REVISION CONTROL

Revision No.	Notes	Date
01	Updated cleaning and painting requirements and product list.	15 July 2015
02	Updated normative reference list, measurement and test equipment list, painting systems requirements, coating products details.	18 February 2020
03	Revised complete document and updated paint products.	23 October 2023

TABLE OF CONTENTS PAGE

1 SCOPE

This specification details the requirements for the corrosion protection of steel structures (mainly lattice towers) and covers the selection and application of protective coating systems and the requirements for labour, materials, tools and equipment, and quality control.

2 NORMATIVE REFERENCES

All national and international standards referred to in this document shall form part of this specification. Where reference is made to a code, specification or standard the reference shall be taken to mean the latest edition of the code, specification or standard, including addenda, supplements and revisions thereto.

Reference	Description
ASTM D4940-10	Standard Test Method for Conductimetric Analysis of Water-soluble Ionic Contamination of Blasting Abrasives
ASTM D4414	Standard practice for measurement of wet film thickness by notch gauges
ASTM D6386	Standard practice for preparation of zinc (hot-dip galvanized) coated iron and steel product and hardware surfaces for painting
ISO 11127-6	Preparation of steel substrates before application of paints and related products- Test methods for non-metallic blast-cleaning abrasives- Part 6: Determination of water-soluble contaminants by conductivity measurement
ISO 11126 (all parts)	Preparation of steel substrates before application of paints and related products- Specifications for non-metallic blast-cleaning abrasives
ISO 4628-3	Paints and Varnishes– Evaluation of degradation of paint coating- designation of Intensity, quantity and size of common types of defects. Part 3: Designation of degree of rusting
ISO 8501 (all parts)	Preparation of steel substrates before application of paints and related products- visual assessment of surface cleanliness
ISO 8502 (all parts)	Preparation of steel substrates before application of paint and related products- Test for the assessment of surface cleanliness
ISO 8502-6	Preparation of steel substrates before application of paint and related products- Test for the assessment of surface cleanliness- Part 6: Extraction of soluble contaminants for analysis- The Bresle method
ISO 8502-9	Preparation of steel substrates before application of paints and related products- Tests for the assessment of surface cleanliness- Part 9: Field method for the conductometric determination of water-soluble salts
ISO 8503 (all parts)	Preparation of steel substrates before application of paints and related products- Surface roughness characteristics of blast-cleaned steel substrates
ISO 8504-1	Preparation of steel substrates before application of paints and related products- Surface preparation methods- Part 1: General principles
ISO 8504-2	Preparation of steel substrates before application of paints and related products- Surface preparation methods- Part 2: Abrasive blast-cleaning
ISO 8504-3	Preparation of steel substrates before application of paints and related products- Surface preparation methods- Part 3: Hand- and power-tool cleaning
ISO 9002	Quality Systems– Model for quality assurance in production, installation, and servicing
ISO 9223	Corrosion of metals and alloys- corrosivity of atmospheres- Classification
OHS Act, 85 of 1993, as amended	Occupational Health and Safety Act and Construction Regulations, and as amended
RAL KI	Auxiliary designation for RAL colours (Reichsausschuß für Lieferbedingungen und Gütesicherung)
SANS 10064 (ISO 8504-2 and 3)	The preparation of steel surfaces for coating
SANS 121 (ISO 1461)	Hot-dip galvanized coatings on fabricated iron and steel articles- Specifications and test methods
SANS 12944-3	Paint and varnishes- Corrosion protection of steel structures by protective paint systems. Part 3- Design considerations

Reference	Description
SANS 12944-4	Paints and varnishes- Corrosion protection of steel structures by protective paint systems- Part 4: Types of surface and surface preparation
SANS 2409	Paints and Varnishes- Cross-cut test
SANS 2808	Paints and Varnishes- Determination of film thickness
SANS 4624	Paints and varnishes- Pull-off test for adhesion
SANS 5772	Preparation of steel substrates before the application of paints and related products– Surface roughness characteristics of blast-cleaned steel surfaces - Profile of blast-cleaned surfaces determined by a micrometer profile gauge
SANS 8502-3	Preparation of steel substrates before application of paint and related products– Test for the assessment of surface cleanliness- Part 3: Assessment of dust on steel surfaces prepared for painting (pressure sensitive tape method)

3 GENERAL REQUIREMENTS

3.1 Contractor responsibility

3.1.1 The Contractor shall be responsible for ensuring that they are fully conversant with the requirements of this specification and the relevant coating systems.

3.1.2 The Manufacturer's specifications and recommended application procedures and guides shall be consulted and applied accordingly. Where there is a difference between this specification and that of the Paint Manufacturers, the Contractor shall bring this to the attention of the Employer's Agent who will give a final decision on the issue at hand.

3.2 Design considerations

3.2.1 Steel components should be designed to be accessible for the purposes of applying, inspecting and maintaining the protective paint system.

3.2.2 The guidelines to ensure accessibility and suitability for painting shall be drawn from SANS 12944-3.

3.2.3 The power lines shall be regarded to be in the Environment Category C3 to C5, unless otherwise indicated in the Contract Schedules.

3.3 Qualified staff

3.3.1 The Contractor shall ensure that there are at all times sufficient suitably qualified, experienced and skilled staff to supervise and carry out all activities.

3.3.2 Staff shall be qualified in terms of the South African Qualification and Certification Committee for the Corrosion {SAQCC (Corrosion)} as follows:

(1) Abrasive Blaster and Painter Course: Basic and advanced surface preparation and application of heavy-duty coatings, (such as PA1 or equivalent course).

(2) Supervisor: Basic and advanced surface preparation and application of heavy-duty coatings, (such as PS1 or equivalent course).

(3) Inspector: Coating inspector course, (such as at level 2 or NACE CIP 1 or equivalent course).

3.3.3 Alternative (and equivalent) qualifications may be considered for approval by the Employer's Agent subject to submission of detailed syllabus for review.

3.3.4 All Training and Qualifications shall be based on candidates undertaking courses which include theory and examinations (practical and written) and shall have unique certification traceability.

3.4 Equipment

3.4.1 Measuring and Testing Equipment

3.4.1.1 The Contractor shall have the following measuring and testing instruments, and these shall be readily available on-site when required, namely:

(1) Wet film comb- Measures the thickness of the wet coating, which is an early method of determining whether the Dry Film Coating Thickness will be correct.

(2) Dry-film thickness gauge- Measures the thickness of the coating for quality control purpose, and conformance to specifications.

(3) Temperature meter- Measure the air and substrate surface temperature to assess the risk of moisture formation on the substrate and to ensure conformance to the paint application guidelines. Application at incorrect temperatures can cause defects such as blistering, pin-holing, cratering, dry spray & mud cracking.

(4) Relative humidity meter- Measures the amount of moisture in the air expressed as a percentage of the total amount (saturation) possible to ensure conformance with the paint application guidelines.

(5) Dewpoint meter- It is a function of the air temperature and the relative humidity. It gives an indication of the temperature at which moisture will begin to form on the surface to be coated. The surface temperature must therefore be greater that the dewpoint temperature during the coating phases.

(6) Soluble salt (salt contamination) tester- Measures the concentration of soluble salts (salt contamination) on metal surfaces in accordance with ISO 8502-6, ISO 8502-9.

(7) Soluble salt tester, using the Test patch, or Bresle Salt kit- Assesses the surface contamination by salts such as chlorides, sulphates and nitrates, prior to applying a coating.

(8) Weber Reilly soluble salt test kit- Determines the concentration of soluble iron salts by the colour produced by reaction with the reagent.

