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KLM Technology Group #03-12 Block Aronia, Jalan Sri Perkasa 2 Taman Tampoi Utama 81200 Johor Bahru Malaysia	<b>SPECIFICATION FOR PROTECTIVE COATING</b>  <b>(PROJECT STANDARDS AND SPECIFICATIONS)</b>	

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## SCOPE

This Project Standard and Specification covers the minimum requirements governing surface preparation, selection and application of the protective coating system to be used on the interior and exterior surfaces of all types of production facilities including structural steel, vessels, piping and equipment on offshore platforms.

## REFERENCES

Throughout this Standard the following dated and undated standards/codes are referred to. These referenced documents shall, to the extent specified herein, form a part of this standard. For dated references, the edition cited applies. The applicability of changes in dated references that occur after the cited date shall be mutually agreed upon by the Company and the Vendor. For undated references, the latest edition of the referenced documents (including any supplements and amendments) applies.

### 1. SSPC (The Society for Protective Coatings)

SSPC-PA1	Shop, Field and Maintenance Painting of Steel.
SSPC-PA2	Measurement of Dry Coating Thickness with Magnetic Gauges
SSPC-SP1	Solvent Cleaning
SSSC-SP2	Hand Tool Cleaning
SSPC-SP3	Power Tool Cleaning
SSPC-SP5	White Metal Blast Cleaning
SSPC-SP6	Commercial Blast Cleaning
SSPC-SP7	Brush –Off Blast Cleaning
SSPC-SP10	Near White Blast Cleaning
SSPC-AB1	Mineral and Slag Abrasive
SSPC-Guide 14	Guide for the Repair of Imperfections in Galvanized or Inorganic Zinc Coated Steel Using Organic Zinc-Rich Coating.

### 2. ASTM (American Society for Testing and Materials)

ASTM A123	Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products
ASTM A153	Zinc-Coating (Hot-Dip) on iron and Steel Hardware
ASTM D4228	Standard practice for qualification of coating applicators for application of coating on steel surfaces.

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3. ISO (International Standards Organization)

- ISO –8501 International Standard for Preparation of Surface
- ISO 1461 Hot dip galvanized coating on fabricated iron and steel articles-Specification and test methods
- ISO 14713 Protection against corrosion of iron and steel structure-zinc and aluminum coating.
- ISO 4624 Adhesion test of paint

4. OSHA (Occupational Safety and Health Act)

- OSHA Occupational Safety and Health Act

5. NACE

- NACE RP0188 Discontinuity (Holiday) Testing of Protective Coating
- NACE RPRP0287 Surface profile Measurement of abrasive blast cleaned steel surfaces using a replica tape.

## DEFINITIONS AND TERMINOLOGY

**Contractor** - shall mean the party contracted to perform the work in accordance with the drawings, specifications and work scope.

## GENERAL

### Blasting / Coating Exclusions

The following surfaces shall not be blasted unless otherwise specified:

- Galvanized
- Non-ferrous metals or stainless steel
- Fibre-glass, plaster or other non-metallic finish
- Ferrous metals supplied with finish coat
- Tank, vessel or piping internals

The following specific items shall not be coated and shall be protected from blasting and coating being applied to adjacent equipment

- Bearings and seals
- Flange mating faces, RF and RTJ and flat faced
- Instrument dials and/or cases
- Cable trays and cables
- Level gauge glasses
- Nameplates Shafts and similar polished or machined surfaces
- Instrument Tags and Valve Position Indicators
- Sprinklers, fusible plugs and fire detectors

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- Control Valve Stems
- Stainless Steel Control Panels
- Stainless Steel Tubing and pipe – work
- CuNi pipe work
- GRE pipe work

### **Standard Coating**

The manufacturer's standard coating shall be used for the following equipment

- Indoor electrical equipment
- Instrument and control panels
- Insulated rotating equipment

### **Equipment Cleaning**

The following equipment shall be cleaned with biodegradable, water soluble cleaner and an epoxy primer shall be applied (tie-coat) to the manufacturer's standing coatings prior to the specified intermediate coat.

- Fan and blower housing
- Outdoor electrical equipment
- Engines and electric motors
- Pumps, compressors and other non-insulated rotating equipment
- Control and relief valves

Equipment shall be recoated as specified if the coating system applied by equipment manufacturer/packager does not comply with this specification or if touch up repairs are necessary.

### **Flanges**

Flanges on piping and valves (including control and relief valves) shall have a primer coat applied to bolt holes and the non-contact area of the face prior or being made-up. After make-up of these connections intermediate and finish coats shall be applied. Flanged ends shall have a finish coat as required in this Specification. Flange faces must not be coated.

### **Piping Spools**

Primer and intermediate coatings shall be applied to spools pre-fabricated for offshore installation. If these spools have an end prepared for field welding, the coatings shall stop 150 mm from the prepared end.

