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Title: **Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings**      Unique Identifier: **240-106365693**

Alternative Reference Number: **N/A**

Area of Applicability: **Engineering**

Documentation Type: **Standard**

Revision: **1**

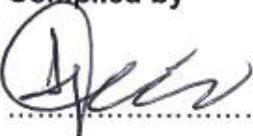
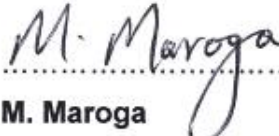

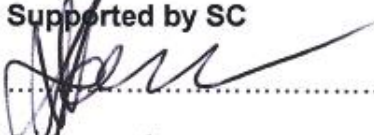
Total Pages: **70**

APPROVED FOR AUTHORISATION

TECHNOLOGY ENGINEERING  
DOCUMENT CENTRE ☎ x4962

Next Review Date: **September 2022**

Disclosure Classification: **Public Domain**

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PCM Reference : **240-53458841**  
SCOT Study Committee Number/Name : **Water Sciences and Technology**

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## **1. INTRODUCTION**

This Standard covers general plant and equipment on all power stations including coal fired, nuclear (Conventional Island), pumped storage and gas turbine installations.

The selection of coating materials for corrosion protection service is directly dependent upon the operating environment. Each specific environment will require a specific coating material. This Standard describes the procedure for the selection and application of coatings for the external corrosion protection of plant, equipment and associated piping systems. The type of input information required for the compilation of these proposed specifications is given in Annexure C.

A number of different organic and inorganic coating materials are available for the external protection of components; these include, but are not limited to, the following:

1. Alkyds
2. Enamels
3. Acrylics
4. Solvent borne or solvent free epoxies
5. Elastomeric or rigid polyurethanes
6. Glass filled polyesters or vinyl esters
7. Zinc Coatings
8. Powder coatings

## **2. SUPPORTING CLAUSES**

### **2.1 SCOPE**

#### **2.1.1 Purpose**

This Standard focuses on the use of coatings as a means of corrosion protection for mild steel substrates exposed to atmospheric conditions.

Selection criteria of generic coating systems for the typical environments and substrate materials should be based on past experience, proven case histories and current international practice.

With the exception of circumstances as described in Section 2.5 (g) and 4.2 in all other cases the Contractor shall be responsible for proposing suitable protective coating systems based on the information provided by the Eskom Engineer in Annex C. The proposed suitable coating system/s shall be submitted to Eskom at the time of tender for review and acceptance.

Any specific queries or requirements not covered by this Standard shall be referred to the Eskom Engineer.

The Standard requirements detailed herein shall not be modified in any way without the written approval of the Eskom Engineer.

#### **2.1.2 Applicability**

This Standard applies to general plant and equipment exposed to atmospheric conditions and the external surfaces of buried piping.

This standard is applicable to situations where the selection and application is performed by external contractors as well as Eskom Maintenance departments.

When considering protective coatings for environmental exposure there are several parameters and aspects that require closer scrutiny especially in cases of significantly sized project packages and or in severely corrosive environments. Examples of these are of components and piping systems exposed to marine and industrial atmospheres. In these instances the Corrosion Department of Eskom, RT&D, must be consulted with detailed proposals submitted by the Contractor. RT&D will be able to provide recommendations on a case by case basis. These recommendations will be based on project size, severity and uniqueness of the environment as well as life cycle costing issues.

## **2.2 NORMATIVE/INFORMATIVE REFERENCES**

Parties using this document shall apply the most recent edition of the documents listed in the following paragraphs.

### **2.2.1 Normative**

- |             |  |
|-------------|--|
| ASTM D4414: | Standard practice for measurement of wet film thickness by notch gauges.   |
| ASTM E376:  | Measuring coating thickness by magnetic field or eddy current electromagnetic test methods.  |
| ASTM D4541: | Standard Method for Pull-off Strength of Coatings using Portable Adhesion Testers.   |
| ISO 12944:  | Paint and varnishes – Corrosion protection of steel structures by protective paint systems. Parts 1 to 8.  |
| ISO 4628:   | Paints and varnishes – Part 1 to 6.  |
| ISO 8501-1: | Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 1: Rust grades and preparation grades of uncoated steel substrates and of steel substrates after overall removal of previous coatings.                                 |
| ISO 8501-4: | Preparation of steel substrates before application of paints and related products – Visual assessment of surface cleanliness – Part 4: Initial surface conditions, preparation grades and flash rust grades in connection with high-pressure water jetting.  |
| ISO 8502-3: | Preparation of steel substrates before application of paint and related products – Tests for the assessment of surface cleanliness-Part 3: Assessment of dust on steel surfaces prepared for painting (pressure sensitive tape method).  |
| ISO 8503-4: | Preparation of steel substrates before application of paint and related products – Surface roughness characteristics of blast cleaned steel substrates – Part 4: Method for the calibration of ISO surface profile comparators and for the determination of surface profile – stylus instrument procedure. |
| ISO 8504:   | Preparation of steel substrates before application of paint and related products – Surface preparation methods.  |
| ISO 4624:   | Paints and varnishes – Pull-off test for adhesion.   |
| ISO 9001:   | Quality Management Systems – Requirements.   |
| SANS 1217:  | Guidelines for internal and external organic coating protection for buried steel pipelines.  |
| SANS 1091:  | National colour standard.  |
| SANS 10140: | Identification Colour Marking.   |

