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## TOPSIDES PAINTING AND COATING FOR CORROSION PROTECTION

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**Tullow Ghana Limited Jubilee FPSO**



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## 1.0 EXECUTIVE SUMMARY

This document specifies the requirements for painting and coatings for corrosion protection for FPSO projects.

## 2.0 BACKGROUND

Tullow Ghana Limited is developing a deep water discovery offshore Ghana named the Jubilee Development. The Jubilee Development area crosses two lease blocks, the Deep Water Tank Block and the West Cape Three Points.

The Jubilee initial development plans are focused on a subsea development with 10 production wells, four water injection wells, and two gas injection wells tied back to an initial, Phase I FPSO. Oil will be exported by direct offloading to a trading tanker. Gas will be initially be re-injected into the reservoirs or exported via a gas export pipeline.

The modularized production facilities for the FPSO will process 160,000 barrels of fluid per day, produce 120,000 barrels of oil per day, re-inject/export 160 million standard cubic feet and inject 232,000 barrels of water per day of reduced sulfate deoxygenated seawater.

## 3.0 BASIS

The Supplier of equipment and services shall comply with these minimum requirements for the selection, application, inspection, and testing of exterior and interior surface coating systems for FPSO offshore topsides facilities. (Topsides are designated as the area above splash zone.)

## 4.0 REFERENCES

Painting and corrosion protection shall be in accordance with the latest edition of the Codes and Standards listed below. A particular code or standard that will apply during the course of design and fabrication shall be the latest revision in force at the time of issuance of the bid inquiry.

Company shall be notified of any conflicts between specifications and reference documents for resolution.

### 4.1 COMPANY

Document Number	Description
0245-MI20-00S1-0060	"Inspection and Quality Control"
0245-MI20-00S1-0031	"Paint Color and Pipe Marking Specification"

### 4.2 CLIENT

Document Number	Description
None	

### 4.3 INDUSTRY

Document Number	Description
ANSI 13.1 (1996)	"Scheme for Identification of Piping Systems"
ANSI Z55.1	"Gray Finishes for Industrial Apparatus and Equipment"
ASTM A 123	"Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products"
ASTM A 143	"Recommended Practice for Safeguarding against Embrittlement of Hot-Dipped Galvanized Structural Steel Products and Procedure for Detecting Embrittlement"
ASTM A 153	"Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware"
ASTM A 385	"Practice for Providing High-Quality Zinc Coatings (Hot-Dip)"
ASTM A 392	"Specification for Zinc-Coated Steel Chain-Link Fence Fabric"
ASTM A 90	"Test Method for Weight of Coating on Zinc-Coated (Galvanized) Iron and Steel Articles"
NACE RP 0287-91	"Field Measurement of Surface Profiles using Replica Tape"
SSPC PA 1	"Shop Field and Maintenance Painting"
SSPC SP 1	"Solvent Cleaning"
SSPC SP 3	"Power Tool Cleaning"
SSPC SP 5	"White Metal Blast Cleaning"
SSPC SP 7	"Brush-off Blast Cleaning"
SSPC SP 10	"Near White Blast Cleaning"
SSPC SP 11	"Power Tool Cleaning to Bare Metal"

### 4.4 DEFINITIONS

Within the body of this specification, the following definitions shall apply:

Term	Definition
ANSI	American National Standards Institute
ASTM	American Society for Testing and Materials
Company	MODEC International, Inc. and / or its assigns
Facility	SUPPLIER or subcontractor shop and/or any property owned by SUPPLIER or subcontractor where any portion of the work will be performed.
NACE	National Association of Corrosion Engineers
Services	Any service or work performed by SUPPLIER that must be performed to comply with the requisition requirements, or the contract, to procure, design, manufacture and delivery of the work.
SSPC	Steel Structures Painting Council
STANDARDS	Industry Codes, Standards, Guides, and Recommended Practices referenced herein. Meaning the latest issue or edition in force at the end of SUPPLIER bid validity date or the contract date.

#### **4.5 MANUFACTURER'S STANDARDS**

Paint manufacturer's data sheets, application instructions, and safety precautions shall be followed as part of this specification. Any location where painting is performed shall maintain copies of the Material Safety Data Sheets (MSDS) for all paint and solvents used on Company materials and equipment.