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### **Seal Welding**

Where enclosed or inaccessible areas cannot be adequately painted, the areas shall be completely enclosed and seal welded. Small areas inaccessible to blasting and painting that cannot be boxed by welding shall be filled with epoxy mastic, caulking compound or other suitable filler to prevent retention of dirt and moisture.

### **Overspray**

Adjacent structures, equipment and all other items shall be protected from blasting, over-spray and drips with tarpaulin, plastic, tapes etc.

### **Nozzles through Insulation**

Flanged nozzles, man ways, platform clips, saddles and other attachments that extend through insulation shall be coated in accordance with the coating schedule for equipment and piping.

### **Coated Bolts**

Galvanized bolts, studs and nuts, where used to bolt up piping, valves etc. or otherwise used to connect painted items, shall receive a top coat of paint over exposed areas after the connections are made.

### **SAFETY**

Safety conditions shall be met, as required by the Occupational Safety and Health Act (OSHA) or other governing bodies, as well as those the contractor may deem necessary.

Particular care must be exercised when working in close or confined spaces, especially when spraying. The maximum allowable concentration of solvent in the air shall not be exceeded. Refer to the manufacturer's recommendations to determine the maximum allowable concentration value. When volatile solvents are flammable, the concentration in air shall be kept below 25 percent of the lower explosive limit by use of adequate exhaust or ventilation facilities.

### **ENVIRONMENTAL REQUIREMENTS**

The contractor will recognize Company's commitment to preserving the environment and shall comply with local codes and standards for transporting, storing, and disposing of hazardous materials and hazardous wastes.

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Upon completion of the job, the contractor shall notify the company of the volume and type of hazardous waste generated.

Upon completion of the job, all non-hazardous wastes, such as empty paint cans, clothes blasting abrasives and equipment, shall be removed by the contractor from the job sites and properly disposed.

## **SURFACE PREPARATION**

### **General**

The surface preparation procedures and requirements except for galvanizing and cadmium plating shall be in accordance with Steel Structural Painting Council(SSPC)SP5,SP6,SP7 & SP10 and ISO-8501-1.

The method of surface preparation used shall be compatible with the priming coat of paint and be one or a combination of the following:

- Solvent Cleaning
- Hand Tool Cleaning
- Power Tool Cleaning
- Blast Cleaning

All fabrication and assembly shall be completed before surface preparation begins. Blast and prime of structural items and piping prior to assembly will be permitted. All bolt holes shall be drilled and their edges smoothed prior to blasting.

### **Requirements of Blasting**

Only dry blasting procedures are allowed. Definitions of and requirements for, the various methods of surface cleaning are given below:

- White Metal Blast: As per SSPC SP5, & visual reference as per ISO 8501-1.
- Near-White Blast: As per SSPC SP10, & visual reference as per ISO 8501-1.
- Commercial Blast: As per SSPC SP6, & visual reference as per ISO 8501-1.
- Brush-off Blast: As per SSPC SP7, & visual reference as per ISO 8501-1

### **Blasting Preparation**

#### **1. Rough Edges**

Rough or sharp edges shall be broken with a power grinder to a 3 mm radius before blasting.

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## 2. Weld Flux and Spatter

Weld flux, slag spatter, slivers etc. shall be ground smooth before blasting. Any surface on which grinding is done after blasting shall be blast cleaned to obtain proper anchor pattern.

## 3. Surface Cleaning

Prior to blasting, all deposits or grease or oil shall be removed from the surface in accordance with SSPC-SP1 Solvent Cleaning using biodegradable water soluble cleaner.

## 4. Chemical Contamination

All chemical contamination shall be neutralized and/or flushed off prior to any other surface preparation.

## 5. Equipment Protection

Items such as motors, machined surfaces, gauges, electrical and instrumentation items tags and nameplates, stainless steel galvanized steel, aluminium, brass, plated surfaces etc. shall be protected to prevent damage or contamination during blasting or painting.

Prior to blasting, openings on engines, pump, vessels, piping etc. shall be effectively sealed to prevent abrasive entering and damaging internal components. All packaged equipment shall be covered and special care taken to cover and seal all instrumentation.

## Blasting Operations

### 1. Weather conditions

Blast cleaning shall not be done on any surface that is moist, or that may become moist, before the application of a primer.

No blasting is permitted when the steel temperature is less than 3°C above the dew point, as measured by a sling hydrometer, or when the relative humidity of the air is more than 85 %.

### 2. Preliminary Blasting

If blasting is performed at night, the surfaces shall be re-blasted the following day to provide the specified surface preparation standard and the anchor profile required for the specified coating system.

### 3. Blasting and Painting

Blasting shall not be done adjacent to painting operations or coated surfaces that are not fully dry. Blasting shall overlap previously coated surfaces by at least 150 mm.