(9) Abrasive soluble salt test kit- Measures the concentration of soluble salts in the blast-cleaning abrasive.

(10) Dust tape test kit- Allows assessment of the quantity and size of dust particles on surfaces prepared for painting.

(11) Cross-cut test kit- Gives a quick visual indication of the adhesion of coatings up to 50 µm.

(12) Cross-hatch test kit- Gives a quick visual indication of the adhesion of coatings up to 250 µm.

(13) Surface profile gauge- Measures the profile height of a surface. The degree of the surface profile on the surface affects a coating's overall performance and determines aspects such as adhesion, coverage and overall volume of coatings used.

(14) Adhesion tester, with self-aligning dolly, 20mm outside diameter and dolly cutter to isolate the sample area beneath the dolly.

3.4.1.2 The instruments and the calibrations shall conform to the requirements of the relevant standards.

3.4.1.3 All test equipment shall have valid calibration certificates.

3.5 Coating materials

3.5.1 Only approved coating materials as detailed in the relevant specifications shall be used.

3.5.2 Coating materials from different Manufacturers shall not be mixed in the same coating systems.

3.5.3 Coating materials shall only be manufactured by the approved coating Manufacturers. The Contractor shall obtain a copy of the coating Batch Certificate and the Product Data Sheet and Hazardous Substances Data Sheet from the coating Manufacturer prior to using the material.

3.5.4 The solvents used shall be those recommended and/or manufactured by the coating Manufacturer. Where the recommended 'solvent' and 'clean-up thinners' for a material differ, the 'clean-up' solvent must not be added to the coating for dilution purposes.

3.5.5 Excessive dilution of paints is not permitted and therefore a maximum of 5% of solvent by volume will be permitted unless the Employer's Agent has approved a higher percentage in individual cases. The maximum capacity of containers shall be 25 litres.

3.5.6 The coating Manufacturer's recommended shelf life and other storage requirements shall be met.

3.5.7 The Contractor and the Employer's Agent shall reach mutual agreement regarding the paint colours to be used. Colours of paints used shall comply with RAL KI.

3.5.8 All paints and coatings shall be brought to site in new unopened containers. All containers shall be clearly marked with the Manufacturer's material batch numbers.

3.5.9 The Contractor shall ensure that the colour selected for the intermediate coat, (or prime coat where intermediate coat is not used), shall be suitable for complete obliteration by the topcoat. This means that the intermediate coat colour shall not be visible after applying the topcoat.

4 SURFACE PREPARATION

4.1 General

4.1.1 In all methods of preparation, the aim is to remove contamination and corrosion as far as practically possible to provide a sound and clean substrate for paint. Hence, the surface preparation shall ensure that the substrate is sound, dry, clean, free of chalk and rust, loose and flaking paint, dust, dirt and grime.

4.1.2 During the surface preparation process, care shall be taken to ensure that no dust/ dirt go into electrical devices that may be installed on the power line tower or other structures in the close vicinity, such as anti-theft devices. The Contractor shall use suitable protective covers, subject to approval by the Employer's Agent.

4.1.3 Sharp edges of the steel shall be dressed to a radius of not less than 2 mm. All burrs, slags and weld spatter shall be removed as per the requirements of SANS 12944-3.

4.1.4 Welds and adjacent parent metal shall be de-slagged, inspected and approved and all splatters shall be removed. The weld areas shall then be abraded and/or ground if required, and contaminants such as flux shall be removed prior to painting.

4.2 Soluble salts

4.2.1 Contamination of steel surfaces from soluble salts- such as chloride, sulphate or nitrate ions- can lead to premature coating failures. By measuring and monitoring the concentration of soluble salts, the surface can be adequately cleaned prior to painting.

4.2.2 Soluble salts shall be removed by cleaning and flushing with fresh potable water. Persistent salt shall be removed by propriety solution, and/or blast-cleaning, as may be required for the specific scope of work, with the prior approval of the Employer's Agent.

4.2.3 Soluble salts levels on the substrate to be coated shall be measured using the Test Patch, or Bresle Method, in accordance with ISO 8502-6.

4.2.4 Soluble salts/ ion contamination in the abrasive blast-cleaning material shall be measured and conform to ISO 11127-6 and/or ASTM D4940-10.

4.3 Surface preparation and cleanliness

4.3.1 The primary objective of surface preparation is to ensure the removal of deleterious matter and to obtain a surface that permits satisfactory adhesion of the priming paint to the steel. It will also assist in reducing the amounts of contaminants that initiate corrosion.

4.3.2 No coating shall be applied to any surface containing traces of grit, dust, grease, grime, oil, loose rust, mill-scale, chemical fall-out, salt deposits, damp or wet surfaces or any other surface contaminant.

4.3.3 The degree of cleanliness of steel substrate, including fasteners, shall be in accordance with the requirements for the relevant coating system and the extent of surface preparation specified in the Employer's specification. The closest equivalent visual assessment of surface cleanliness as provided in ISO 8501 shall be used as a guideline.

4.3.4 Dust and debris on prepared surfaces shall be less than 0.2 % when tested in accordance with SANS 8502-3.

4.3.5 For weathered unpainted hot-dip galvanized surfaces, the extent of surface preparation shall not result in removal of more than 10 µm of galvanizing.

4.3.6 The degree of cleanliness for substrate having existing paint shall be based on the following procedure and requirements:

(1) Remove the topcoat fully, and any other chalking/ loose/ flaking/ poorly bonded coating, and at least 70% of the intermediate coat, to provide a "key" between remaining existing & new coatings. The remaining existing paint shall adhere properly to a pull-off strength of at least 3 MPa.

(2) If 3 MPa is not achieved, remove the remaining intermediate coat to the extent that the resultant substrate test for adhesion shall exceed 3 MPa.

4.3.7 Should the maximum specified surface profile values as per the paint manufacturer's guidelines be exceeded, particularly but not limited to existing weathered unpainted surfaces, due to the use of improper equipment and/or procedures, or excessive abrasion of the substrates, or any other cause by the Contractor, then the Contractor shall apply an additional layer of primer.

4.3.8 Assess all cleaned surfaces as described in ISO 8501 and ISO 8502 for compliance with the requirements of the contract specifications. In the event of non-compliance, repeat the procedure.

4.4 Preparation before cleaning by mechanical and hand tool and/or abrasive blasting (Solvent Cleaning)

4.4.1 Solvent cleaning and rinsing is a pre-requisite for the surface preparation for painting.

4.4.2 Oil, grease and grime shall be removed by washing with an approved cleaner/ degreaser (detergent solution), scrubbing of stubborn contaminants with brushes and/or scouring pads, and rinsing with clean freshwater prior to additional surface preparation and application of coating.

4.4.3 Chemical contamination and salts shall be removed by means of neutralizing or flushing or both prior to additional surface preparation.

4.4.4 Rinsing shall be done using high pressure freshwater to flush out all the solutions of oil, grease, and grime in the degreaser, and all the salts and contaminants from the surfaces, cracks, and crevices. This will also ensure proper washing of hard-to-reach surfaces. If high-pressure freshwater washing

is difficult to undertake, then subject to approval by the Employer's Engineer, normal fresh hosing with thorough scrubbing may be employed. This is time consuming, but necessary, as to paint over salt residues will certainly lead to detachment or blistering of the fresh paint.

4.5 Mechanical and hand tool cleaning

4.5.1 This method of cleaning shall include use of mechanical power tool and use of hand tools such as wire brush, sandpaper, scouring pad, scraper, and chipping hammer.