### **5.0 GENERAL**

#### **5.1 INSPECTION AND QUALITY CONTROL**

Inspection and quality control shall conform to 0245-MI20-00S1-0060. Daily Paint Quality Control Reports, DAT-GN-0400-02, shall be completed for all coating applications.

#### **5.2 SURFACES EXCLUDED FROM ABRASIVE BLASTING AND PAINTING**

The following surfaces shall not be abrasive blasted nor painted:

- Copper and copper alloys
- Instrument tubing including fusible plugs and tubing used in the ESD system
- Fiberglass, plastic or plastic-coated material not susceptible to ultraviolet deterioration
- Stainless steel instrument cases and process control panels
- Nameplates, machined surfaces, instrument glass, flange faces, control valve stems, and similar items
- Stainless steel process piping and vessels (unless specifically required)
- Insulated stainless steel process piping and vessels
- Electrical conduit, breathers and drain fittings

#### **5.3 MANUFACTURED ITEMS**

Manufactured items such as valves and level gauges shall be coated in accordance with this specification.

If manufacturer's paint system is not in accordance with this specification, Contractor shall blast and paint the item in accordance with this specification. This requirement may be waived only by the Company in writing.

Seals, sealing surfaces, packings and/or instruments shall be protected from damage caused by the blasting medium or infiltration of the blasting medium or coating into the interior of the component.

Equipment or instruments affected by blasting and coating operations shall be assembled and disassembled as required to protect the equipment.



## 5.4 ITEMS POSSIBLY AFFECTED BY COATING OPERATIONS

Items that may be adversely affected by the blasting and coating operations and which cannot be disassembled or otherwise adequately protected shall be cleaned and prepared for painting by solvent washing in accordance with section 8.1.1 followed by power tool cleaning in accordance with section **Error! Reference source not found.**

### 5.4.1 Power Tool Cleaning

If power tool cleaning is carried out, 100% of the surface shall be cleaned using power wire brushing in accordance with SSPC-SP 3.

### 5.4.2 Proprietary Acid Descaling/Derusting and Hot Passivation

This may be used in some circumstances as an alternative to blasting, subject to Company approval.

### 5.4.3 Galvanized Surfaces

Galvanized surfaces shall be:

- a. Thoroughly degreased with emulsifying agents.
- b. Wire brushed or sweep blasted to remove corrosion products and degreased with emulsifying agent.

Where blasting is not practical an etch primer shall be used.

### 5.4.4 Stainless Steel, Nickel and Copper Based Alloys

- a. Stainless steel, nickel, and copper based alloys, if specified to be painted, shall be:
  1. Degreased.
  2. Blasted with chloride free abrasive such as alumina to give a minimum surface profile of 40 microns (0,001 6 in). Copper slag abrasives are not acceptable. If grit blasting is impractical, the surfaces may be prepared by hand or power tools using P60 grade paper.
  3. Cleaned with equipment that has not been used on carbon steel.
- b. Stainless steel surfaces shall be protected from contamination by debris produced during grit blasting of adjacent carbon steel. If contamination does occur, cleaning should be carried out using a power disc.

### 5.4.5 Aluminum

Aluminum, if specified to be painted, shall be:

- a. Degreased.
- b. Abrasive blasted with a non-metallic abrasive such as alumina to give a minimum surface profile of 40 microns (0.0016 in).



## **5.5 SURFACES IN CONTACT**

Surfaces of components in contact (bottom of skids, mounting surfaces of equipment, pipe supports, brackets, bolt holes, etc.,) shall be painted.

Surfaces in contact shall receive a minimum of one coat of primer prior to assembly (unless otherwise instructed by the Company).

## **5.6 THREADS**

Exposed threads on carbon steel piping shall be coated with Galvoweld or equal (zinc primer containing a minimum of 90% zinc by weight).

Application of the above material shall take place after the final make-up of the fitting and prior to application of the piping paint system.

## **5.7 ENVIRONMENTAL CRITERIA**

Blasting shall be performed during dry weather.

Dry blast cleaning operations shall not be conducted on surfaces that are exposed to rain, water spray, or any other moisture.

Blasting shall not be permitted if metal surface temperatures are less than 10°C (18°F) above the dew point or when the relative humidity of the air is greater than 85%.