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## **Blasting Equipment**

### 1. Compressed Air

The air compressor shall be capable of maintaining a minimum of 700 kpa air pressure at each blasting nozzle.

The compressed air supply shall be free of water and oil. Adequate separators and traps shall be provided on the equipment, which shall be regularly purged of water and oil to maintain efficiency.

### 2. Nozzle

The nozzle shall be a 10 mm (maximum) internal diameter venture style nozzle.

### 3. Power Tools

Power tools may be used to obtain a 'near white' metal surface (per SSPC-SP3) where blasting is not possible, or on items which might be damaged by blasting.

### 4. Shot Blasting Equipment

Shot blasting equipment may be used for specific applications. Shot shall be changed as required to maintain the angular profile requirement.

## **Blasting Abrasive**

### 1. Abrasive

The abrasive shall be as per SSPC-AB-1. The abrasives shall be copper slag, steel balls, garnet or coal slag and shall be free of contamination of dust and chlorides to produce the required anchor profile and graded as to be free from clay, silt or other matter likely to become embedded in the steel surface. Abrasives which have a tendency to shatter and adhere or embed in the steel surface shall not be acceptable. Recycled abrasive shall not be used. Use of silica sand is not permitted.

### 2. Shot Blasting Material

Shot blasting material shall pass through a 16 mesh screen. At least 15% steel grit shall be mixed with the graded shot to remove any rust, scale or other impurities pined into the surface by the shot. Shot blasting material is limited to iron, steel or synthetic shot which is applied by compressed air nozzles or centrifugal wheels. Shot blasting material shall be checked at least two times a week for replacement of abraded material.

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## Post – Blasting Procedure

The blast cleaned surface shall be rendered dust free and coated with the specified primer as soon as possible to avoid formation of oxidation on the surface, but in any case, four hours from the time of blasting, and at least one hour prior to sundown of the day it is blasted and before any rusting occurs. Any steel surface not primed within these limits or that is wet shall be re-blasted.

No acid washes or other cleaning solutions or solvents shall be used on metal surfaces after they are blasted. This includes washes intended to prevent rusting. All areas around the intended paint surface shall be cleaned of sand prior to coating. Drains shall be purged of sand and flushed.

Biodegradable water – soluble cleaning solution used to clean previously painted surfaces shall not lift, soften or otherwise damage the existing coating.

## COATING APPLICATION

### General Application

All application, inspection and safety procedures shall be carried out in accordance with SSPC Painting Manuals, Vol. 1 Chapter 14.2 and Vol. 2 Chapter 5) and as set out below.

#### 1. Supply and Storage

All coatings shall be furnished, mixed and applied in accordance with manufacturer's recommendations and as specified herein. Mixing of different manufacturer's coatings or applications on the same surface is not permitted.

All coating materials and thinners shall be in original, unopened containers being the manufacturer's label batch numbers and instructions. For materials having a limited shelf life, the date of manufacture and the length of life shall be shown. Materials older than their stated shelf life shall not be used.

Materials shall be stored in accordance with the manufacturer's recommendations. Coating materials that have gelled, other than thixotropic materials, or materials that have deteriorated during storage shall not be used.

#### 2. Pot Life

If the coating requires the addition of a catalyst, the manufacturer's recommended pot life for the application conditions shall not be exceeded. When the pot life is reached, the spray pot shall be emptied, cleaned and a new material catalyzed.

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### 3. Mixing

Mixing and thinning directions as furnished by the manufacturer shall be followed. Only thinners specified by the manufacturer shall be used.

All coating materials shall be stirred with a power mixer use, until the pigments, vehicles and catalysts are thoroughly mixed and then strained while being poured into the spray pot. During application the materials shall be agitated according to the manufacturer's recommendations.

### 4. Unblasted Surfaces

Coating shall not be applied within 75 mm of an unblasted surface.

A 300 mm wide strip of uncoated, blasted surface shall be left between primed and unblasted surfaces, so as to prevent damage to the newly dried coating when additional blasting is done.

## Application Requirements

### 1. Cleanliness

Surfaces shall be clean free from dust and dry. Any blast cleaning dust or grit remaining on the surfaces shall be removed by means of compressed air before priming or application of any coating. Any surface with a rust bloom shall be re-blasted.

### 2. Temperature

Coating shall only be applied when the temperature of the steel is at least 3°C above the dew point ambient air temperature must be within the limits specified by the manufacturer.

### 3. Weather Conditions

No coatings shall be applied during fog, mist or rain or when humidity is greater than 85% or on to wet surfaces. In case the minimum temperature at the fabrication yard is below 50C, the contractor shall propose alternate coating procedure for Company's approval at the binding stage itself.

The company has the right to suspend application of coating when damage to the coating may result from actual or impending weather condition.