4.5.2 Mechanical and hand tool cleaning shall be in accordance with the procedure specified in SANS 10064 (ISO 8504-3).

4.5.3 The grades of cleanliness for mechanical and hand tool cleaning in accordance with various standards is shown in the table below.

Cleaning methods	**Alternate Description**	**Degree of Cleanliness**		
		ISO 8501	**SSPC**	**NACE**
Solvent cleaning	Removal of soluble substances		SP 1	
Hand tool cleaning	Thorough cleaning	St 2	SP 2	
Power tool cleaning	Very thorough cleaning	St 3	SP 3	
Power tool cleaning to bare metal	Minimum surface profile of 25 µm		SP 11	
Commercial Grade Power Tool Cleaning	Random staining may persist on substrate		SP 15	
Note: (1) ISO: International Standards Organisation (2) SSPC: Steel Structures Painting Council (3) NACE: National Association of Corrosion Engineers				

4.5.4 The degree of cleanliness achieved shall be in accordance with the requirements for the relevant coating system, but this shall not be less than St 2 of ISO 8501-1.

4.6 Abrasive blast cleaning

4.6.1 Abrasive blast-cleaning of steel and existing paint on steel shall be carried out using abrasive blast-grit, in accordance with SANS 10064 (ISO 8504-2).

4.6.2 The grades of cleanliness for abrasive blast cleaning in accordance with various standards is shown in the table below.

Cleaning methods	**Alternate Description**	**Degree of Cleanliness**		
		ISO 8501	**SSPC**	**NACE**
Solvent cleaning	Solvent cleaning		SP 1	
Light blast cleaning	Brush-off; Sweep blast cleaning	Sa 1	SP 7	4
Industrial blast cleaning	Industrial for thin coatings; moderate sweep blast cleaning		SP 14	8
Thorough blast cleaning	Commercial	Sa 2	SP 6	3

Cleaning methods	Alternate Description	Degree of Cleanliness		
		ISO 8501	SSPC	NACE
Very thorough blast cleaning	Near white metal	Sa 2.5	SP 10	2
Blast cleaning to visually clean steel	White Metal	Sa 3	SP 5	1

4.6.3 For the surface preparation of tower steel which is hot-dip galvanized, weathered unpainted or previously painted, with corrosion levels ranging from mild to moderate with few patches of severe corrosion (noting that the severely corroded steel is usually replaced), experience has shown that in order to achieve the desired cleanliness without excessive removal of galvanizing (not more than 10 µm), sweep blast to thorough blast cleaning is deemed sufficient. In **Annexure A**, thorough blast cleaning is indicated to ensure that the Contractor caters for this grade of cleanliness.

4.6.4 Consideration could be given by the Contractor to apply the various types of blast-cleaning, namely:

(1) Compressed-air abrasive blast-cleaning.
(2) Compressed-air moisture-injection abrasive blast-cleaning.
(3) Compressed-air wet abrasive blast-cleaning.

4.6.5 The basic requirements for the abrasive media (blast-grit) are as follows:

(1) Non-hazardous and be composed of clean, sound, hard particles, free from foreign substances such as dirt, oil, grease, toxic substances, organic matter, and water-soluble salts.

(2) Capable of producing the surface profile as specified for the relevant coating system.

(3) Low dust type.

(4) Conductivity shall be < 250 µSiemens/cm.

(5) Shall not be of the silica sand, chrome, nickel slag, and such like products which are hazardous to the environment.

4.6.6 Blast guns (and not straight nozzles) shall be used with maximum nozzle pressure of 350 kPa. The compressor and blasting equipment shall be fully equipped to ensure that this requirement is met, such as by means of air pressure regulation. Should there be a need to increase this maximum pressure value, approval shall be sought from the Employer's Agent.

4.6.7 Preliminary blast-cleaning tests shall be done to determine the most effective abrasive, the resulting surface preparation grade and the resulting surface profile (ISO 8501-1 or 2 or 3).

4.6.8 After dry abrasive blast-cleaning, remove loosely adhering dust, debris, and blast-cleaning abrasive from the surface by brushing or by use of compressed air free of oil and moisture.

4.6.9 After wet abrasive blast-cleaning, wash all surfaces down with fresh water to remove loosely adhering abrasive and other residues. The water may contain an agreed rust inhibitor. Compressed air free of oil and moisture or other means may then be used to assist in drying the surfaces before application of paint.

5 COATING APPLICATION

5.1 Approval

5.1.1 No work shall be performed until the Quality Assurance/ Quality Control (QA/QC) documentation to be used are approved by the Employer's Agent. These can be in the form of Quality, Inspection and Test Plans (QITPs), Site Data Schedules, and such like.

5.2 Mixing of paint

5.2.1 The Contractor shall ensure that all paints are mixed in accordance with the Manufacturer's guidelines, instructions and material data sheets.

5.2.2 During application, containers shall be agitated often enough to keep pigments in suspension.

5.3 Coating

5.3.1 All surfaces shall be coated as specified. Surfaces which do not require coating shall be suitably protected. Successive coats shall be of distinctly different colour to the previous coat to ensure correct inter-coat coverage. Special attention shall be given to cracks, crevices, and edges to ensure complete coverage and paint thickness.

5.3.2 On pre-coated surfaces all traces of soluble salts and other corrosive airborne contaminants shall be removed (with degreaser, potable water and scrubbing brushes or similar cleaning material) and surfaces shall be allowed to dry prior to further paint application.

5.3.3 Concealed surfaces shall be completely coated. Suitable sponges may be used for application of coating on concealed surfaces or back to back angles. In the case where it is impractical to coat the concealed surface, the opening shall be sealed utilizing an approved mastic material.

5.3.4 Apply the primer coat to all surfaces to the correct thickness immediately after cleaning operations (mechanical, hand and/or blast as may be specified). Thereafter this shall be inspected by the Contractor's Inspector and Employer's Representative. This primer coat shall be a different colour to that of the other layers.

5.3.5 Apply stripe coat to all edges, corners, bolts, bolt holes, cut ends and weld beads by brush application, prior to the application of the intermediate coat. The stripe coat on the edges and other places are not intended to increase the overall specified dry film thickness of the system but to ensure protection and that the minimum thickness required are actually achieved at sharp edges. In order to assist in its identification, the stripe coat shall be a different colour to that of the other layers.

5.3.6 Apply the intermediate coat to all surfaces to the correct thickness after the stripe coat, and thereafter this shall be inspected by the Contractor's Inspector and Employer's Representative. This intermediate coat shall be a different colour to that of the other layers.

5.3.7 Apply the topcoat (finishing coat) to all surfaces to the correct thickness after the intermediate coat, and thereafter this shall be inspected by the Contractor's Inspector and Employer's Representative. This topcoat shall be a different colour to that of the other layers.

5.4 Application

5.4.1 All application work shall be carried out in strict accordance with the relevant recommendations, procedures, guidelines and/or instructions given in the most current Product Data Sheets. This includes climatic conditions, methods of surface preparation, overcasting times, application equipment and methods to be utilized and pertinent requirements not listed in this specification. The Product Data Sheet shall be deemed to be part of this specification.

5.4.2 All coating shall be evenly applied to form a smooth, continuous, unbroken coating free from sags, runs, mud-cracking and other defects.

5.4.3 Damaged paint, due to handling and erection of components, shall be cleaned and repaired. Rust spots and any other deleterious matter shall be removed. Spot repairs shall be carried out such that the patch painting extends at least 25 mm beyond the damaged areas. Spot repairs shall reinstate each of the previous coats and shall commence directly after surface preparation.

