



Surface preparation and painting Procedure

Page 1 of 15 Project Doc. No. : NGL-V-7123-VE-PR-0012

OIEC Doc. No.:

Status: A

Class: 1

# **Surface preparation and painting Procedure**

| Code1   | (Approved): No Comment and release for Manufacturing     (Document to be stamped as Final for considering in Vendore Data Book)  |   |  |  |  |  |  |
|---|--|---|--|--|--|--|--|
| Code2   | (Work May be Proceed) (Approved with Comment): VENDOR/Sub-contractor shall correct/revise document and issue it as "FOR APPROVAL"  |   |  |  |  |  |  |
| Code3   | (Commented): VENDOR/Sub-contractor shall correct/revise and resubmit it as "FOR APPROVAL" of the date documents specified (Corrected document to be resubmitted before starting manufacturing) |   |  |  |  |  |  |
| No Code   | Class2 documents wi  | ANT and PURCHASER check results on<br>Il be returned without any CODE.<br>or shall correct/revise document and<br>MATION" |  |  |  |  |  |
| Note- The above checking results by CONSULTANT and PURCHASER shall in no way relieve VENDOR/Sub-contractor of any liability, obligation and responsibility out of the Purchase Order and the mutual agreement in writing. |  |   |  |  |  |  |  |
|   | <b>△</b>   | Date:<br>Dept:<br>Signature:  |  |  |  |  |  |

P.O. Number : 18645-Z-0121-03

Site Location : IRAN - Ilam - Cheshmeh khosh

|      | Name & Siş  | gnature:            |                                  |                |                  |
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|      |             |                     |                                  |                |                  |
|      |             |                     |                                  |                |                  |
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Surface preparation and painting Procedure

Page 2 of 15 Project Doc. No. : NGL-V-7123-VE-PR-0012

OIEC Doc. No.:

Status: A

Class: 1

## TABULATION OF REVISED PAGES

| D    | Mo | dified | In Rev | . Num | ber | D    | Mo | dified | In Rev | . Num | ber | D    | Mo | dified | In Rev | . Num | ber |
|------|----|--------|--------|-------|-----|------|----|--------|--------|-------|-----|------|----|--------|--------|-------|-----|
| Page | D0 | D1     | D2     | D3    | D4  | Page | D0 | D1     | D2     | D3    | D4  | Page | D0 | D1     | D2     | D3    | D4  |
| 1    | Х  |        |        |       |     | 26   |    |        |        |       |     | 51   |    |        |        |       |     |
| 2    | Х  |        |        |       |     | 27   |    |        |        |       |     | 52   |    |        |        |       |     |
| 3    | Х  |        |        |       |     | 28   |    |        |        |       |     | 53   |    |        |        |       |     |
| 4    | Х  |        |        |       |     | 29   |    |        |        |       |     | 54   |    |        |        |       |     |
| 5    | Х  |        |        |       |     | 30   |    |        |        |       |     | 55   |    |        |        |       |     |
| 6    | Х  |        |        |       |     | 31   |    |        |        |       |     | 56   |    |        |        |       |     |
| 7    | Х  |        |        |       |     | 32   |    |        |        |       |     | 57   |    |        |        |       |     |
| 8    | Х  |        |        |       |     | 33   |    |        |        |       |     | 58   |    |        |        |       |     |
| 9    | Х  |        |        |       |     | 34   |    |        |        |       |     | 59   |    |        |        |       |     |
| 10   | Х  |        |        |       |     | 35   |    |        |        |       |     | 60   |    |        |        |       |     |
| 11   | Х  |        |        |       |     | 36   |    |        |        |       |     | 61   |    |        |        |       |     |
| 12   | Х  |        |        |       |     | 37   |    |        |        |       |     | 62   |    |        |        |       |     |
| 13   | Х  |        |        |       |     | 38   |    |        |        |       |     | 63   |    |        |        |       |     |
| 14   | Х  |        |        |       |     | 39   |    |        |        |       |     | 64   |    |        |        |       |     |
| 15   | Х  |        |        |       |     | 40   |    |        |        |       |     | 65   |    |        |        |       |     |
| 16   |    |        |        |       |     | 41   |    |        |        |       |     | 66   |    |        |        |       |     |
| 17   |    |        |        |       |     | 42   |    |        |        |       |     | 67   |    |        |        |       |     |
| 18   |    |        |        |       |     | 43   |    |        |        |       |     | 68   |    |        |        |       |     |
| 19   |    |        |        |       |     | 44   |    |        |        |       |     | 69   |    |        |        |       |     |
| 20   |    |        |        |       |     | 45   |    |        |        |       |     | 70   |    |        |        |       |     |
| 21   |    |        |        |       |     | 46   |    |        |        |       |     | 71   |    |        |        |       |     |
| 22   |    |        |        |       |     | 47   |    |        |        |       |     | 72   |    |        |        |       |     |
| 23   |    |        |        |       |     | 48   |    |        |        |       |     | 73   |    |        |        |       |     |
| 24   |    |        |        |       |     | 49   |    |        |        |       |     | 74   |    |        |        |       |     |
| 25   |    |        |        |       |     | 50   |    |        |        |       |     | 75   |    |        |        |       |     |