Surfaces shall not be coated in rain, wind, snow, fog, mist, dust, or in areas where injurious airborne elements exist.

Unless otherwise authorized by Company, coating shall be applied only if all the following conditions exist:

- Air temperature is above 10°C (50°F)
- Surface temperature is above 4.4°C (40°F)
- Surface temperature is at least 10°C (18°F) above dew point
- Relative humidity is below 85%
- Any other conditions as recommended by coating manufacturer

Before painting during cooler temperatures, Contractor shall consult with the paint manufacturer and obtain prior Company approval.

If rain falls on painted surfaces prior to curing, surfaces shall be reblasted and repainted.

## **5.8 TIME CRITERIA**

Blasting shall be performed during daylight hours.

Blast cleaned surfaces shall be coated with primer within 4 hours, prior to sundown of the same day, and before any rusting occurs.

Coatings shall be applied only during daylight hours.

## **5.9 POST-PREPARATION**

Nameplates, manufacturer's identification tags, instrument glass, finished flange faces, control valve stems, and similar items shall be cleaned, restored to their original condition, and reattached.

## **6.0 COATING SYSTEMS**

The type and minimum thickness of coatings shall be in accordance with Table 12-1.

Documents showing Coating manufacturer, coating products and systems to be applied shall be submitted by Contractor and approved by Company.

One manufacturer shall generally supply coating products for all systems, otherwise technical justification is to be submitted and approved by Company on compatibility of different paint company's product.

The lead content of inorganic zinc silicates shall not exceed 0.05%.

Organic coatings, excluding silicone and silicone acrylic, shall be lead and chromate free and VOC compliant.

### **6.1 PAINT STORAGE**

### **6.2 FIRE AND SAFETY**

Storage areas shall not constitute a potential fire hazard to the work.

### **6.3 TEMPERATURE**

Paint, thinners, and associated materials shall be kept in fully enclosed, ventilated storage room(s) within the temperature limits and time restraints for storage specified in manufacturer's product data sheets.

### **6.4 REJECTION OF IMPROPERLY STORED COATING MATERIALS**

Coating materials that have jelled, exceeded shelf life or otherwise deteriorated during storage shall not be used.

Rejected materials shall properly be disposed in accordance with applicable regulations.

## **7.0 BLASTER/PAINTER QUALIFICATIONS**

### **7.1 GENERAL**

Each blaster/painter shall be tested and only qualified blasters and painters shall execute the work.

### **7.2 QUALIFICATION PROCEDURE**

Each blaster/painter shall blast to a white metal finish and apply one coat of paint to a test stand provided by Contractor or to part of the complete fabrication.

The cost for blaster/painter testing shall be for Contractor's account.

To pass the test, the blaster/painter shall show proficiency and knowledge, and shall be graded in the following:

- Handling of the blast nozzle to blast different areas.
- Closeness of the finish to white metal.
- Setting up and mixing the products specified for the work.
- Application technique.
- Uniformity and millage of the applied product.
- Safety equipment.
- Procedures for blasting and painting equipment.
- Scaffolding.

## **8.0 SURFACE PREPARATION**

### **8.1 PRE-BLAST PREPARATION/PROTECTION**

#### **8.1.1 General Clean-Up**

All fabrication, assembly, and non-destructive testing of a particular component shall be complete before surface preparation begins.

The surfaces shall be inspected and confirmed prior to blast cleaning free from any foreign matter such as weld flux, weld spatter, pores in welding seams, lamination defects, sharp edges, flame cuts, fragments, slivers, oil, grease, salt, etc.

All gasket surfaces, flange faces, valve stems, name plates, pressure gauges, instrument cases, gauge glasses, electrical conduit and fixtures, instrument tubing, aids to navigation, and all previously installed and coated equipment including galvanized equipment shall be protected.

All steel stored in a coastal site or shipped as deck cargo shall be water washed and checked for salt contamination prior to coating operations. The frequency and nature of these checks shall be sufficient to maintain the required standard of salt contamination.

Any oil, grease or other contaminants on the working surface shall be removed by solvent cleaning in accordance with SSPC-SP 1 "Solvent Cleaning".

Acid washes or other cleaning solutions or solvents shall not be used on metal surfaces after being blasted. This includes any inhibitive washes intended to prevent rusting.