5.4.4 During the application of the coating system, adequate precautions and protective covering/ sheets shall be applied over insulators and other items (such as anti-theft devices, joint boxes housing optical ground wire) on the tower to prevent grit and paint contamination.

5.4.5 All electrical components that show any indications of paint contamination from the painting work shall be cleaned or replaced at the Contractor's expense. Should cleaning result in damage, especially in the case of the insulators, the Contractor shall be responsible for the cost of replacement.

5.4.6 Labels, signs, etc., or where otherwise specified, shall be removed from the structure before application of the coating system and replaced after the coating system has cured, unless other instructions are given by Site Instruction. All structures shall be provided with temporary labels during the painting process.

5.4.7 Where backfilling is required at foundations, care shall be taken to ensure that the equipment used for compacting is wrapped with a thick layer of rubber to minimize damage to the newly painted structure.

5.4.8 With respect to items/topics not covered by the detailed specifications (e.g., over-coating and curing times, mixing ratios, pot life, thinning, safety precautions etc.), the Manufacturer's recommendations shall be strictly adhered to; (refer to product data sheets).

5.4.9 Where dark-coloured base coats are used, additional coats may be required to ensure complete uniformity of the topcoat.

5.5 Ambient conditions

5.5.1 Coating shall not be applied under the following conditions:

(1) When the surface may become damaged by rain, airborne dust, chemical fall-out, fog or condensation. When it is anticipated that these conditions will prevail during the drying period, suitable enclosures shall be provided to protect the surfaces.

(2) When the ambient air temperature or the steel temperature is outside the coating Manufacturer's range. In any case this shall not be less than +10 °C, even though the paint could be used at a lower temperature.

(3) When the ambient relative humidity exceeds 85 %.

5.6 Galvanizing

5.6.1 Hot-dip galvanizing shall be in accordance with the requirements of SANS 121 (ISO 1461) for heavy-duty galvanizing.

5.7 Primer coat

5.7.1 The primer coat shall be applied within 4 hours of the surface preparation operation.

5.8 Fasteners (including Step-bolts)

5.8.1 All replacement nut and bolts shall be hot-dip galvanized in accordance with the requirements of SANS 121 (ISO 1461) for heavy-duty galvanizing.

5.8.2 All nuts and bolts shall be thoroughly and completely cleaned (remove all pollution/ oxidation/ residue particles) and degreased with a suitable degreaser, washed with clean water, and shall be fully coated in accordance with the painting specification.

6 PAINTING NEW GALVANIZED MEMBERS

6.1 The Contractor shall furnish the materials specified and ensure that they are applied in strict accordance with this specification.

6.2 The Contractor shall be wholly responsible for surface preparation and coating application. The coated surfaces shall meet the minimum dry film thickness required by this specification.

6.3 The extent of coating application, i.e., primer only or full coating system application, in the shops or on site shall be as specified in the project scope of work.

6.4 Where the full coating system is applied in the shops, provisions must be made for the repair of handling damage to the coating after erection.

7 PAINTING ON SITE

7.1 The Contractor shall furnish the material specified and ensure that they are applied in strict accordance with this specification.

7.2 Where coating activities are shared between the shops and the site, coated surfaces shall be inspected and examined for mechanical damage on arrival on site.

8 REFERENCE STRUCTURES AND FOUNDATIONS

8.1 The purpose of establishing one or more reference structures/ foundations is to establish a standard with respect to the quality of workmanship that is expected from the Contractor throughout the project. Should any premature failure of the coating system occur, these reference structures and foundations shall form an integral part of the investigation.

8.2 At the beginning of the refurbishment of each power line, one or more structures shall be selected as reference points for the entire power line, or multiple power lines, as may be decided by the Employer's Agent.

8.3 This structure/s, or part thereof, shall be prepared and coated under the supervision of all parties concerned (i.e., the Contractor's relevant Project Management and Engineering staff, the Coating Specialist from the Paint Manufacturer, the Employer's Engineer, Agent and Representatives).

8.4 The application tools and equipment, the qualifications and competency of the application staff, personnel protective equipment, compliance to health and safety procedures as per safety file, the degree of surface preparation, the application procedure and actual application, the test equipment and tests shall be the subject of the assessment.

8.5 The Contractor shall document the proceedings and all assessments and results and provide such to the Employer's Agent upon completion of the exercise.

8.6 The Contractor shall perform the surface preparation and conduct inspections and do the relevant tests. The sellotape tests (SANS 8502-3) will act as the standard reference for all other structures of that line (or multiple lines) with respect to the allowable percentage dust and debris.

8.7 After proper surface preparation of the structure/s or part thereof, and the various checks and tests are done and recorded, as may be determined jointly by the various representatives, with the final approval by the Employer's Agent, the full coating system shall be applied in accordance with the appropriate detailed specification.

9 HEALTH, SAFETY AND ENVIRONMENTAL COMPLIANCE

9.1 General

9.1.1 The Contractor shall ensure that they comply with all statutory regulations, municipality by-laws, etc., concerning the environment (including any fauna and flora) and the health and safety of his personnel and members of the public who may be affected by his work.

9.1.2 Proper risk assessments, safety procedures, and environmental protection measures shall be in place prior to any cleaning and painting work being carried.

9.1.3 The Contractor shall advise the Employer's Agent of all hazardous materials to be brought on site.

9.2 Safety plan

9.2.1 The Contractor shall compile a safety plan, prior to the commencement of site work.

9.3 Fire hazards

9.3.1 The Contractor shall ensure that adequate precautions are taken to avoid fire hazards.

9.4 Storage of hazardous materials

9.4.1 Oily or solvent rags shall be kept segregated in closed containers and in minimum quantity. Any spillage of volatile material shall be wiped up immediately.

9.4.2 Solvents are volatile materials hence shall be stored in designated areas.

9.5 Scaffolds and rigging

9.5.1 The Contractor shall provide and erect such scaffolds and rigging as may be required. All scaffolds and rigging shall comply with the requirements of the OHS Act, as amended.

9.5.2 Temporary welded support elements are not permitted except where written approval has been granted by the Employer's Agent.

9.6 Disposal of materials

9.6.1 Used construction materials, such as but not limited to blast-grit, shall be collected, bagged and disposed of at a suitable disposal facility. Proper records of the disposals shall be kept and shall be made available to the Employer's Agent or Representative upon request. The cost of this activity shall be including in the price for cleaning and painting.

10 INSPECTION AND TESTING

10.1 Surface preparation

10.1.1 The degree of surface preparation achieved shall be in accordance with the requirements for the relevant coating system, but this shall not be less than thorough mechanical and hand cleaning and moderate sweep to thorough blast-cleaning.

10.1.2 The average profile, and peak to valley values, when measured by SANS 5772 (ISO 8503), shall be as specified in the Manufacturer's Data Sheet for the primer and other coating layers to be applied.

10.2 Visual inspection

10.2.1 Visual inspection for paint film shall be performed after each coat is applied. All defects including pinholes, dry spray and sags shall be corrected before the next full coat is applied.

10.3 Dry film thickness (DFT)

10.3.1 DFT shall be measured in accordance with SANS 2808.

10.3.2 The required DFT is given in 'windows' for each coat in the relevant coating systems, i.e. required minimum and acceptable maximum. No individual thickness shall be less than 85 % of the specified minimum thickness, and not more than 15 % of thickness measurements taken shall be less than the specified thickness.

10.3.3 Where excessive film thickness can be detrimental to the integrity of the coating, the Manufacturer's recommended maximum thickness shall apply.