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Surface preparation and painting Procedure

**Page 3 of 15** 

Project Doc. No. : NGL-V-7123-VE-PR-0012 OIEC Doc. No.:

Status: A

Class: 1

# **Table of Contents**

| 4 |
|---|
| 4 |
| 4 |
| 4 |
| 4 |
| 4 |
| 5 |
| 6 |
| 6 |
| 6 |
| 7 |
| 7 |
| 7 |
| 8 |
| 9 |
| 9 |
|   |





Surface preparation and painting Procedure

Page 4 of 15

Project Doc. No. : NGL-V-7123-VE-PR-0012 OIEC Doc. No.:

Status: A

Class: 1

### 1. Scope

The following procedure covers the minimum requirements for surface preparation and paint application for Air cooled heat exchangers, which will be exposed to corrosive environment for "NGL 3100 Project".

### 2. TERMS AND DEFINITIONS



**PROJECT TITLE:** Natural Gas Liquids Complex 3100 (NGL 3100 Project)

**EPC Contractor:** The Company that provides a product or service under a signed contract or agreement. Oil Industries' Engineering & Construction Company (hereafter OIEC) is called CONTRACTOR or EPC

CONTRACTOR in this document. **Shall**: Mandatory requirements **Must**: Mandatory requirements

**Should**: Recommended or advisory requirements

**SUPPLIER / VENDOR**: Refers to person(s) or company/party (ies) entering into a contract or agreement to supply and/or fabricate the Material in accordance with the requirements of the contracts and specifications.

01

### 3, Paint Manufacturers Obligations

- 3.1) The vendor shall request paint supplier to send technical data sheet and test and analysis certificates and then submit to purchaser and contractor inspector for verification.
- 3.2) 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. Manufacturer shall provide a guarantee that no such materials have been reconstituted for any reason what so ever.

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

#### 4. Reference

NGL-CT-1-0000-PI-SP-2016-D5 Painting Specification

01

- ASTM D4752
- ASTM D 3359 Standard Test Method for Measuring Adhesion by Tape Test
- ASTM D 4541 Standard Test Method for Pull-Off Strength of Coating Using Portable Adhesion Testers
- ISO 8501-1 Preparation of Steel Substrates before Application of Paints and Related Products, Visual Assessment of Surfaces Cleanliness
- ISO 8503-1-2-3-4 Roughness Characteristics of Blast-Cleaned Steel Substrate
  - SIS 055900 Swedish Standard
  - RAL-K1 Standards for Colours (Shades)

#### 5. Requirement

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

#### 6. General

- 6.1) The manufacturer shall provide skilled and experienced personnel to carry out the work together with competent and qualified supervision.
- 6.2) The manufacturer shall comply fully with this procedure 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 procedure.





