DOCUMENT TITLE:

Surface preparation and painting Procedure for E-4106

Code1	☑ Approved: Vendor shall issue "AFC"/ "FIN" status.
Code2	☐ Approved as noted: Vendor to amend and submit the "Issued for Approval" status.
Code3	☐ Commented: Vendor to amend and submit the "Issued for Approval" status.
Code4	☐ Rejected: (vendor to resubmit with same revision

The above checking result by Purchaser shall in no way relieve Vendor of any liability, obligation and responsibility out of the purchase order and the mutual agreement in writing

Date: 23-Dec-2021
Dept.: ME
Signature: A.Baghsi

Only for internal review

CV	**PI**	**EL**	**IN**	**ME**	**MA**
ST	**MC**	**PR**	**SF**	**HV**	**TC**

01	15-Dec-2021	ISSUED FOR APPROVAL	M. Khajehzadeh	M. Abbaszadeh	P. Karimizadeh
00	13-Nov-2021	ISSUED FOR APPROVAL	M. Khajehzadeh	M. Abbaszadeh	P. Karimizadeh
REV.	DATE	DESCRIPTION	PREPARED	CHECKED	APPROVED

Project No.:17175

REVISION INDEX

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1. SCOPE

The following procedure covers the minimum requirements for surface preparation and paint application for air cooled heat exchanger of “ABADAN REFINERY UPGRADING PROJECT”.

2. REFERENCE

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NIOEC-SP-80-02, "NIOEC Specification for Painting"

ASTM A123, "Standard Specification for zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products"

ASTM D4414, "Standard Practice for Measurement of Wet Film Thickness by Notch Gauges"

ASTM D4541, "Standard Test Method for Pull-Off Strength of Coatings Using Portable Adhesion Testers"

ASTM D4752, "Standard Test Method for Measuring MEK Resistance of Ethyl Silicate (Inorganic) Zinc-Rich Primers by Solvent Rub"

ASTM D5402, "Standard Practice for Assessing the Solvent Resistance of Organic Coatings Using Solvent Rubs"

JOB SPECIFICATION FOR PAINTING: 1071-00-ED-MC-SP-8002

2.1 - For undated references, the latest edition of the referenced document before the year 2010 (including any supplements and amendments) applies. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall mutually be agreed upon by NIOEC and the Vendor/Contractor.

2.2. The following design codes, standards and specification shall be used for the design and application of painting and protective coatings, where referred to in this specification.

ASTM (AMERICAN SOCIETY FOR TESTING AND MATERIALS)

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

BSI (BRITISH STANDARDS INSTITUTION)

BS 381C (1988) "Colors for Identification, Coding and Special Purposes"

BS 6150(2002) "Painting of Building"

IPS (IRANIAN PETROLEUM STANDARDS)

IPS-M-TP-168 "Material and Equipment standard for Acrylic Silicone Finish Paint for Temperature Applications Up to 230°C"

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

IPS-M-TP-205 "Material and Equipment standard for Zinc Rich Epoxy Paint (Organic) as Primer, Intermediate and Top Coat"

IPS-M-TP-210 "Material and Equipment standard for Zinc Silicate (inorganic) Paints as Primer, Intermediate and Top Coat"

IPS-M-TP-215 "Material and Equipment standard for Epoxy Polyamide Primer"

IPS-M-TP-220 "Material and Equipment standard for Epoxy Polyamide Intermediate Paint"

IPS-M-TP-225 "Material and Equipment standard for Epoxy Polyamide Paint as Top Coat"

IPS-M-TP-235 "Material and Equipment standard for Two Pack Aliphatic Polyurethane Paint as Top Coat"

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

12944(1998) "Paints and Varnishes-Corrosion Protection of Steel Structures by Protective Paint System"

8501-1(1988) "Rust Levels of Steel Structure and Quality Levels for Preparation of Steel Surfaces for Rust Protecting Surfaces"

ISO (INTERNATIONAL ORGANIZATION FOR STANDARDIZATION)

12944(1998) "Paints and Varnishes-Corrosion Protection of Steel Structures by Protective Paint System"

8501-1(1988) "Rust Levels of Steel Structure and Quality Levels for Preparation of Steel Surfaces for Rust Protecting Surfaces"

NIOEC-SP (NIOEC SPECIFICATION)

NIOEC-SP-00-10 "NIOEC Specification for units"

1071-00-ED-MC-SP-8002 Latest revision of Job specification for painting

SSPC (STEEL STRUCTURE PAINTING COUNCIL)

SSPC-Vol. 1(1994) "Good Painting Practice"

SSPE-Vol. 2(1994) "Systems and Specification"

NOTE: In terms of any deviation between project specifications and this procedure, project specifications are priority.