10.3.4 The increase in thickness created by the application of the stripe coat shall not be used to increase the maximum specified thickness of the system.

10.3.5 All deficient film thickness shall be rectified to the approval of the Employer's Agent at the Contractor's expense.

10.3.6 Actual readings and not averages shall be recorded.

10.4 Adhesion tests

10.4.1 After surface preparation, and inspections for cleanliness, designate one or more surface areas for primer adhesion tests. After primer is applied on the structure, allow to dry and do cross-cut, cross-hatch and pull-off adhesion tests.

10.4.2 Random cross-cut/ cross-hatch and pull-off adhesion tests, shall be carried out on the applied coatings (primer, intermediate and/or top coat) using the SANS 2409 and SANS 4624 test methods respectively. Adhesion 'pull-off' values of the new coating to the substrate (A/B) shall be a minimum of 5 MPa with no inter-coat adhesion failure or cohesive failure.

10.4.3 The number and location of tests shall be agreed with the Contractor's representative at the start of the works. Coatings damaged by adhesion tests shall be repaired by the Contractor.

11 QUALITY ASSURANCE

11.1 Contractor qualification

11.1.1 The Employer's Agent may, at his discretion, require a Quality Audit of the painting Contractor to ensure that they have the requisite management, tools and equipment, skilled staff and quality control facilities to carry out quality control during application of coatings to ensure compliance with the specification.

11.1.2 The Contractor shall accept full responsibility for the quality of his work and of materials used, irrespective of any quality surveillance that may be carried out by the Employer's Agent and/or Site Representatives.

11.1.3 The Contractor shall obtain confirmation from the material manufacturer, in writing, that the materials used comply with the specification and are suitable for the intended use.

11.2 Quality control

11.2.1 The Contractor shall have the necessary equipment and staff knowledgeable in test procedures to carry out the quality control required to ensure compliance with the specification.

11.2.2 The Contractor's site supervisor shall ensure the work is executed to the required specifications and shall check and sign off work done by personnel under his/her control.

11.2.3 Quality control shall be carried out by a qualified and experienced Inspector who is independent of the application activities.

11.2.4 In order to comply with this specification, as well as to monitor and record the following parameters throughout the coating process, the Contractor shall always have suitable calibrated equipment on-site.

Parameters to be monitored:

(1) Material batch records, such as batch numbers, date of manufacture, expiry dates of paint materials.

(2) Product data sheets.

(3) Psychrometric records, such as air and substrate temperature, humidity, dew point, etc.

(4) Storage conditions of coating materials (here the ambient temperature and humidity shall be recorded).

(5) Calibration dates of all quality control test equipment.

(6) Records of surface preparation; (Degree of surface cleanliness– as per reference standard).

(7) Soluble salt test- by means of the Bresle Method (ISO 8502-6) or other approved standard methods. The amount of soluble salts shall be checked in locations on the steel which are least exposed to rain and sunshine.

(8) Acidity/ basicity (pH) measurements.

(9) Ambient and substrate temperatures – by means of calibrated temperature probes.

(10) Relative humidity– with a calibrated humidity meter.

(11) Dew point– by means of a dew point calculator.

(12) Other environmental conditions, e.g., incidence of industrial fall-out, mist, rain, etc.

(13) Mixing times of paint and quantities used.

(14) Wet film thickness (WFT) per each coat- in accordance with ASTM D4414.

(15) Dry film thickness (DFT) per each coat- in accordance with SANS 2808.

(16) Over coating times- as per product data sheet.

(17) Records of other specific tests as required by the Employer's Agent.

11.2.5 These records shall be kept in a format that meets the approval of the Employer's Agent.

11.2.6 The cost of quality control by the Contractor shall be included in the Contractor's bid price.

11.2.7 Before the commencement of the contract, the Contractor shall prepare a Quality Inspection and Test Plan (QITP) detailing each activity to be carried out during the execution of the works. Each activity shall be supported by a detailed procedure for that activity. The QITP shall also detail the specific activity, requirement for photographic evidence of work done, inspection requirements, listing whether it be a witness or hold point, and defining the responsibilities of the various parties at these stages of works.

11.2.8 The Contractor shall use an inspection schedule which shall include the item of plant, the activity and date for inspection. This shall be submitted to the Employer's Agent or Representative for inspection requests. Upon receiving written acceptance/ rejection of a particular activity or item, the Contractor shall update the schedule, with details as instructed by the Employer's Agent.

11.2.9 Such documentation shall be reviewed and approved by the Employer's Agent beforehand.

11.3 Quality surveillance

11.3.1 The Employer's Agent may use a Representative or employ an independent technically qualified organisation to carry out Quality Surveillance of the work on his behalf. The surveillance shall include audits, sampling, monitoring, inspections and/or tests. In the event of a dispute, the decision of the Employer's Agent shall be final.

11.3.2 For the purpose of carrying out quality surveillance, the Employer's Agent or his authorised Representative shall be granted access to any part of the Contractor's premises relevant to the work being carried out, at any reasonable time. The Contractor shall provide, at his own cost, any equipment or labour necessary to gain access to surfaces which are coated, to be coated or are in the process of being coated.

11.3.3 The Employer's Agent or his authorised Representative may remove any reasonable samples of materials to be in the coating application. Rejection of the samples will place a hold on the use of material of the same batch number and may lead to rejection of all that batch of material and the reworking of any components that have already been coated with rejected materials.

11.3.4 The Employer's Agent or his authorised Representative may carry out reasonable destructive tests to ascertain compliance with the specification. Areas thus damaged shall be repaired by the Contractor to the satisfaction of the Employer's Agent at no additional cost.

11.3.5 The cost of quality surveillance executed by the Employer's Agent or Representative will be borne by the Employer, except where surveillance results in repeated rejection of the work or when notice by the Contractor results in a fruitless trip, in which cases the cost of surveillance shall be for the Contractor's account, as per the Conditions of Contract.

11.3.6 The Employer's Representative shall document the surveillance observations and findings and submit such at regular intervals as determined by the Employer's Agent. The Representative shall also have written records of the acceptance/rejection of any item for which an inspection is done and submit such timeously to the Contractor and the Employer's Agent.

11.4 Quality control documentation

11.4.1 Upon completion of the works, the Contractor shall provide the Employer's Agent with a Data Book containing all the relevant Quality Control documents and records pertaining to the works.

11.4.2 This data book shall contain records as per Quality Control parameters, as follows:

(1) Material batch records, (including Batch Release Certificates).

(2) Product Data Sheets.

(3) Psychrometric records (including steel temperatures).

(4) Records of surface preparation.

(5) Records of dates and times of the application of each coat.

(6) Dry film thickness measurements per coat.

(7) All other relevant QC records.

11.4.3 The Contractor shall submit one copy of the Data Book to the Employer's Agent and keep one copy for his own records.

12 PAINTING SYSTEMS

12.1 The acceptable Painting Systems are given in **Annexure A** and based on recommendations from the paint manufacturers.

12.2 The acceptable cleaning and coating products are listed in **Annexure B**. These products have been accepted based on the recommendations and product offering from the listed paint manufacturers. Products that are discontinued shall not be used, instead the equivalent replacement products shall be used, subject to acceptance and approval by the Employer's Agent.

12.3 The abrasive material for blasting shall be specified in the Contract Schedules and/or Scope of Work for the particular project/s.

12.4 Should the Contractor and/or the Manufacturer wish to propose alternative material or coating products that may be better suited for the structure and/or site conditions, they shall submit a detailed motivation to the Employer's Agent. The motivation shall include but not be limited to the following:

(1) Full (but only relevant) details of the alternative products and application procedures.