Dirt, scale, or other surface contaminants shall be removed prior to the start of blasting.

Hard surface layers, resulting from flame cutting, shall be removed by grinding prior to blast cleaning, unless it can be demonstrated by appropriate site trial that the required surface profile can be achieved on a repeatable basis.

Any major surface defects, particularly surface laminations or scabs detrimental to the protective coating system shall be removed by suitable dressing. Where such defects have

been revealed during blast cleaning, and dressing has been performed, the dressed area shall be re-blasted to the specified standard.

All welds shall be inspected and if necessary repaired prior to final blast cleaning of the area.

### **8.1.2 Steel Surfaces**

Welding flux in crevices shall be removed.

Burrs, weld splatter, slivers, mill scale, indentations, and other sharp surface projections shall be ground smooth prior to further surface preparation.

Grinding done after abrasive blasting shall be blast cleaned to obtain proper anchor pattern.

Bolt holes shall be drilled and reamed before blast cleaning.

Sharp edges shall be rounded to a minimum radius of 2.5 mm (3/32-inch).

### **8.1.3 Electrical/Instrumentation**

Local mounted instruments, gauges, nameplates, control valve stems, valve I.D. tags, vessel I.D. tags, stainless steel tubing, controllers, tubing, conduit and cable trays, polished rods on pumps, code stamps, electrical fixtures, and aids to navigation shall be protected to prevent damage during blasting and painting.

Where practical, electrical cable shall be installed after blasting.

Nameplates that are attached in a manner that allows corrosion to occur behind the nameplate shall be removed prior to abrasive blasting and painting and reattached after painting is complete.

### **8.1.4 Mechanical, Piping, and Fittings**

Flanges on finished piping shall be taped and sealed closed prior to blasting.

Non-mating flange surfaces shall be blasted and coated in accordance with this specification. Gaskets and ring faces shall be protected from blasting.

Flanged valves and any other items that cannot be effectively blasted and primed after assembly shall be blasted and primed separately prior to assembly. Mating surfaces and threads shall be carefully protected from blasting.

Machined and threaded surfaces shall be protected from damage caused by the blasting medium.

Bolt holes and flange faces outside gasket surfaces on all flanged connections shall be blasted and finish painted prior to assembly.

## **8.2 ABRASIVE BLASTING**

### **8.2.1 General**

Abrasive blasting shall be performed in the area away from painting operations and freshly coated surfaces.

Abrasive blasting shall be performed using approved equipment.

### 8.2.2 Blasting Equipment

Air compressors shall supply a continuous volume of air to each blast nozzle with adequate pressure 6.9 barg (100 psig) at the nozzle and volume to achieve the required surface profile.

Blast nozzles shall have dead-man type controls.

Blast nozzles shall be of a size that minimizes over blast in touch-up situations.

Blast nozzle pressure shall be verified at the start of each shift using an approved nozzle pressure gauge.

The compressed air supply shall be provided with driers and oil mist extractors to keep the air supply dry and oil free.

The cleanliness of the compressed air shall be verified at the beginning of each shift by blowing air without abrasives or coating onto a clean white cloth. If oil or water appears on the cloth, all traps and separators shall be blown down until subsequent white cloth tests show no water or oil.

Accumulations of oil and water shall be removed from air receivers by daily purging (automatic and/or manual).

Air temperatures at the compressor discharge shall not exceed 66°C (150°F).

### 8.2.3 Abrasive

Unless specifically approved in advance by the Company, the abrasive shall be mineral slag or a metal shot / grit mixture.

The maximum particle size shall be no larger than that passing No. 16 wire mesh screen.

Abrasive material containing any oil, moisture, or impurities (particularly salt or organic material) or inclusions of any kind shall not be used.

### 8.2.4 Blasting Operations

The use of centrifugal wheels to propel the abrasive, or machine shot blasting, shall be acceptable only if the Contractor can demonstrate that an anchor pattern with the required surface profile is being produced.

### 8.2.5 Blast Cleaned Surface Requirements

Abrasive blasted surface profiles shall be measured using replica tape in accordance with NACE RP 0287-91. Surface profiles shall be in accordance with the manufacturer's recommendation for the product and for the service.

