECK

Coating film sould be inspected visually after each application & before application & before application of the next coat in order toverify that the whole surface is free of defect as:

-mud cracking

-Inclusion & cleanliness

-Holidays

-Bubble

-Mechanical damage

-Runs/sags

-Over spray

g. THICKNESS CHECK

- Dry paint thickness shall be measured with a magnetic probe,such as micro test of elcomter or equivalent. It is imperative that the magnetic probe be calibrated for each thickness of coating steel support with a non-magnetic block whose thickness is as close as possible to the coating being

checked.

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

- NOT: Average of spot measurments >= specified DFT

All individual measurments >= 90% of specified DFT.

- Should be the thickness less , or more if a maximum thk.is specified , two additional measurements are also in defect ,the item subjected to investigation shall be rejected.

The surfaces represented by the item rejected shall also rejected.

(Zinc ethyle silicate):

- Before over coating it shall be checked, with the solvent recommended by the paint manufacturer, that the hydrolysis is completed by soaking the surface with a rag impregnated with the recommended solvent.

- For each successive coat, the minimal allowable thickness shall be at least 53% of the specified thickness, the maximum thickness shall not exceed 100% of the specified thickness.If the paint remains soft or shows mud crack or orange skin or wrinkling, the paint shall be rejected and request for new application.

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 elcometer wheel or comb type.

h. ADHERENCE CHECK

a) for final coating Paint adherence shall be checked as per ASTM method D3359, methode A or B. Exhibiting an adhision of less than 15 Kg.cm2 shall be rejected & repaired.

Method A (x cut) shall be-used for paint film thicker than 125 microns, Methode B (Lattice pattern) shall be used for paint film up to 125microns.

Test Method A: An X-cut is made in the film to the substrate.

Pressure-sensitive tape is applied over the cut and then removed. Acceptable rating are 5A (No peeling or removal) or 4A (Trace peeling or removal along incisions or at their intersections.)

Test Method B : A lattice pattern with either six or eleven cuts in eachdirection (cross cut) is made in the film to the substrate, pressure-sensitive tape is applied over the lattice and then descriptions and illustrations. Spacing between the cut lines shall be 1 mm for film thickness up to 50 microns and 2 mm for film thickness from 50 to 125 microns. Acceptable results are rate 5B (the edges of the cuts are completely smooth, none of the squares of the lattice is detached) or 4B (small flakes of the coating are detached at intersections; less than 5% of the area is affected).

- If the test is unsatisfactory, the entire surface shall be blast

The adherence testing shall be done on fully cured systems only.
Pull off test shall be carried out for paint systems with dry film thickness above 400 µm. Pull off test shall be checked as per ASTM method D4541 or ISO 4624 standards.

i. MEK TEST

b) Test method for resistance of ethyl silicate (primer coating): in this method we use a solvent rub technique for assessing the MEK resistance of ethyl silicate zinc-rich primers the MEK resistance of some two component ethyl silicate zinc-rich primers has been shown to correlate well with the cure of the primer as determined by diffuse reflectance infrared spectroscopy .the technique can be used in the fabricating shop .

-**TERMINOLOGY**

Double rub the act of rubbing a solvent saturated cloth in one complete forward and backward motion over a coated surface.

-SIGNIFICANCE AND USE

Ethyl silicate zinch-rich primers cure by the reaction of the vehicle with moisture thereby providing a binder.

As relative humidity and temperature vary during the day , so does the rate of cure.

A certain min. degree of cure is recessary prior to topcoating .this can be agreed upon befor the test method.

-PROCEDURE OF TEST

select areas on the primer surface at least 150 mm long on which to run the tests.

Clean the surface with tap water or dry cloth to remove loose material.

Measure the dry film thickness of the primer .

Mark a 150-by 25mm rectangular test area on the undamaged cleaned suface using a pencil or other suitable solvent resistant marker.

Fold the cheesecloth (100%cotton mesh size grade 28 by 24 approximately 300 by 300 mm) into a pad of double thickness and saturate it to a dipping wet condition with the methyl ethyl ketone (MEK) (for steelwork) .