(2) Additional benefit to the Employer.

(3) Product licensor and technical back-up available.

(4) Location, experience and ISO quality rating of the production facility.

(5) Detailed case histories, with applications and conditions similar to that of this Employer.

(6) Performance guarantee offered.

(7) Manufacturer's data sheets and Hazardous Substances data sheets for each product.

13 GUARANTEES

13.1 The requirements in these specifications are written to achieve a minimum of 10-year coating system durability in the existing C3 to C5 atmosphere.

13.2 The Employer will require performance guarantees for the applied coating systems. Such guarantees shall be offered jointly by the Contractor and the coating product Manufacturer/s.

13.3 The period of guarantee (defects liability period) shall be specified in the contract document.

13.4 The coating will be considered defective as follows:

(1) Rusting of the coated surfaces develop within 3 years, where it is rated more than Ri 1 or 0.05 % (in accordance with ISO 4628-3).

(2) Rusting of the coated surfaces develop within 5 years for maintenance work and 8 years for new work, where it is rated more than Ri 2 or 0.5 % (in accordance with ISO 4628-3).

(3) Blistering, flaking, delamination, cracking, alligatoring, or any other defects not specifically listed, are present within 5 years that in the opinion of the Employer's Agent or Representative, reduces the aesthetic appearance or compromises the integrity of the coating system.

13.5 The Dry Film Thicknesses indicated in the Paint Specifications shall be the minimum values. The Contractor, in consultation with the Paint Manufacturer and product specification, may increase these values to achieve the required guarantees.

14 HANDLING AND STORAGE

14.1 The following precautions shall be taken for the site handling and storage of paint products:

(1) All paint products shall be stored under cover – in shade (i.e., not in direct sunlight).

(2) All containers for paint handling (e.g., application on tower), shall be clean.

(3) Paint containers shall be kept on a flat surface.

(4) Paint containers shall be kept on an impermeable sheath.

(5) Paint containers shall be kept closed when not in use and sealed properly.

(6) Used paint containers and tools shall be disposed of properly.

14.2 The following precautions shall be taken for the site storage of coated items:

(1) Handling: All coated components shall be handled using soft sling.

(2) Loading: All coated components to be transported shall be loaded with support blocks, packing between pieces and tight lashing to avoid chafing.

(3) Off-loading at site shall be conducted using the same care and precaution for on-loading. Components shall not be tipped off the transportation.

(4) Stacking: Items shall be stacked using timber packing or other approved means to avoid coating contact. Sufficient bearing area of packing shall be used to avoid damage to coating.

15 ANNEXURE A: PAINTING SYSTEMS

15.1 Re-cleaning specification for time-lapse between cleaning-painting and painting-painting

(1) Blast-clean and apply primer within 4 hours on the same day. If not, then repeat washing and rinsing and blast-cleaning.

(2) Time delay and required action for any subsequent coating application.

(a) **Next day but less than 24-hour delay:** Inspect for foreign residue- visual and sellotape test. (Optional: Webber Reilly Test). Lightly rinse with water, if necessary.

(b) **24 to 72 hours:** Apply cleaner/ degreaser. Scrub with brushes and/or scouring pads. Wash thoroughly with water. Rinse using high pressure freshwater. Thereafter inspect and test for residue. Repeat cleaning process if required level of cleanliness not achieved.

(c) **72 hours to 1 month:** Inspect for foreign residue- visual and sellotape test and keep records. Apply cleaner/ degreaser. Scrub with brushes and/or scouring pads. Wash thoroughly with water to remove all surface contamination. Lightly sand the existing coating to ensure a key is achieved. Rinse using high pressure freshwater. Thereafter inspect and test for residue. Repeat cleaning process if required level of cleanliness not achieved.

(d) **> 1 month:** Inspect for foreign residue and contaminants- visual and sellotape test and keep records. Consult the paint manufacturer for guidance on the cleaning process and subject to approval by Employer's Agent, clean substrate as per manufacturer's recommendation. Irrespective of the recommendation, the minimum will be wash and rinse thoroughly: Apply cleaner/ degreaser. Scrub with brushes and/or scouring pads. Wash thoroughly with water to remove all surface contamination. Lightly sand the existing coating to ensure a key is achieved. Rinse using high pressure freshwater. If necessary, perform a light sweep-blast of the surface. Thereafter inspect and test for residue. Repeat cleaning process if required level of cleanliness not achieved. Once surface is completely dry, re-apply coating for the same layer.

Note: Reimbursement for the additional work due to the delays shall only be considered if the time-delay was due to the Employer.

15.2 Painting system new galvanized steel and fasteners (NGPS01)

(Minimum 10-year durability in the existing C3 to C5 atmosphere)

Item	Activity	Requirement
1	Surface Preparation	• Thoroughly prepare the galvanized steel and fastener surface using a proprietary brand pre-cleaner (supplied by the paint Manufacturer) and using either 'Scotch-Brite' or equivalent scouring pads and/or bristle brushes to achieve a 'water break-free' surface. Ensure that the passivation layer is completely removed. • The above shall include washing with clean fresh water and cleaner/ degreaser to remove oil, grease, grime, and neutralizing and removal of chemical contaminants and salts. • Rinse using high pressure freshwater to flush out all the solutions of oil, grease, and grime in the degreaser, and all the salts and contaminants from the surfaces, cracks, and crevices. • Additionally, prepare surface by mechanical tool, hand tool and/or light sweep blast-cleaning (whichever is most appropriate) to achieve a clean and roughened surface suitable for painting.
2	Primer Coat	• Apply primer coat on the same day and within 4 hours of blasting. • If not done within 4 hours, check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one complete coat of Galvanized Iron Surface Tolerant Epoxy/ Tie-coat (> 60 % volume solids content) to a dry film thickness of 100 to 125 µm.
3	Stripe (primer) coat	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply stripe coat on all corners/ edges of the steel members and on the complete bolts, as well as all other surfaces where required, to ensure minimum primer DFT is achieved.
4	Intermediate Coat (for 3-coat system only)	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one coat of High Build Micaceous Iron Oxide Epoxy (> 60 % volume solids content), and touch-up, to a dry film thickness of 100 to 125 µm.
5	Topcoat (Finishing coat)	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one complete coat of Aliphatic Acrylic Polyurethane of required colour, and touch-up, to a dry film thickness as per manufacturer's guidelines or 60 µm, whichever is the greater.
6	DFT of new coating	• Applied 2-coat system: 160 to 185 µm. • Applied 3-coat system: 260 to 310 µm.

15.3 Painting system for weathered unpainted galvanised steel (WUPS01)

(Minimum 10-year durability in the existing C3 to C5 atmosphere)

Item	Activity	Requirement
1	Surface Preparation	• Wash with clean fresh water and cleaner/ degreaser to remove oil, grease, grime. Neutralize and remove chemical contaminants and salts. • Rinse using high pressure freshwater to flush out all the solutions of oil, grease, and grime in the degreaser, and all the salts and contaminants from the surfaces, cracks, and crevices. • Prepare surface by blast-cleaning, predominantly moderate sweep blast-cleaning and some areas requiring thorough blast-cleaning. • Remove all existing loose red rust (from exposed steel) and white rust (from weathered galvanizing) by blast-cleaning.
2	Primer coat	• Apply primer coat on the same day and within 4 hours of blasting. • If not done within 4 hours, check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one complete coat of High Build Aluminium Pigmented Surface Tolerant Epoxy (> 80% volume solids content) to a dry film thickness of 100 to 125 µm.
3	Stripe (primer) coat	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply stripe coat on all corners/ edges of the steel members and on the complete bolts, as well as all other surfaces where required, to ensure minimum primer DFT is achieved.
4	Intermediate Coat (for 3-coat system only)	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one coat of High Build Micaceous Iron Oxide Epoxy (> 60 % volume solids content), and touch-up, to a dry film thickness of 100 to 125 µm.
5	Topcoat (Finishing coat)	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one complete coat of Aliphatic Acrylic Polyurethane of required colour, and touch-up, to a dry film thickness as per manufacturer's guidelines or 60 µm, whichever is the greater.
6	DFT of new coating	• Applied 2-coat system: 160 to 185 µm. • Applied 3-coat system: 260 to 310 µm.