Surface preparation and painting Procedure

Page 5 of 15

Project Doc. No. : NGL-V-7123-VE-PR-0012 OIEC Doc. No.:

Status: A

Class: 1

- 6.3) Prior to the commencement of work, the manufacturer shall submit fully detailed procedure for the approval of purchaser, as to how he intends to carry out the work within the frame work of this specification & Document.
- 6.4) The parts 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
- Packing glands
- Packing seal
- Pressure gauges
- Gauges glasses
- Instrument dials
- 6.5) 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

- 7.1) 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.
- 7.2) All rough edged cuts, welds, weld spatters, indentations, all surfaces and 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.
- 7.3) All bolt holes shall be drilled and blunted before blasting.
- 7.4) 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.

### 7.5) Required Cleanliness

All surfaces prepared for coatings shall satisfy:

- SA 2 1/2 of the 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.

#### 7.6) Required Roughness

7.6.1) 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.

- 7.6.2) The prepared surfaces should be cleaned using dry air or clean brush.
- 7.7) Surface preparation shall not take place in the following conditions:
- At temperature below 3°C
- When the relative humidity is greater than 85%

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

- When the metal surface temperature is less than 3 °C above the ambient dew point or in excess of 38 °C.
- Rainy weather
- 7.8) All abrasives shall be supplied fresh, unused and free of dust, dirt and other foreign matter. They shall be kept dry at all times. Used blasting material is prohibited for reusing unless for re-blasting before paint application, if required as per project specification.

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 also girts shall not be recycled.

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.







Surface preparation and painting Procedure

Project Doc. No. : NGL-V-7123-VE-PR-0012 OIEC Doc. No.:

Status: A

Class: 1

### 8. Storage, Mixing and Thinning of Products

#### 8.1) Storage Condition

All paints and thinner shall be stored under covered shelter for protection from direct sunlight, rain and extremely high, low outdoor temperature and in a place where there is a good air-conditioned and temperature is not higher than 35 °C. Smoking or open flames shall not be permitted within the storage areas while providing suitable fire-preventing materials. Thinners, solvents, etc. shall be stored in a suitably ventilated fireproofed building, separate from other painting consumables.

#### **8.2) Mixing**

- 8.2.1) Before opening the can, the paint should be checked if it complies with the specification.
- 8.2.2) 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.
- 8.2.3) 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.
- 8.2.4) 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.
- 8.2.5) The paint in opened can should be stirred sufficiently until it becomes uniform. Up to 5 liters of paint should be stirred manually, and over 5 liters use a machine. No stirring is allowed with compressed air.
- 8.2.6) 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(max. 20-30 min) before their use. The mixed paints shall be applied within their pot life.
- 8.2.7) When thinner is necessary, unspecified thinner should not be used. Also, the amount should not be exceeded.
- 8.2.8) For color, it is necessary to use paints mixed to the specified color at the production plant.

#### 8.3) Thinning

- 8.3.1) No thinners are to be added unless necessary for proper application, thinning must never exceed manufacturer recommendations.
- 8.3.2) Thinners used must be those suggested by the manufacturer.
- 8.3.3) When use of thinner is authorized by the manufacturer, 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.

### 9. Priming

- 9.1) 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.
- 9.2) 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.
- 9.3) The primer to finishing coat paint shall be from the same manufacturer for each system to ensure compatibility.

#### 10. Painting Application

10.1) 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.

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.

#### 10.2) Application

6





Surface preparation and painting Procedure

Page 7 of 15

Project Doc. No. : NGL-V-7123-VE-PR-0012

OIEC Doc. No.:

Status: A

Class: 1

#### General

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

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

(1) Humidity: 80% or higher

(2) Rainy, snowy and foggy weather

(3) Temperature: below 4°C

(4) Strong wind and severe sand dust

(5) Painted metal surface temperature is higher than 35°C.