Do not allow more than 10 s to elaspe before proceeding to the next steps.

Place the properly protected index finger into the center of the pad while holding excess cloth with the thumb and remaining fingers of the same hand.

With the index finger at a 45 angle to the test surface , rub the rectangular test area with moderate pressure first away from the operator and then back towards the operator .one forward and back motion is one double rub and complete at the rate of approximately 1/5 .

Continue rubbing the surface with the MEK saturated pad , wetting the pad as necessary without lifting it from the surface , until either the metal substrate is exposed or 50 double rubs have been completed if the former , record the number of rubs when the substrate is exposed .

Select an adjacent area to be used as a control .

Inspect the test areas and the cheesecloths.

Rate the results in accordance the followings :

- Burnished appearance in rubbed area, slight amount of zinc or cloth after 50 double rubs .
- Or some marring and apparent depression of the film after 50 double rubs.

j. INSPECTION RESULTS

All quality control results shall be written up into reports.

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

15. REPAIR OF DEFECTS OR DAMAGE

a. Any defect of damage that may occur shall be repaired before the application of further coats and where necessary the particular surfaces made paint free. remedial work shall be carried out prior to packing for shipment.

b. Areas where due to inadequately prepared surface solvent entrapment, excessive application of prime and/or finish coats, etc.

The tested paint system consistently fails to meet the required test standards for adhesion, the contract shall remove the affected area by blast cleaning and shall reapply the full paint system to meet the required standard.

c. area which are to be over coated shall be thoroughly cleaned free from grease, oil and other foreign matter and shall be dry. The surface shall then be prepared to the standard as originally specified (for large damaged areas), or prepared to the highest possible standard using mechanically operated tools (for small local damaged spots to 1 m2).

d. Damaged areas of galvanized surface : Remove oil, greas & any other forein material from the surface by washing with a suitable chloride –free solvent , in accordance with SSPC-SP1

standard , on all galvanized areas near surfaces damaged by welding & then bristle brush washed with clean water.

e. When thorouly , a minimum of two coats of two pack zinc rich epoxy paint shall be applied by brush to provide a zinc coating thickness that is a minimum of 30 µ more than the galvanized layer.

16. PAINT SYSTEM

Painting shall be done according to project specification.

17. PAINTING REPORTS

See Attachment 1.

I. FOR ALL HEADER BOXES (CARBON STEEL)

Items No.: E-400-108/208, E-450-101-201, E-460-110 A/B/C

Shop finishing system **CN-2- (Atmospheric exposure up to 120°C-Uninsulated):**

1- Blast –cleaning grade sa 2 1/2 as per standard ISO 8501-1:1988 or as SSPC VIS –1 degree sp-10.

2- primer: One layer coat of ZINC rich epoxy (M-TP-205)

Dry film thickness= 75 µ

3-Intermediate: one layer coat of MIO H.B Epoxy(M-TP-220)

Dry film thickness= 150 µ

4- Finishing: one layer coat Polyurethane (M-TP-235)

Dry film thickness=50 µ

(Total Dry film thickness=275 microns)

Finish color: **LIGHT IVORY, RAL 1015**

II. FOR ALL HEADER BOXES (CARBON STEEL)

Items No.: E-400-102/202

Shop finishing system **CN-4- (Atmospheric exposure (200 °C to 450 °C)-Uninsulated and Personnel Protection Insulation)**

1- Blast –cleaning grade Sa3 as per standard ISO 8501-1:1988 or as SSPC VIS –1 degree sp-5.

2- primer: Inorganic Zinc Rich M-TP-210 Dry film thickness= 75 µ

3-Intermediate: Heat resistant aluminum silicone paint Dry film thickness= 25 µ

4- Finishing: Heat resistant aluminum silicone paint Dry film thickness=25 µ

(Total Dry film thickness=110 microns)

Finish color: **Aluminum, RAL 9006**

III. FOR ALL STEEL STRUCTURES WITH SIDE FRAMES & PLENUM FAN-RING:

Shop finishing system **CN-2- (Atmospheric exposure up to 120°C-Uninsulated):**

1- Blast –cleaning grade sa 2 1/2 as per standard ISO 8501-1:1988 or as SSPC VIS –1 degree sp-10.