15.4 Painting system for Weathered previously painted (Epoxy/ Urethane) galvanised steel (WEPS01)

(Minimum 10-year durability in the existing C3 to C5 atmosphere)

Item	Activity	Requirement
1	Surface Preparation	• Wash with clean fresh water and cleaner/ degreaser to remove oil, grease, grime. Neutralize and remove chemical contaminants and salts. • Rinse using high pressure freshwater to flush out all the solutions of oil, grease, and grime in the degreaser, and all the salts and contaminants from the surfaces, cracks, and crevices. • Prepare surface by thorough blast-cleaning. The blast-cleaning shall remove the existing topcoat and at least 70% of the intermediate coat, and any other chalking/ loose/ flaking/ poorly bonded coating, as well as to provide a “key” between remaining existing & new coatings. The remaining existing paint shall adhere properly to a level of at least 3 MPa. This shall be checked on a sample basis. • Remove all existing loose red rust (from exposed steel) and white rust (from weathered galvanizing) by blast-cleaning.
2	Primer coat	• Apply primer coat on the same day and within 4 hours of blasting. • If not done within 4 hours, check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one complete coat of High Build Aluminium Pigmented Surface Tolerant Epoxy (> 80% volume solids content) to a dry film thickness of 100 to 125 µm.
3	Stripe (primer) coat	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply stripe coat on all corners/ edges of the steel members and on the complete bolts, as well as all other surfaces where required, to ensure minimum primer DFT is achieved.
4	Intermediate Coat (for 3-coat system only)	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one coat of High Build Micaceous Iron Oxide Epoxy (> 60 % volume solids content), and touch-up, to a dry film thickness of 100 to 125 µm.
5	Topcoat (Finishing coat)	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one complete coat of Aliphatic Acrylic Polyurethane of required colour, and touch-up, to a dry film thickness as per manufacturer’s guidelines or 60 µm, whichever is the greater.
6	DFT of new coating	• Applied 2-coat system: 160 to 185 µm. • Applied 3-coat system: 260 to 310 µm.

15.5 Painting system for Weathered previously painted (Vinyl/ Enamel) weathered galvanised steel (WVPS01)

(Minimum 10-year durability in the existing C3 to C5 atmosphere)

Item	Activity	Requirement
1	Surface Preparation	• Wash with clean fresh water and cleaner/ degreaser to remove oil, grease, grime. Neutralize and remove chemical contaminants and salts. • Rinse using high pressure freshwater to flush out all the solutions of oil, grease, and grime in the degreaser, and all the salts and contaminants from the surfaces, cracks, and crevices. • Prepare surface by thorough blast-cleaning. The blast-cleaning shall remove existing topcoat and at least 70% of the intermediate coat, and any other chalking/ loose/ flaking/ poorly bonded coating, as well as to provide a “key” between remaining existing & new coatings. • The remaining existing paint shall adhere properly to a pull-off value of at least 3 MPa. This shall be checked on a sample basis. • Remove all existing loose red rust (from exposed steel) and white rust (from weathered galvanizing) by blast-cleaning.
2	Primer coat	• Apply primer coat on the same day and within 4 hours of blasting. • If not done within 4 hours, check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one complete coat of High Build Aluminium Pigmented Surface Tolerant Epoxy (> 60 % volume solids content), of the type compatible with the vinyl/ enamel surface and to accommodate application of urethane topcoat, to a dry film thickness of 100 to 125 µm.
3	Stripe (primer) coat	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply stripe coat on all corners/ edges of the steel members and on the complete bolts, as well as all other surfaces where required, to ensure minimum primer DFT is achieved.
4	Intermediate Coat (for 3-coat system only)	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one coat of High Build Micaceous Iron Oxide Epoxy (> 60 % volume solids content), and touch-up, to a dry film thickness of 100 to 125 µm.
5	Topcoat (Finishing coat)	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply one complete coat of Aliphatic Acrylic Polyurethane of required colour, and touch-up, to a dry film thickness as per manufacturer’s guidelines or 60 µm, whichever is the greater.
6	DFT of new coating	• Applied 2-coat system: 160 to 185 µm. • Applied 3-coat system: 260 to 310 µm.

15.6 Painting system for steel and bolts at foundation and concrete

(SCPS01 = STUBPS01 + CONPS01)

(Minimum 10-year durability in the existing C3 to C5 atmosphere)

Item	Activity	Requirement
1	Surface Preparation	• Remove the earth-strap if obstructing the preparation and coating process. Refit on a daily basis for electrical continuity, and then do the final fitment after application of coating. **The area of connection between the structure steel and earth-strap shall be cleaned to give a proper electrical connection.** • Wash with clean fresh water and cleaner/ degreaser to remove oil, grease, grime. Neutralize and remove chemical contaminants and salts. • Rinse using high pressure freshwater to flush out all the solutions of oil, grease, and grime in the degreaser, and all the salts and contaminants from the surfaces, cracks, and crevices. • Remove defective concrete cap/ pier. Also remove concrete to expose any corrosion on the stub/ bracing. • Mark the position that will be 500 mm above the proposed gradient or build-up. Mark 50 mm below that position, which will then be 450 mm above the gradient or build-up. Clean this 50 mm strip above the 450 mm mark. Lightly sand the existing area to ensure a key is achieved. Mask off the area above the 450 mm mark to avoid blasting above 450 mm. • Clean the stub, fasteners and connected steel, via thorough blast-cleaning, up to 450 mm mark. • For existing piers, blast-clean the concrete, (remove existing Bitumen or Coaltar), from the final top level to 500 mm below the final ground level. • For large exposed existing capping, blast-clean the top of the capping for the gradient/ build-up area with an additional 200 mm on all sides.
2a	Prime coat on steel and bolts	• Apply primer coat on the same day and within 4 hours of blasting. • If not done within 4 hours, check time-lapse as per Clause 15.1 and prepare surface as specified. • Remove the mask on the steel at the 450 mm position and clean the area. • Apply to the steel from the bottom up to the 500 mm mark, one coat zinc-rich primer (> 60 % volume solids content) to a dry film thickness of 100 to 125 µm.
2b	Stripe coat on steel and bolts	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply stripe coat on all corners/ edges of the steel members and on the complete bolts, as well as all other surfaces where required, to ensure minimum primer DFT is achieved.
3	Intermediate coat on steel and bolts	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply to the steel and bolts (with earth-strap moved out of the way), one complete coat to a dry film thickness of 100 to 125 µm as measured on the steel surface.
4	Prime coat on the concrete	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply to the concrete (with sealer where applicable) one coat of primer to a dry film thickness of 100 to 125 µm.
5	Topcoat (Finishing coat)	• Check time-lapse as per Clause 15.1 and prepare surface as specified. • Apply to the steel, bolts and concrete (with earth-strap moved out of the way), one complete coat of topcoat to a dry film thickness as per manufacturer's guidelines or 60 µm, whichever is the greater.
6	DFT of new coating	• Applied coat system on steel and bolts: 260 to 310 µm. • Applied coat system on concrete: 160 to 185 µm.