- SANS 10064: The preparation of steel surfaces for coating.
- SANS / ISO 2808: Paints and varnishes – Determination of film thickness.
- SANS 5159: Adhesion of paint and varnish films (cross cut test).
- SANS 5769: Cleanliness of blast cleaned surfaces for painting (assessed by freedom from dust and debris).
- SANS 5772: Profile of blast cleaned surfaces for painting (determined by a micrometer profile gauge).
- SANS 5870: Hardness of vulcanized rubbers of hardness 30 — 95 degrees.
- SIS 055900: Swedish Code of Practice – Pictorial surface preparation standard for painted steel surfaces.
- 34-1658: Distribution Standards – Part 0: Corrosion Protection Specification for New Indoor and Outdoor distribution Equipment, components, materials and structures manufactured from steel.

### 2.2.2 Informative

None

### 2.3 DEFINITIONS

Definition	Description
approved	Refers to written approval by Eskom.
applicator	Refers to personnel applying the coating system. Coating applicators/painters qualified to SAQCC (Corrosion Protection) Module PA1 'General Heavy Duty Coatings Applicator'.
coat/coating/film	A continuous film of paint resulting from a single application on the outer surface of a component.
coating/paint system	"Coating/paint system" is an all-embracing term including method and degree of surface preparation, generic type, thickness and number of coats and the method of application of the coats.
contractor	The coating applicator or Contractor having the main Contractual responsibility to Eskom.
dry film thickness/nominal	The thickness of a coating remaining on the surface when it has hardened, the dry film thickness specified for each coat or for the entire paint system to achieve the required durability.
durability	The expected life of a coating system.
generic coating	Refers to a type of product e.g. epoxy, polyurethane, etc.
inspector	Coating inspectors qualified to SAQCC (Corrosion Protection) 'Coating Inspectors' Level 1 (shop inspections) or Level 2 (site inspections) or NACE Coating Inspection Programme (CIP)
manufacturer	The manufacturer of the coating material and associated products such as primers, adhesives, solvents, cleaners etc.
maintenance	The sum of all measures which ensure that the function of the protection against corrosion is maintained.
primer	The base coat of a bonding system, which is applied directly to the metal substrate. This coat provides the link between the substrate and the topcoat.
project	The whole of the work for which the Standard is developed.

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reference areas	Suitable areas on the structure used to establish a minimum acceptable standard for the work, to check that data is correct and to assess coating performance.
substrate	A surface which has been prepared by grit blasting, followed by the application of the coating system.
surface preparation	The preparation of a substrate prior to applying the coating, i.e. welding, grinding, blasting, cleaning, application of tie coats.
specification	A technical document describing all the requirements that are to be observed when using protective coatings systems to protect against corrosion.
specified	Conditions agreed to at the time of Contract award. These may not be altered unless agreed to by the Contractor and the Eskom Engineer
supervisor	Refers to a person having a minimum of two years' experience in the field of surface preparation and application of surface coatings. Competent site supervisors qualified to SAQCC (Corrosion Protection) Module PS1 'General Painting Supervisors'.

### 2.3.1 Disclosure Classification

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### 2.4 ABBREVIATIONS

Abbreviation	Description
ASTM	American Society for Testing and Materials
DFT/NDFT	Dry Film Thickness/Nominal Dry Film Thickness
EID	Electrical Insulation Defect
ISO	The International Organization for Standardization
NOSA	National Occupational Safety Association
OHS	Occupational Health and Safety
QC	Quality Control
QCP	Quality Control Plan
RT&D	Research Testing and Development
SANS	South African National Standards
SAQCC	South African Qualification and Certification Committee for Corrosion Protection

### 2.5 ROLES AND RESPONSIBILITIES

- a) The Contractor shall be responsible for quality assurance and control. Any approval, check, certificate, consent, examination, inspection, instruction, notice, proposal, request, test, or similar act by Eskom (including absence of disapproval) shall not relieve the Contractor from any responsibility under the Contract, including responsibility for errors, omissions, discrepancies and non-compliances.
- b) The Contractor shall take note of and respond to any comments made by Eskom on the Contractor's documents. However, Eskom is not bound to check the Contractor's documents for any errors, omissions, ambiguities or discrepancies or compliance with the requirements of the Contract. Eskom's receipt of, or review of, or comment on, the Contractor's documents will not relieve the Contractor from responsibility for the Contractor's errors or omissions or departure from the requirements of the Standard.