3. DEFINITION

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Project: Abadan Refinery Upgrading Project

Employer: National Iranian Oil Engineering and Construction Company (NIOEC)

Contractor: Consortium of Sinopec Engineering Incorporation (SEI) and Oil Design and Construction Company (ODCC)

Purchaser: Consortium of Sinopec Engineering Incorporation (SEI) and Oil Design and Construction Company (ODCC)

Vendor: Aban Air Cooler Co.

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4. 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.

5. GENERAL

5.1) 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.

5.2) 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.

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

5.4) 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.

5.5) 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.

5.6) 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

5.8) 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.

5.9) In case of any deviation between1071-00-ED-MC-SP-8002 and current specification, 1071-00-ED-MC-SP-8002 shall be followed.

6. SURFACE PREPARATION

6.1) 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.

6.2) All rough-edged cuts & welds, weld spotters, 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.

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

6.4) 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.

6.5) 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, SA 2 1/2: Near white blast cleaning

SA 3: White blast cleaning

6.6) Required Roughness

6.6.1) - 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 80 microns when total thickness of the coats of the paint applied is greater than 400 microns.

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

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

a- At temperature below 10 °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.

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.

6.8) 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.

6.9) 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.

7. STORAGE, MIXING AND THINNING OF PRODUCTS

7.1) STORAGE CONDITION

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

7.1.2)-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.

7.1.3)-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.

7.1.4)-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.

7.2) Mixing

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

7.2.2) 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.

7.2.3) 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.

7.2.4) 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.

7.2.5) 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.

7.2.6) 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.

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

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

7.3) Thinning

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

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

7.3.3) 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.

8. PRIMING

8.1) 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.

8.2) 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.

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

9. PAINTING APPLICATION

9.1) 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 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.

9.2) 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: 35 °C or higher

(6) When the temperature of the surface is less than 3ºC above the dew point of the surrounding air, and/ or the relative humidity is higher than 80%

(7) When there is the likelihood of an unfavorable change in weather conditions within two hours after coating

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.

10. GALVANIZING

10.1) 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.

11. INSPECTION

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

11.2) 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.

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

11.4) 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.

11.5) 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.

11.6) 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.

11.7) 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.

11.8) MEK test for Zinc Silicate shall be carried out as per job specification.

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12. QUALITY CONTROL AND TESTING

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

12.2) 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.

12.3) 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.

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

- Visual check
- Thickness check

- Adhesion test

12.5) 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

12.6) 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-gage 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 >= specified DFT

All individual measurements >= 90% of specified DFT

Total specified thickness shall not be more than %20 of the specified thickness.

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12.7) Adherence Check

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

12.8) Inspection Results

All quality control results shall be written up into reports.

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

13. REPAIR OF DEFECTS OR DAMAGE

Touch up work on damaged surfaces:

Surface is damaged as substrate material is seen:

The surfaces 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 up to 1 square meter After surface preparation, 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.

14. PAINT SYSTEM

13.1) Inorganic zinc rich primer, two component, high build type moisture curing ethyl silicate type zinc primer. The metallic zinc content is a minimum 80% by weight of total solids & provides sacrificial protection & high anti-corrosive stability to steel surfaces. continuous heat resistance is achieved in the temperature range up to 400 °C.

Organic zinc rich primer two component epoxy-based zinc rich primer. The metallic zinc content is a minimum 80% by weight of total solids & provides sacrificial protection & high anti-corrosive stability to steel surfaces. Continuous heat resistance is achieved in the temperature range up to 150 °C.

Epoxy: Two component polyamide cured epoxy paint. Generally, it has good resistance to chemicals & exhibits good durability. Continuous heat resistance is achieved in the temperature range up to plus 120 °C.