2- primer: One layer coat of ZINC rich epoxy (M-TP-205)

Dry film thickness= 75 µ

3-Intermediate: one layer coat of MIO H.B Epoxy (M-TP-220)

Dry film thickness= 150 µ

3- Finishing: one layer coat Polyurethane (M-TP-235)

Dry film thickness=50 µ

(Total Dry film thickness=275 microns)

4

Finish color:

Main steel structures and side frame: BROWN BEIGE, RAL1011

Handrail (toe plate and mid-rail, upper rail and post): Orange, RAL 2003

Stairway (excluding toe plate and mid-rail, upper rail and post): Black RAL 9005 , See Pic-1

Safety gates: Orange, RAL 2003

Platforms **See Pic-3**

Ladder and cage **See Pic-2**

4

IV. FOR FIREPROOF BEAM AND COLUMN AND BRACING OF STEEL STRUCTURE OF ITEMS: E-400-108/208, E-450-101-201

1- Blast –cleaning grade sa 2 1/2 as per standard ISO 8501-1:1988 or as SSPC VIS –1 degree sp-10.

2- primer: One layer coat Zinc Rich Epoxy ace. to M-TP-205

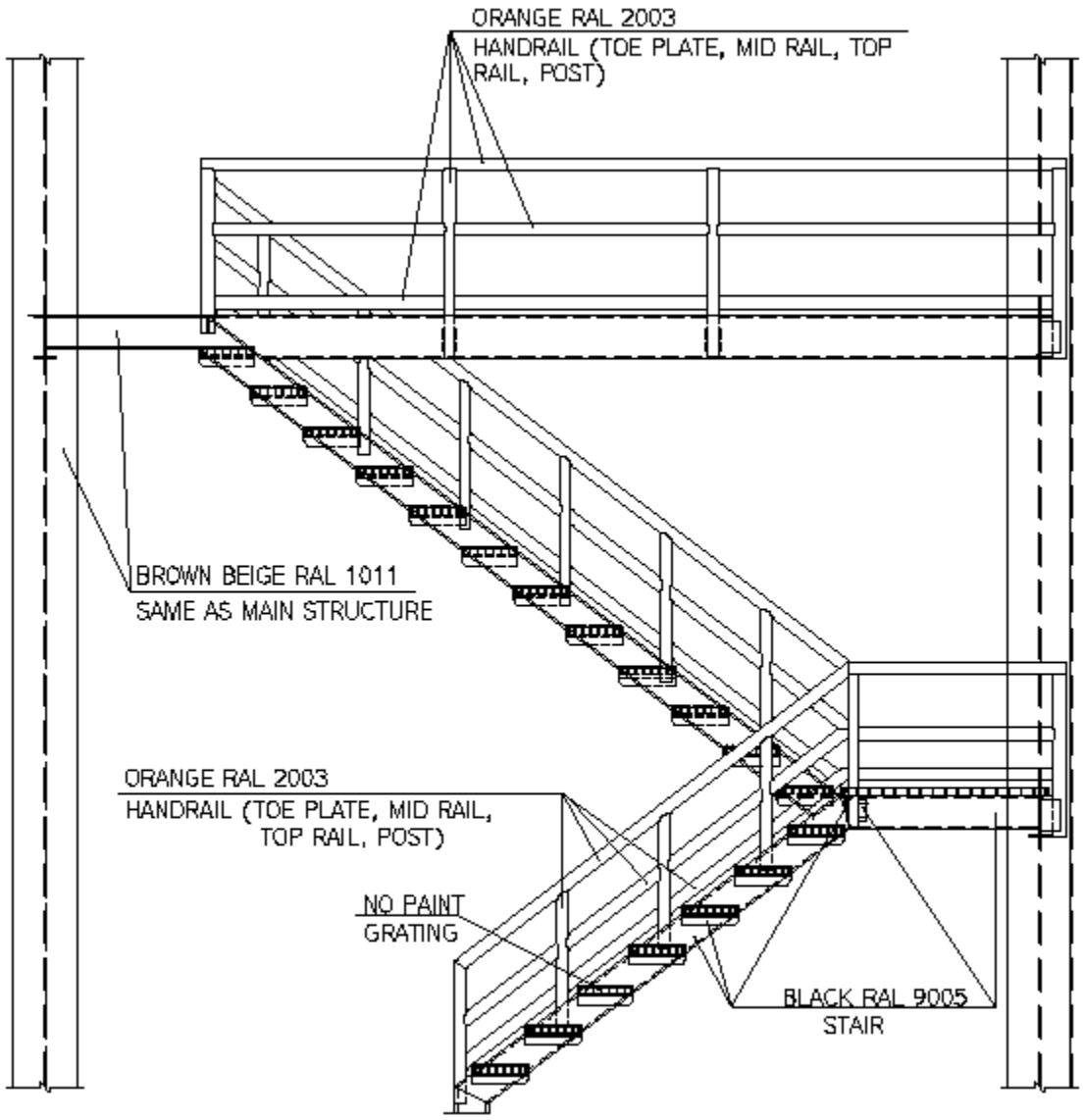
Dry film thickness= 75 µ

3- Intermediate: one layer coat of MIO H.B Epoxy ace. to M-TP-220

Dry film thickness=100 µ

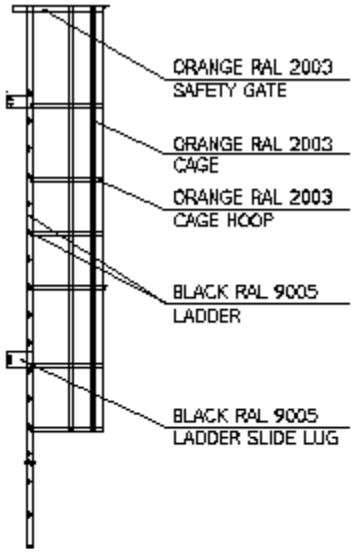
(Total Dry film thickness=175 microns)