Galvanized and aluminum surfaces shall be degreased by steam cleaning prior to surface preparation in accordance with SSPC-SP 1 "Solvent Cleaning"..

Abrasive blasted surfaces shall be rendered dust free by blow-off with compressed air or vacuum cleaning prior to the application of primer.

A minimum of 150 mm (6 inches) around the edges of abrasive blasted areas shall be left bare. If adjoining a coated surface, blasting shall continue a minimum of 25 mm (1 inch) into the coated surface.

### **8.3 SURFACES THAT CANNOT BE ABRASIVE BLASTED**

Surfaces that cannot be abrasive blasted shall be degreased by steam cleaning prior to surface preparation in accordance with SSPC-SP 1 "Solvent Cleaning".

Care shall be taken not to burnish the metal surface.

Rough edges shall be feathered.

## **9.0 COATING APPLICATION**

### **9.1 GENERAL**

Surfaces shall be coated in accordance with this specification and the Manufacturer's recommended coverage rates.

Paint exceeding the shelf life date shall be discarded.

Manufacturer's recommended pot life shall not be exceeded. Any paint materials remaining at the end of a shift shall be discarded.

### **9.2 PROTECTION OF FLANGE, MACHINED, AND THREADED SURFACES**

#### **9.2.1 Flange Surfaces**

Gaskets and ring faces of non-mating flange surfaces shall be protected from paint overspray.

Mating surfaces and threads shall be carefully protected from paint overspray.

#### **9.2.2 Machined and Threaded Surfaces**

Machined and threaded surfaces on carbon steel materials shall be protected with a rust preventative compound or thick plastic protectors.

Machined and threaded surfaces shall be protected from damage that could be caused by paint overspray.

### **9.3 PAINT PREPARATION**

#### **9.3.1 Mixing**

Before use, coating ingredients in any container shall be thoroughly mixed by power-driven mixers to a smooth and uniform consistency for a minimum of 5 minutes. Hand mixing using paddles shall not be permitted. For two component systems, the catalyst and the coating shall be thoroughly mixed after the catalyst has been added to the coating.

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

Coating material shall not be mixed or kept in suspension by use of a bubbling air stream.

Where a skin has formed in the container, the skin shall be cut loose and discarded. If such skins are sufficiently thick to have a practical effect on the composition and quality, the paint shall not be used.

Pigmented material shall be strained after mixing except where application equipment is provided with adequate strainers. Strainers shall be capable of passing the pigment and removing any skin.

Material that does not have a limited pot life, or does not deteriorate on standing, may be mixed any time before using. If settling has occurred, material shall not remain in spray pots or buckets overnight but shall be gathered into a closed container and remixed before use.

### **9.3.2 Thinning**

Thinners shall not be added unless necessary for proper application.

Thinning shall not exceed the limitations established by manufacturer.

Thinners shall be as stated on the manufacturer's product specification sheets.

Thinners shall be supplied by the manufacturer of the coating materials in which it is used.

If use of thinner is permissible, thinner shall be added during the mixing process. Painters shall not add thinner after paint has been thinned to the proper consistency.

Thinning shall be done under supervision acquainted with the correct amount and type to be added.

## **9.4 GENERAL APPLICATION TECHNIQUES**

Prior to the application of any coat of material, damage to previous coats shall be touched up.

Coatings shall not be placed on edges prepared for field welds or within four inches of these edges.

Painting shall not be allowed over abrasive blasted areas less than 150 mm (6 inches) away from the unblasted area.

Each coat shall be uniformly applied as a continuous film of uniform thickness free of pores. Skips, sags, and drips shall be avoided. Holidays in the final coat at edges, corners, welds, and inaccessible areas shall be protected by hand brushing with an additional layer of finish coat.

Painters shall be equipped with wet mil gauges and each painter shall make frequent checks of wet film thickness.

Areas of organic coatings with a thin layer of coating or areas of organic coatings missed in the applications shall be recoated and permitted to dry before the next coat is applied, or in accordance with manufacturer's recommendation.

Each coat shall be in a proper state of cure or dryness before the application of the succeeding coat. Material shall be considered dry for recoating when an additional coat can be applied without the development of any detrimental film irregularities, such as lifting or loss of adhesion of the undercoat, and after the manufacturer's minimum recommended drying time has elapsed.