Polyurethane: Two component isocyanate-free, aliphatic type polyurethane top coat. Generally, this paint product extremely hard & good chemical, weather resistance & excellent durability & gloss retention.

Silicon Acrylic One component, aluminum (or color) pigmented acrylic-modified silicon resin. Heat resistant up to 200 °C. Full cure can be achieved at ambient temperature.

13.2) Paint system applicable shall be in accordance with 1A, 1C.

15. PAINTING REPORTS

See Attachment 1.

Refer to attachment next page.

Paint System Determination

Item No.	Material	Insulation	Fireproofed	Operating Temperature (°C)	Paint System
E-4106	Carbon Steel	No	No	220	C
Steel Structures and Side Frame	Carbon Steel	No	No	Ambient	A

*** Plenum, Fan ring and fan guard shall be Hot - dip galvanized.**

** Steel surfaces not in direct bonded contact, but inaccessible after assembly shall receive the full specified paint system before assembly. During assembly, if there are any damages to paint surface, it shall be repaired by suitable method.

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Paint system A:

Item: **Steel Structure, Side frame**			Operating Temperature:	**Up to 120 °C**
Minimum surface preparation				SA 2 ½
Paint and DFT (microns)	Primer	Zinc Rich Epoxy - IPS-M-TP-205		75
	Intermediate	Epoxy polyamide - IPS-M-TP-220		150
	Finishing	Two Pack Polyurethane - IPS-M- TP-235		50
Total DFT (microns)				275
	Main Steel Structure (all items)			1011, Brown beige
	Hand Rail (Toe plate and mid-rail), Stair Way (toe plate and mid-rail), Platforms lower edges and toe plates, mid-rail and safety platform, Safety gates			2003, Orange
	Hand Rail (Excluding toe plate and mid-rail), Stair Way (excluding toe plate and mid-rail), Upper ladder and round platforms and top rail			9005, Black
	Piping supports			1001, Light beige or 9006, Aluminum

Paint system C:

Item: **E-4106 Header Boxes**		Maximum Operating Temperature:	**201 to 400 °C**
Minimum surface preparation			SA 3
Paint and DFT (microns)	Primer	Zinc Silicate - IPS-M-TP-210	75
	Intermediate	Silicon Aluminum	25
	Finishing	Silicon Aluminum	25
Total DFT (microns)			125
Finishing **RAL**		Header Box	**9006**, Aluminum