Finish color: **BROWN BEIGE, RAL1011**

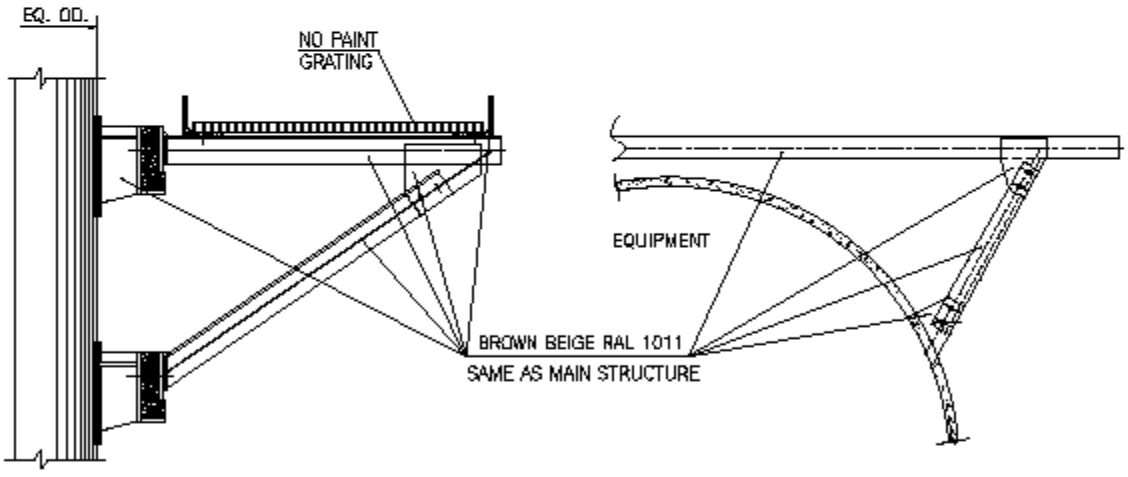


PIC 1- STAIR AND HANDRAIL

4



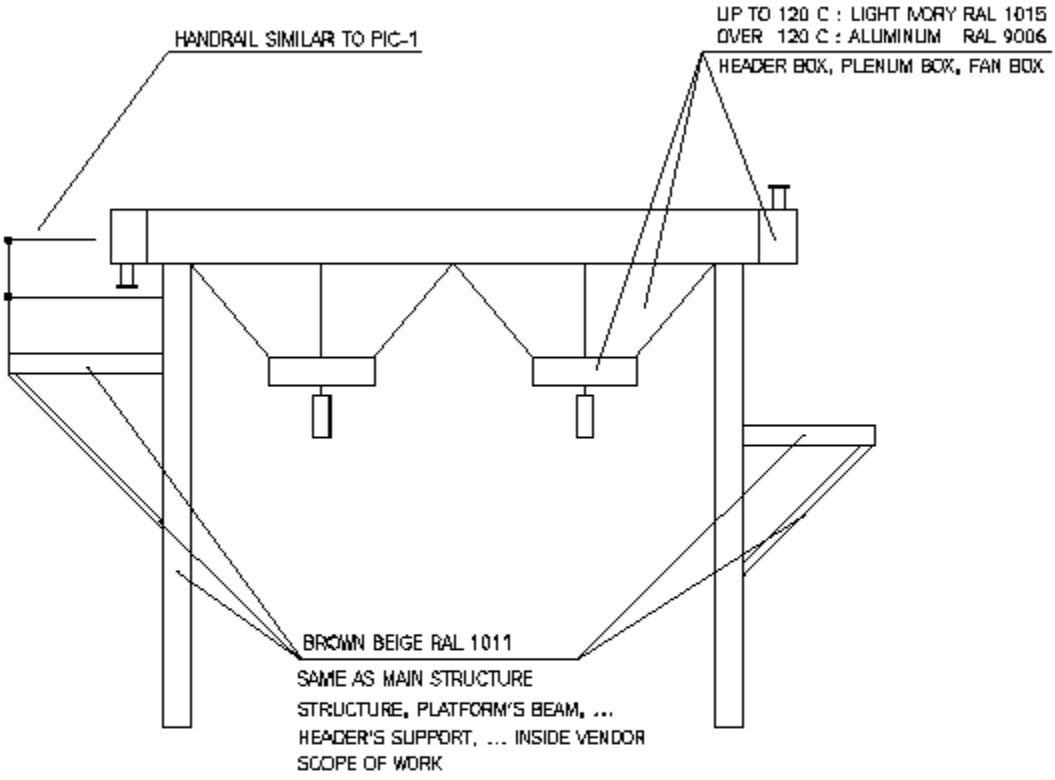
PIC 2– LADDER



– TYPICAL FOR PLATFORM ON STRUCTURE AND ON THE GROUND (ALL BROWN BIEGE RAL 1011)
– HANDRAIL SIMILAR TO PIC–1

PIC 3–PLATFORM

4



- IF THERE IS LADDER IN VENDOR'S SCOPE OF WORK, IT SHALL BE SIMILAR TO PIC-2.

PIC 4-AIR COOLER

AAC	Quality Control	Report No.:
	Painting Report	Date Of Exam. :

PROJECT No. :
PROJECT NAME:

VISUAL CHECK RESULT:
MEK TEST RESULT:

SAND BLAST :
PRIMER :
INTERMEDIATE :
FINISHING :
FINISH COLOR :

TOTAL
THK :
THK :
THK :

Temperature :
Humidity :
Dew point temp :

ITEM NO:

SR. No.	Description	THK(mic)	Result	Date	TIME	Curing & adhesion
1	Sand Blast					
2	Primer					
3	Intermediate					
4	Finish					

Note:MEK TEST RESULT:

A.A.C INSPECTOR	A.A.C	PURCHASER/CONTRACTOR	TPI
NAME & SIGNATURE	NAME & SIGNATURE	NAME & SIGNATURE	NAME & SIGNATURE
Qualification	Qualification	Qualification	Qualification
DATE	DATE	DATE	DATE