Alternate coats shall be tinted sufficiently to produce enough contrast to indicate complete coverage of the surface. If the paint is the color of the steel, or if the tinting of the final coat is objectionable, the first coat to be applied shall be tinted. The tinting material shall not be detrimental to the service life of the paint.

Stripe painting shall be brush applied after the first coat (primer), using the intermediate coat on all welds, corners, and crevices for the following systems listed in Table 9-1.

**a) Table 9-1 Group and System**

Group	System
A	1, 2
B	1
E	1, 2, 3

Abrasive particles visible in the painted surface shall be reblasted as required to remove all particles.

## **9.5 AIR SPRAY EQUIPMENT**

### **9.5.1 General**

Suitable regulators and gauges shall be provided for both the air supply to the pressure pot and the air supply to the pressure gun.

Air caps, nozzles, and needles shall be those recommended by the coating manufacturer for the material being sprayed.

The equipment shall be kept in satisfactory condition for proper paint application.

Lines and pots shall be cleaned at least once per shift and before the addition of new paint material.

### **9.5.2 Traps or Separators**

Traps or separators shall be installed between the air source and the spray equipment to remove oil and condensed water from the air.

Traps or separators shall be of adequate size and the drain valves shall be opened slightly to permit continuous draining of condensate during operations.

The air from the spray gun impinging against the surface shall show no condensed water or oil.

### **9.5.3 Agitation**

Continuous mechanical agitation shall be used to keep ingredients properly mixed in the spray pots or containers.

#### **9.5.4 Cleanliness**

Spray equipment shall be kept sufficiently clean such that dirt, dried paint, and other foreign materials are not deposited in the paint film.

Solvents left in the equipment shall be completely removed before use to prevent contamination of the coating materials.

Prior to use, equipment shall be purged with thinner compatible with product to be sprayed.

After filling the equipment with the coating material, the painter shall discharge product from the spray gun into a waste container until all noticeable traces of thinner have disappeared from the material being sprayed.

### **9.6 BRUSH APPLICATION**

#### **9.6.1 Equipment**

Brushes shall be of a style and quality that complies with recommendations of the coating manufacturer.

Round or oval brushes are most suitable for rivets, bolts, irregular surfaces, and rough or pitted steel.

Wide, flat brushes are suitable for large flat areas, but they shall not have a width over 125 mm (5 inches).

Surfaces not accessible to spray or brushes may be painted by daubers or sheepskin mitts.

#### **9.6.2 Application**

Coatings shall be brushed on all areas which cannot be properly spray coated for any reason.

Brushing shall be done such that a smooth coat as nearly uniform in thickness as possible is obtained.

Paint shall be worked into all corners and crevices.

Runs or sags shall be brushed out.

Brush marks shall be minimized.

Successive coats of paint shall be applied by cross-hatching the previous coat.

### **9.7 DRYING OF COATED SURFACES**

#### **9.7.1 Forced Drying**

Paint shall not be force dried under conditions which cause checking, wrinkling, blistering, formation of pores, or detrimentally affect the condition of the paint.

#### **9.7.2 Drier Compounds/Accelerators**

Drier compounds or accelerators shall not be added to the paint unless specifically called for in the manufacturer's specification for the paint.

## **9.8 PROTECTION OF COATED SURFACES**

Wet paint shall be protected against contamination from dust or other foreign matter.

Paint shall be protected from rain, condensation, snow, and freezing to the fullest extent practical until hardened or cured as required by the product specification.

Surfaces already coated that have identification numbers, flow directions, or color-coding shall be protected from paint and spray.

## **10.0 HOT-DIP GALVANIZING**

### **10.1 SPECIFICATIONS**

#### **10.1.1 Miscellaneous Steel Products**

Grating, ladders, handrails, stair treads, walkways, and helideck guards, and other items so specified on the Contract Drawings shall be prepared for hot-dipped galvanizing in accordance with ASTM A 385.

These items shall be galvanized in accordance with ASTM A 123, except that the weight of the zinc coating shall meet the requirements of ASTM A 143.

Hot dipped galvanizing of bolts, nuts, and washers shall conform to ASTM A 153, and ASTM A 143.

#### **10.1.2 Wire Mesh**

Woven wire mesh shall be galvanized in accordance with ASTM A 392.