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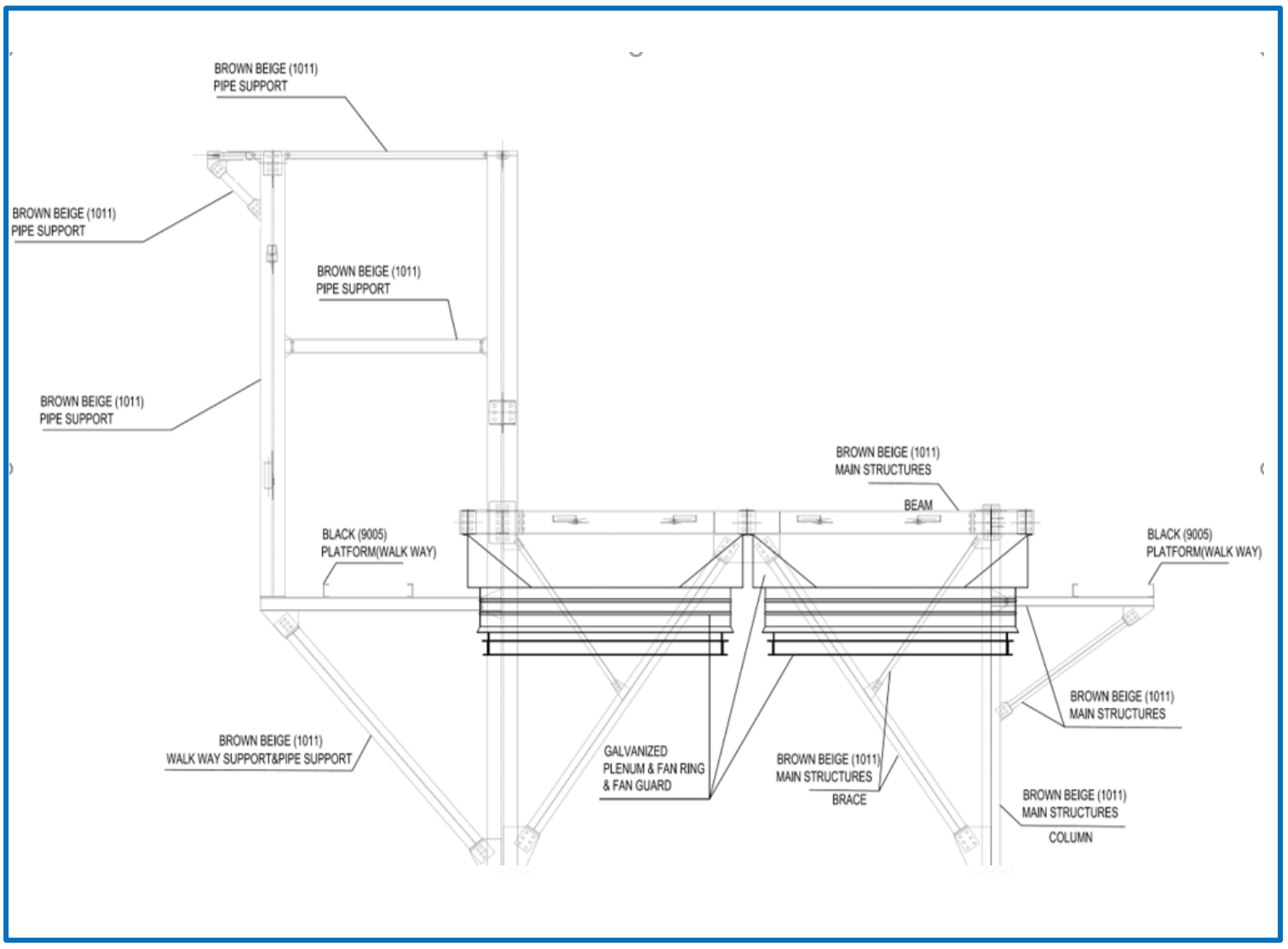

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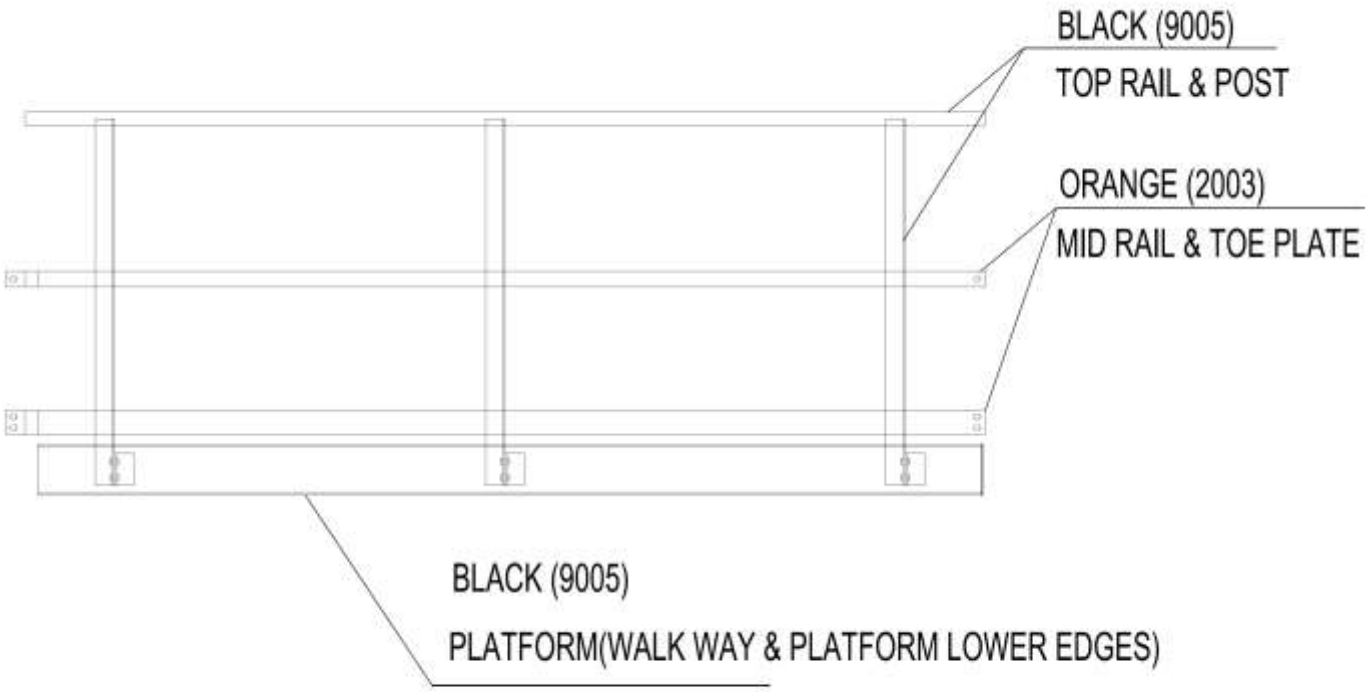