### 4. Coats

Each coat shall be applied uniformly and completely over the entire surface. Each coat shall be allowed to dry for the time specified by the manufacturer before the application or a succeeding coat. To reduce the possibility of intercoat contamination and to assure proper adhesion between successive coats, all coats shall be applied as soon as possible after the minimum specified drying time of the preceding coat.

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#### 5. Brush Application

After the primer coat has been applied, hard-to-spray areas, such as corners, edges and welds, shall be brush painted with the same paint and film thickness as the Intermediate or finish coat.

#### 6. Finish Coat

An additional layer of finish coat shall be hand brushed at edges, corners, welds and hard-to spray areas to eliminate holidays in the final coats.

#### 7. Field Welds

No coating shall be placed within 150 mm of edges prepared for field welds nor to surfaces awaiting non-destructive testing.

#### 8. Inorganic Zinc Primer

Inorganic zinc primer coats that have not been top coated within three (3) days of application shall be pressure washed with clean, fresh water. It is preferred that intermediate/top coat for inorganic zinc primer coats be applied within minimum of seven (7) days after the primer coat.

### **Spray Application**

#### 1. Equipment

- a. All equipment to be used for spray applications shall be inspected and tested before application begins.
- b. All equipment shall be maintained in good working order and shall be equal to that described in the manufacturer's instructions.
- c. All equipment shall be thoroughly cleaned before and after each use and before adding new material.
- d. An adequate moisture trap shall be installed between the air supply and each pressure pot. The trap shall be of the type that will continuously bleed off any water or oil from the air supply.
- e. Suitable pressure regulators and gauges shall be provided for both the air supply to the pressure pot and the air supply to the spray gun. Spray equipment and operating pressures shall comply with the recommendations of the manufacturer.
- f. The length of hose between the pressure pot and spray gun shall not exceed 15 m.

#### 2. Procedures

- a. Pressure pot, material hose and spray gun shall be kept at the same elevation where possible. When spraying inorganic zinc, the elevation difference shall not exceed 3m.

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- b. The spray gun shall be held at right angles to the surface.
  - c. Each pass with the spray gun shall overlap the previous pass by 50%.
  - d. The spray width shall not exceed 300 mm.
  - e. All runs and sags shall be immediately brushed out or the surface recoated.
  - f. Large surfaces shall receive two passes (except when applying inorganic zinc) at right angles to each other (crosshatched).
3. Airless Spray Equipment
- a. Airless spray equipment may be used for applying epoxy or aliphatic polyurethane coatings.
  - b. Airless spray equipment shall not be used for applying inorganic zinc silicate.
  - c. The manufacturer's recommendations in selection and use of airless spray equipment shall be followed.

## **Brush Application**

1. General Requirements
- Coating shall be brushed on all areas, which cannot be properly spray coated.
  - Inorganic zinc primer coatings shall not be applied by brushing, not even for touch – up repairs.
2. Equipment for Brush Application
- Brushes shall be of a style and quality that will permit proper application of coating. 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. Brush width shall not be greater than 100 mm. No extension handles shall be used on brushes.
3. Procedure for Brush Application
- a. Brushing shall be done so that a smooth coat, uniform in thickness, is obtained. There shall be no deep or detrimental brush marks.
  - b. Paint shall be worked into all crevices and corners.
  - c. All runs and sags shall be brushed out to prevent air pockets, solvent bubbles or voids.
  - d. When applying solvent type, coatings, care shall be taken to prevent lifting of previous coats.

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### **Roller Application**

Roller application is permitted for paint materials where this is the manufacturer's recommended method of application, such as for deck paints containing non-skid material. The manufacturer's recommended procedures shall be used.

### **Over spray and Drip Protection**

Appropriate protection of buildings, structures and equipment from drips and spray and shall be provided to all equipment and facilities.

### **Safety Equipment**

Appropriate safety equipment shall be provided for blasters, painters and other workers involved in the preparation and application of coating systems. Work areas shall be adequately ventilated.

### **REPAIR OF DAMAGED AREAS**

All areas of paintwork that are locally damaged during transportation, handling or erection shall be fully repaired to the satisfaction of the company. Prior to the application of any coat, damage to previous coat(s) shall be touched-up by removing the damaged coatings, preparing the surface and reapplying the protective coat(s).

### **Coating Damage**

Surfaces where coating is damaged after application of the finish coat shall be repaired as follows:

#### **1. Top Coat**

The top coat damaged, but base coat undamaged and the metal substrate is not exposed:

- a. Damaged coating shall be removed with a hand file and abraded back to the sound coating using emery paper or a fine grinder.
- b. The damaged area shall be wiped with a suitable solvent to remove debris. The periphery of repair area shall be feathered back for a minimum distance of 25 mm into the adjacent undamaged coating by light abrasion or grinding to produce a smooth chamfered surface profile.
- c. Apply a new topcoat as specified.