### **10.2 PROCEDURES**

#### **10.2.1 Galvanized Connections**

Items to be galvanized shall be galvanized after fabrication.

Where it is impossible to galvanize a completely fabricated unit, joints which must be welded after galvanizing shall have the welds metalized after assembly of the unit.

#### **10.2.2 Painted Connections**

Galvanized members that are to be permanently fixed to the structure by welding shall be attached after the supporting members are primed but before topcoats are applied.

The heat-affected zone shall be cleaned of all welding flux, blasted, and primed with the Company approved coating system from Table 12-1.

## **10.3 SURFACE REPAIR**

Galvanized surfaces that require welding, cutting, drilling, or other preparation and any galvanized surface that has been damaged shall be repaired with a Company approved coating repair system (zinc primer containing a minimum of 90% zinc by weight, i.e., Galvoweld or equal).



Before application of repair coating, surfaces shall be washed with fresh water.

Rust and surface contaminants shall be removed in accordance with this specification. The areas shall then be cleaned by solvent washing.

Coating material shall be applied immediately after completion of surface preparation.

## **11.0 REPAIR OF DAMAGE TO SHOP PAINT**

Where shop paint has been damaged in handling, damaged and loosely adhering paint shall be removed and the surface thoroughly cleaned by blasting wherever possible or by power tools if conditions do not permit blasting.

Edges of the breaks shall be feathered using sandpaper or emery cloth and the designated number of prime and finish coats applied.

Damage to the finish coating prior to delivery shall be reprimed and refinished.

## **12.0 OFFSHORE PAINTING AND REPAIR**

The type, manufacturer, number of coats, and thickness of coatings shall be as specified in Table 12-1. Color and marking shall be as specified in 0245-MI20-00S1-0031, "Paint Color Scheme and Pipe Marking Specification".

The Installation Contractor shall touch up coatings that have been damaged during transport and installation.

Minor coating repairs made necessary as a result of normal installation procedures, i.e., removal of installation aids and sea-fastening, sling damage, etc., shall be performed in accordance with Table 12-1 Generic Systems shown below.

Installation Contractor shall paint structural and piping interface connection areas.

Surface preparation of the structural and piping interface connection areas shall be in accordance with Section 8.0 of this specification.

**b) Table 12-1: Generic Systems**

SYSTEM	COMPONENTS	SURFACE PREP	COAT	GENERIC TYPE	DFT (MICRONS)
<b>GROUP A: STRUCTURAL</b>					
1	Structural steel including pipe supports	SP10 / SA2.5	1 2 3	Zinc rich epoxy primer (Interzinc 52) High Build Epoxy (Intergard 475HS) Acrylic Polyurethane (Interthane 990)	75 175 50
2	Module deck	SP10 / SA2.5	1 2 3	Zinc Rich Epoxy Primer Interzinc 52) High Build Epoxy (Intergard 475 HS) Acrylic Polyurethane (Interthane 990)	75 175 50
3	Galvanized and aluminum parts	Degrease SP 7	1 2	High Build Epoxy (Interseal 670HS) Acrylic Polyurethane (Interthane 990)	100 50
4	E-House Interior Under Insulation	SP 10 / SA 2.5	1	Epoxy A/ C (Interseal 670HS)	150
	E-House Interior Bare Steel	SP 10 / SA 2.5	1 2	Epoxy A/ C (Interseal 670 HS) Epoxy Finish (Intergard 740)	150 150
<b>GROUP B: PROCESS EQUIPMENT</b>					
1	Exterior surfaces of vessels, manifolds, piping, pumps and other equipment or process skid units with surface temperatures not exceeding 93.3°C (200°F), except those specified as galvanized (Note 3)	SP 10 / SA 2.5	1 2 3	Zinc rich epoxy primer (Interzinc 52)High Build Epoxy (Intergard 475HS) Acrylic Polyurethane (Interthane 990)	75 150 50
2	Galvanized and aluminum parts with surface temperatures not exceeding 93.3°C (200°F). (Coating is not required on galvanized parts unless specifically required by Company)	Degrease SP 7	1 2	High Build Epoxy (Interseal 52) Acrylic Polyurethane (Interthane 990)	100 50
3	Exterior surfaces of stainless steel and copper with surface temperatures not exceeding 93.3°C (200°F). (Not required unless specifically requested by Company)	Degrease SP 7	1 2	High Build Epoxy (Interseal 670HS) Acrylic Polyurethane (Interthane 990)	100 50
4	Exterior surfaces of equipment where abrasive blasting is not permitted, and with surface temperatures not exceeding 93.3°C (200°F), except those specified as galvanized	Degrease SP 3	1 2 3	High Build Epoxy (Interseal 670HS) High Build Epoxy (Interseal 475HS) Acrylic Polyurethane (Interthane 990)	75 150 50
5	Exterior Surfaces of equipment where abrasive blasting is not permitted and with surface temperatures not exceeding 204.4°C (400°F), except those specified as galvanized	Degrease SP 11	1 2	Epoxy Phenolic (Intertherm 228) Epoxy Phenolic (Intertherm 228)	100 100
<b>GROUP C: SUBMERGED SERVICE</b>					
1	Totally submerged structural steel, piping, and equipment	-	-	Refer to Company standard for Hull.	-
2	Totally submerged galvanized and aluminum parts. (Coating not required on galvanized items unless specifically requested by Company)	-	-	Ditto.	-
<b>GROUP D: HIGH TEMPERATURE SERVICE</b>					
1	Non-insulated exterior surfaces, 148.9°C to 371.1°C (300°F to	SP 10 / SA 2.5	1	Inorganic Zinc Silicate (Interzinc 22)	50