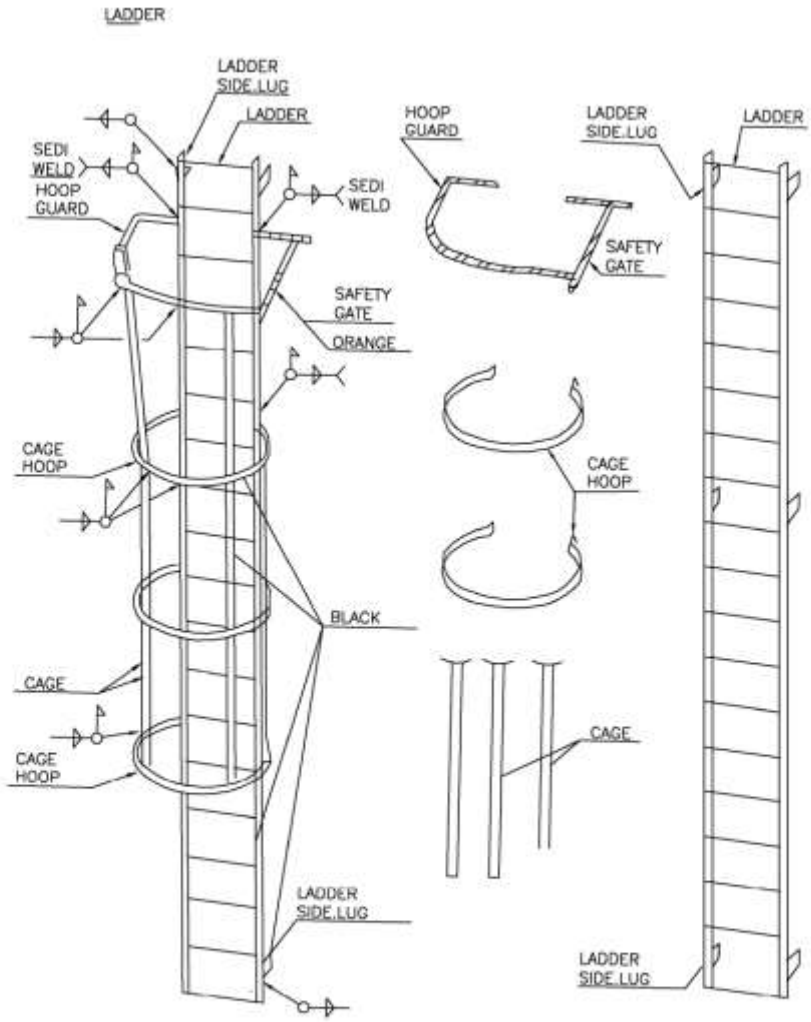

LADDER (ALL BLACK RAL 9005)
SAFETY GATE OR SAFETY DEVICE (ORANGE RAL 2003)

Attachment 1

AAC	**Quality Control**	**Report No.:**
	Painting Report	**Date of Exam:**

Procedure No.:
Document No:
Sand Blast: **TOTAL**
PRIMER: **THK:**
INTERMEDIATE: **THK:**
FINISHING: **THK:**
FINISH COLOR:
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:

Inspector	A.A.C Inspector	CLIENT	CONTRACTOR
NAME & SIGNTURE			
QUALIFICATION			
DATE			

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