(6) In any case of forbidding by paint supervisor.

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 EPC contractor. Application shall be by airless spray.

### 11. Galvanizing

11.1) 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.

### 12. Inspection

- 12.1) EPC Contractor shall advise the owner inspector before commencing specific paint applications.
- 12.2) 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.
- 12.3) 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.
- 12.4) 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.
- 12.5) Inspection by the paint manufacturer or an independent inspection service shall not relieve the EPC contractor of responsibility for ensuring that the work is carried out in accordance with the specification.
- 12.6) Before commencement of shop preparation and painting, a meeting between the coating manufacturer, EPC contractor and client 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.

12.7) 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.

### 13. Quality Control and Testing

- 13.1) Contractor shall submit his proposed quality control and testing procedures covering all phases of surface preparation and paint application to EPC contractor for approval.
- 13.2) 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.
- 13.3) 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.
- 13.4) After paint application following test shall be performed by Quality Control Departments:
- Visual check
- Thickness check
- Adhesion test



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Surface preparation and painting Procedure

Page 8 of 15

Project Doc. No. : NGL-V-7123-VE-PR-0012 OIEC Doc. No.:

Status: A

Class: 1

#### 13.5) 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

#### 13.6) 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 coat 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 m<sup>2</sup> in area.

**NOTE**: Average of spot measurements >= specified DFT

All individual measurements >= 90% of specified DFT

## 13.7) Adherence Check

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

#### 13.8) Inspection Results

All quality control results shall be written up into reports.

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

## 14. Repair of Defects or Damaged Painted Surface



Touch up work on damaged surfaces:

(1) Surface is damaged as substrate material is seen:

After surface preparation according to original standard, 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





Surface preparation and painting Procedure

Page 9 of 15 Project Doc. No. : NGL-V-7123-VE-PR-0012 OIEC Doc. No.:

Status: A

Class: 1

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

14.1) 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. Silicone Aluminum: a heat resistant, aluminum pigmented based on silicone resin. Continuous heat resistance is achieved in the temperature range up to 400 °C.

Epoxy-MIO: Two component polyamide cured epoxy paint pigmented with micaceous iron oxide. 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.

Phenolic Epoxy Polyamine, a two component polyamine cured epoxy modified with phenolic novolac grade. Continuous heat resistance is achieved in the temperature range up to 160 °C.

14.2) Paint system applicable shall be in accordance with paint systems 1, 3, refer to next page.

### 15. Painting Report

Refer to attachment next page





Surface preparation and painting Procedure

Page 10 of 15 Project Doc. No. : NGL-V-7123-VE-PR-0012

OIEC Doc. No.:

Status: A

Class: 1

## **Paint System Determination**

| Item No.                           | Material     | Operating Temperature (°C) | Paint System          |
|------------------------------------|--------------|----------------------------|-----------------------|
| E-3130-01                          | Carbon Steel | 230                        | 3                     |
| E-3170-01                          | Carbon Steel | 290                        | 3                     |
| E-3170-02                          | Carbon Steel | 88.65                      | 1                     |
| Side Frame                         | Carbon Steel | Ambient                    | Hot dip<br>galvanized |
| Steel Structures (un-fireproofed), | Carbon Steel | Ambient                    | 1                     |
| Steel Structures (fire proofed),   | Carbon Steel | Ambient                    | 11                    |

## Paint system 1:

|                  | 170-02 Header Box<br>eel Structure  | es,          | Operating Temperature:                   | Up to 90°C  |  |  |
|------------------|---|--------------|--|-------------|--|--|
|                  | Minim   | um surfa     | ce preparation                           | SA 2 ½      |  |  |
| Paint and        | Primer  | Zinc Ric     | ch Epoxy                                 | 75          |  |  |
| DFT              | Intermediate  | 125          |  |             |  |  |
| (microns)        | Finishing   | Aliphati     | c Polyurethane                           | 50          |  |  |
|                  | To  | otal DFT     | (microns)                                | 250         |  |  |
|                  |   | 9010, White  |  |             |  |  |
| Finishing<br>RAL | Main Steel Stru<br>Way Support, M   | 1007, Yellow |  |             |  |  |
| KAL              | Hand Rail (Toe plate and mid-rail), Platforms lower edges(walkway), safety gate |              |  | 9010, White |  |  |
|                  | Hand Rail (Ex   | cluding to   | oe plate and mid-rail), top rail, ladder | 9005, Black |  |  |