SYSTEM	COMPONENTS	SURFACE PREP	COAT	GENERIC TYPE	DFT (MICRONS)
	700°F). (Note: All equipment surface temperatures must exceed 148.9°C (300°F) in order to provide proper curing)		2 3	Silicone Aluminum (Intertherm 50) Silicone Aluminum (Intertherm 50)	25 25
2	Insulated exterior surfaces of piping, vessels, etc. with surface temperature not exceeding 204.4°C (400°F), except austenitic stainless steel process piping	SP 10 / SA 2.5	1 2	Epoxy Phenolic (Intertherm 228) Epoxy Phenolic (Intertherm 228)	100 100
3	Non-insulated exterior surfaces. 93.3°C to 260°C (200°F to 500°F). (Note: Curing takes place at ambient temperatures)	SP 10 / SA 2.5	1 2	Inorganic Zinc Silicate (Interzinc 22) Silicone Phenolic (Intertherm 875)	50 40
<b>GROUP E: TANK LININGS</b>					
1	Interior surfaces of fresh water storage tanks	SP 10 / SA 2.5	1 2	High-Build Epoxy (Interline 850) High-Build Epoxy (Interline 850)	150 150
2	Interior surfaces of glycol and diesel fuel storage tanks	SP 10 / SA 2.5	1 2	High-Build Epoxy (Interline 850) High-Build Epoxy (Interline 850)	150 150
3	Interior surfaces of crude oil and salt water separation vessels	SP 10 / SA 2.5	1 2 3	Modified Phenolic (Interline 399) Modified Phenolic (Interline 399) Modified Phenolic (Interline 399)	90 90 90
<b>GROUP F: OFFSHORE TOUCH-UP</b>					
1	Offshore touch-up painting above the splash zone	SP 10 / SA 2.5	1 2 3	Zinc Rich Epoxy Primer (Interzinc 52) High-Build Epoxy (Intergard 475 HS) Acrylic Polyurethane (Interthane 990)	75 150 50
<b>GROUP G: SPLASH ZONE</b>					
1	Fender area on splash zone	-	-	Refer to Company standard for Hull.	-

**NOTES:**

1. Color of each coat shall contrast with color of previous coat.
2. Color of the final topcoat shall be advised by the Company.
3. Color of emergency caution plates and apparatus shall be in red (Munsell No. 5R4/13).
4. Drying and curing times shall conform to Manufacturer's instructions.
5. Products not specified in this specification shall be submitted to Company for approval.
6. Initial startup operation of equipment protected with Group D shall be carried out at controlled rate of temperature increase in accordance with manufacturer's instructions to ensure final cure and to avoid damage to the paint.
7. Group E System 1 shall be NSF certified. Final topcoat shall be WHITE unless otherwise noted.
8. DFT shown is typical and actual DFT shall conform to manufacturer's instructions subject to Company approval.

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