15.7 Painting system for earth-strap (ESPS01):

(1) Existing earth-strap: Refurbish same as for surface preparation and coating of stubs.

(2) New earth-strap: Join to existing earth-strap via bolted connection and the joint to be sealed using Denso mastic and UV-resistant tape, or equivalent.

(3) Existing and new earth-strap sealing and fastening to tower:

(a) The earth-strap from 1 m below the final ground level to the top-end of the earth-strap, (except the portion that needs to make contact with the structure), shall be sealed with Denso UV-resistant tape, or equivalent.

(b) The contact surfaces on the earth-strap and stub shall be properly cleaned and temporarily covered with a tape to prevent being coated, as these surfaces are to remain uncoated for electrical continuity when bolted together.

(c) Apply electrical joint compound to the contact surfaces (earth-strap and steel) and then connect the earth-strap to the tower.

(d) After tightening the earth-strap to the tower steel, apply 2 coats (Primer and topcoat that is specified for the Stub) at the fastener and surrounding earth-strap and tower steel.

16 ANNEXURE B: ACCEPTABLE COATING MANUFACTURERS AND THEIR PRODUCTS

16.1 General

The coating products were recommended by the Paint Manufacturers for the tower refurbishment based on the Employer's Painting Specifications.

The Manufacturers shall therefore be responsible for having provided this paint products and shall inform the Employer's Agent of any changes to the coating products either due to product updates or to ensure compatibility and functionality.

Number of coats:

- **Two-coat (2C) paint system**: consists of the primer and topcoat, with the stripe coats and touch-ups.
- **Three-coat (3C) paint system**: consist of the primer, intermediate and topcoat with the stripe coats and touch-ups.

16.2 Coating Products for NGPS01 (New hot-dip galvanised steel and fasteners; less than 6 months old; complete or portion of a tower)

Item	Descriptions	2C	3C	Kansaiplascon	Jotun	PPG	Stoncor	AkzoNobel
1	Degreaser	Y	Y	M/Care Aquasolve Degreaser	Galvanised Metal Cleaner / HD Degreaser	GP Cleaner 5011	Carboclean 250	FIXIT Degreaser
2	Primer: Galvanized iron epoxy primer/ tie-coat	Y	Y	Plascotuff 3500 (Alu)	Jotamastic 90 (Alu)	SigmaCover 380	Carboguard 890 (Alu)	Interseal 670 HS (Alu)
3	Intermediate coat: High build micaceous iron oxide epoxy	N	Y	Plascotuff 3500	Jotamastic 90	SigmaCover 380	Carboguard 880	Intergard 475 HS
4	Topcoat: Aliphatic acrylic polyurethane	Y	Y	Plascothane 9000	Hardtop XP	SigmaDur 550	Carbothane 137HS	Interthane 990

16.3 Coating Products for WUPS01 (Weathered unpainted steel and fasteners)

Item	Descriptions	2C	3C	Kansaiplascon	Jotun	PPG	Stoncor	AkzoNobel
1	Degreaser	Y	Y	M/Care Aquasolve Degreaser	Galvanised Metal Cleaner / HD Degreaser	GP Cleaner 5011	Carboclean 250	FIXIT Degreaser
2	Primer: High build aluminium pigmented surface tolerant epoxy	Y	Y	Plascotuff 3500 (Alu)	Jotamastic 90 (Alu)	SigmaCover 380	Carboguard 890 (Alu)	Interseal 670 HS (Alu)
3	Intermediate coat: High build micaceous iron oxide epoxy	N	Y	Plascotuff 3500	Jotamastic 90	SigmaCover 380	Carboguard 880	Intergard 475 HS
4	Topcoat: Aliphatic acrylic polyurethane	Y	Y	Plascothane 9000	Hardtop XP	SigmaDur 550	Carbothane 137HS	Interthane 990

16.4 Coating Products for WEPS01 (Weathered epoxy/ urethane painted steel and fasteners)

Item	Descriptions	2C	3C	Kansaiplascon	Jotun	PPG	Stoncor	AkzoNobel
1	Degreaser	Y	Y	M/Care Aquasolve Degreaser	HD Degreaser	GP Cleaner 5011	Carboclean 250	FIXIT Degreaser
2	Primer: High build aluminium pigmented surface tolerant epoxy	Y	Y	Plascotuff 3500 (Alu)	Jotamastic 90 (Alu)	SigmaCover 380	Carboguard 890 (Alu)	Interseal 670 HS (Alu)
3	Intermediate coat: High build micaceous iron oxide epoxy	N	Y	Plascotuff 3500	Jotamastic 90	SigmaCover 380	Carboguard 880	Intergard 475 HS
4	Topcoat: Aliphatic acrylic polyurethane	Y	Y	Plascothane 9000	Hardtop XP	SigmaDur 550	Carbothane 137HS	Interthane 990

16.5 Coating Products for WVPS01 (Weathered vinyl/ enamel painted steel and fasteners, and recoating with epoxy/ urethane products)

Item	Descriptions	2C	3C	Kansaiplascon	Jotun	PPG	Stoncor	AkzoNobel
1	Degreaser	Y	Y	M/Care Aquasolve Degreaser	HD Degreaser	GP Cleaner 5011	Carboclean 250	FIXIT Degreaser
2	Primer: High build aluminium pigmented surface tolerant epoxy- must adhere to existing paint system	Y	Y	Plascotuff 3500 (Alu)	Jotamastic 90 Alu	SigmaFast 205	Rustbond Penetrating Sealer	Interseal 670 HS (Alu)
3	Intermediate coat: High build micaceous iron oxide epoxy	N	Y	Plascotuff 3500	Jotamastic 90	SigmaCover 380	Carboguard 880	Intergard 475 HS
4	Topcoat: Aliphatic acrylic polyurethane	Y	Y	Plascothane 9000	Hardtop XP	SigmaDur 550	Carbothane 137HS	Interthane 990

16.6 Coating Products for SCPSO1 = STUBPS01 + CONPS01, for steel (stub and connected steel/ bolts), and concrete

Item	Descriptions	Kansaiplascon	Jotun	PPG	Stoncor	AkzoNobel
1	Degreaser	M/Care Aquasolve Degreaser	Galvanised Metal Cleaner / HD Degreaser	GP Cleaner 5011	Carboclean 250	FIXIT Degreaser
2a	Prime coat for steel and bolts: Zinc rich	Plascozinc 3	Barrier 80 S	SigmaZinc 109HS	Carbozinc 859	Interzinc 52
2b	Stripe coat on steel and bolts	Plascozinc 3	Barrier 80 S	SigmaZinc 109HS	Carbozinc 859	Interzinc 52
3	Intermediate coat for steel and bolts: High build micaceous iron oxide epoxy	Plascotuff 3500	Jotamastic 90	SigmaCover 380	Carboguard 880	Intergard 475 HS
4	Prime coat for concrete	Plascoguard Gehopon 7 Sealer	Penguard Clear Sealer	SigmaPrime 200	Stonprime 639	Intergard 740 (Thin at 30%)
5	Topcoat for steel, bolts and concrete: Aliphatic acrylic polyurethane	Plascothane 9000	Hardtop XP	SigmaDur 550	Carbothane 137HS	Interthane 990

16.7 Coating Products for ESPS01 (Earth-strap):

Refer to requirements under Painting system for earth-strap.