## Paint system 3:

| Item: E-3136  | 0-01, E-3170-01 He<br>Boxes | eader     | Maximum Operating Temperature: | 201 to 400 °C   |  |  |
|---------------|-----------------------------|-----------|--------------------------------|-----------------|--|--|
|               | Minin                       | num surfa | ce preparation                 | SA 2 ½          |  |  |
| Paint and     | Primer                      | Inorgani  | c zinc ethyl silicate          | 75              |  |  |
| DFT           | Intermediate                | Aluminu   | m Silicone                     | 25              |  |  |
| (microns)     | Finishing                   | Aluminu   | m Silicone                     | 25              |  |  |
|               | Т                           | otal DFT  | (microns)                      | 125             |  |  |
| Finishing RAL |                             |           | Header Box                     | 9006, Aluminium |  |  |





Surface preparation and painting Procedure

Page 11 of 15 Project Doc. No. : NGL-V-7123-VE-PR-0012

OIEC Doc. No.:

Status: A

Class: 1

## Paint System 11:

| Item: \$  | Steel Structures (fi                      | re proofed parts)       | Operating Temperature: | Up to 125 °C |  |  |
|-----------|---|-------------------------|------------------------|--------------|--|--|
|           | Minin                                     | num surface preparation |                        | SA 2 ½       |  |  |
| Paint and | Paint and Primer Phenolic Epoxy Polyamine |                         |                        |              |  |  |
| DFT       | Intermediate                              |                         | 100                    |              |  |  |
| (microns) | (microns) Finishing -                     |                         |                        |              |  |  |
|           | T   | otal DFT (microns)      |                        | 200          |  |  |
|           | Finishing F                               | PAL                     |                        |              |  |  |
|           | 1 misming 1                               | W IL                    | (grey or white)        |              |  |  |

<sup>\*</sup> Side frame shall be Hot - dip galvanized.

Note: All following sketches are illustrated in next pages, are the same for each item.



<sup>\*</sup> Electrical motors would be painted as per manufacturer's standard with final RAL 9010.





Surface preparation and painting Procedure

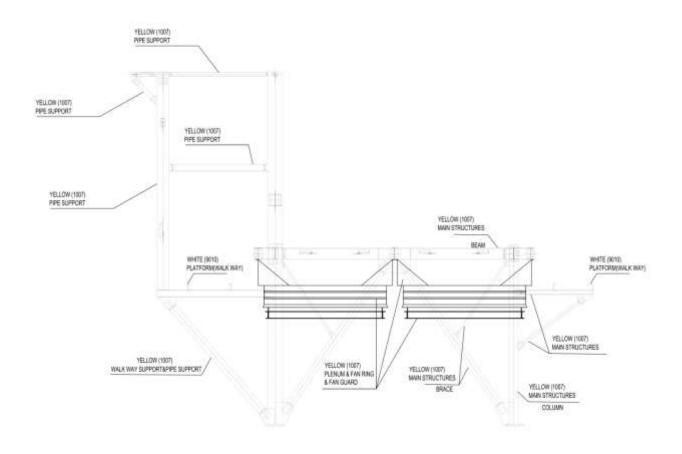
Page 12 of 15

Project Doc. No. : NGL-V-7123-VE-PR-0012

OIEC Doc. No.:

Status: A

Class: 1







Surface preparation and painting Procedure

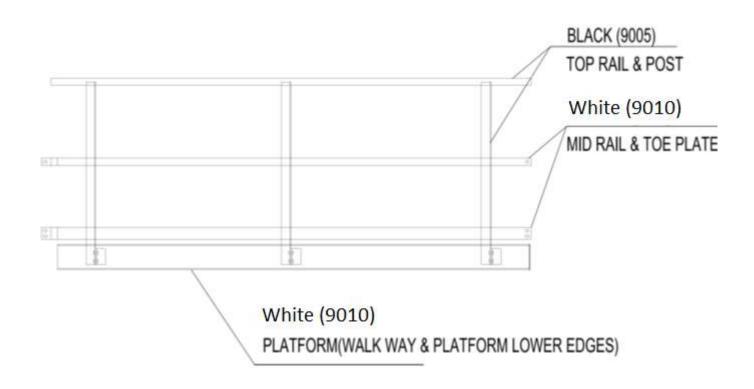
Page 13 of 15

Project Doc. No. : NGL-V-7123-VE-PR-0012

OIEC Doc. No.:

Status: A

Class: 1







Surface preparation and painting Procedure

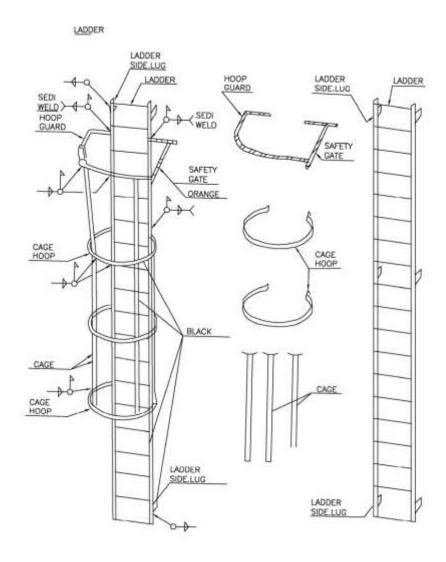
Page 14 of 15

Project Doc. No. : NGL-V-7123-VE-PR-0012

OIEC Doc. No.:

Status: A

Class: 1



LADDER (ALL BLACK RAL 9005) SAFETY GATE (White RAL 9010)





Surface preparation and painting Procedure

Page 15 of 15

Project Doc. No. : NGL-V-7123-VE-PR-0012 OIEC Doc. No.:

Status: A

Class: 1

### Attachment 1

|                                    |   |          | Au        | acnmen               | <i>l</i> 1 |     | _                 |
|------------------------------------|---|----------|-----------|----------------------|------------|-----|-------------------|
|                                    | AAC   |          | Qual      | Report No.:          |            |     |                   |
|                                    |   |          | Pair      | nting Re             | eport      |     | Date Of Exam. :   |
| DOI<br>SAM<br>PRIII<br>WIR<br>FINE | DCEDURE No.: CUMENT NO.: D BLAST: MER : ERMEDIATE : STANS : STANS : |          |           | THK:<br>THK:<br>THK: | POTAL      |     |                   |
|                                    | pesture :   |          |           | Humki                | ty:        |     | Description:      |
| mei                                | M NO:   |          |           |                      |            |     |                   |
| SR. No.                            | Description   | 1        | THK(mic)  | Result               | Date       | TRE | Curing & adhesion |
| 1                                  | Sand Blast  | :        |           |                      |            |     |                   |
| 2                                  | Primer  |          |           |                      |            |     |                   |
| 3                                  | Intermediab   | <u>.</u> |           |                      |            |     |                   |
| 4                                  | Finish  |          |           |                      |            |     |                   |
|                                    |   |          |           |                      |            |     |                   |
| Inspector A.A.C                    |   | AAC      | Inspector |                      | Purcha     | ser | TPI Inspector     |
| М                                  | WE & BIGINATURE   |          |           |                      |            |     |                   |
| <b>a</b>                           | - Perla   |          |           |                      |            |     |                   |
| DAG                                | TE .  |          |           |                      |            |     |                   |