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- c) Any such approval or consent, or any review shall not relieve the Contractor from any obligation or responsibility.
- d) The Eskom Engineer shall ensure that this Standard is utilised for compiling an enquiry for the external corrosion protection of plant, equipment and associated piping with coatings.
- e) At the time of tender enquiry the Contractor will receive the completed information sheet ANNEXURE C: QUESTIONNAIRE FOR THE SELECTION OF SUITABLE COATING FOR THE EXTERNAL CORROSION PROTECTION OF PLANT, EQUIPMENT AND ASSOCIATED PIPING from the Eskom Engineer. The information sheet shall contain all of the information that the Contractor needs to be able to select the correct coating compound and application procedure.
- f) Annexure C is specific to a given environment and as such a separate Annexure C shall be completed for each environment to which the component is exposed i.e. industrial is regarded as a different environment to the inside of a plant. The Eskom Engineer shall be responsible for correctly populating all required information requested on the Questionnaire/s.
- g) In certain instances this Standard will be accompanied by an Annexure D. The Eskom Engineer is required to consult with the Corrosion Department of Eskom, RT&D in compilation of specific requirements. In these instances Annexure D will specify Eskom's selection for all or part of the project and shall apply accordingly.
- h) In the absence of Annexure D, in all other cases the Contractor shall be fully responsible for the selection of the coating system.
- i) The Contractor shall be fully responsible for the control and execution of the successful application of coating systems above. The Contractor should note that Eskom will not be liable for any rectifications, additional costs, etc. as incurred by the Contractor, any of his / other Sub-Contractors or the coating manufacturer as a result of potential coating failures, re-work, additional work, etc. during the execution of the coating activities.
- j) The Eskom Engineer shall be responsible for consulting with the Corrosion Department of Eskom, RT&D in order to assess the requirement relating to the request for all Mandatory Tender Returnables described in Section 3 below.
- k) In the event that no instruction to waive specific requirements in terms of the above are detailed in the Tender or Scope of Works information then the Contractor shall comply with all the requirements as required in Section 3.
- l) This Standard provides a high level indication of Eskom's requirements with regards to external coating systems for steel substrates in atmospheric or indoor applications. The Contractor is responsible for using the Standard requirements in this document in the process of deciding which coating system he intends proposing to the Eskom Engineer for use in a specific application.
- m) The Contractor shall be responsible for ensuring that all Sub-Contracting parties such as the coating applicator and the coating manufacturer are fully conversant with the requirements of this Standard and referenced standards in this document.
- n) Any specific queries or requirements not covered by this Standard shall be referred to the Eskom Engineer.
- o) The Contractor shall be responsible for ensuring that he is fully conversant with the requirements of this Standard. In the event of conflict between this document and the referenced standards, the requirements of this document shall prevail.
- p) The Contractor shall take full responsibility for all aspects related to the coating system proposal and the successful application and quality thereof, including but not limited to the following aspects:



- Coating system selection
  - Logistics
  - Product chemical formulation control
  - Application nuances & procedures
  - Surface preparation & over-coating period details
  - Any potential deviations/additional requirements to the product data sheet requirements
  - Additional costs not envisaged or that arise in successfully applying the proposed coating systems to be borne by the Contractor.
- q) Eskom's representative/s and/or third party/independent inspection authority shall have un-hindered access to witnessing all testing processes at both the coating manufacturing facility and coating applicators' facility.

## **2.6 PROCESS FOR MONITORING**

- a) The Corrosion Department of Eskom, RT&D, must be consulted with detailed coating system proposals submitted by the Contractor. RT&D will be able to provide recommendations on a case by case basis. The level of involvement by RT&D will be based on project size, severity and uniqueness of the environment and will be decided between RT&D and the respective Eskom Engineer prior to the pre-job meeting.
- b) A pre-job meeting to discuss and analyse the procedures and processes to be used on the project shall be held prior to commencement of the work. The purpose of the pre-job meeting would be to ascertain specifics in relation to this Standard. Attendance shall include the Eskom Engineer, Contractor, manufacturer, applicator and inspector. The requirement for attendance/involvement by RT&D will be based on project size, severity and uniqueness of the environment and will be decided between RT&D and the respective Eskom Engineer prior to the pre-job meeting.
- c) Quality Control and assurance functions, processes and requirements are described in subsequent sections of this Standard.

## **2.7 RELATED/SUPPORTING DOCUMENTS**

Not Applicable

## **3. MANDATORY TENDER DOCUMENTS**

The following section describes the exhaustive list of documents to be submitted by the Contractor for the proposed coating manufacturer and applicator. The Eskom Engineer, in the enquiry document, shall state which of these documents are mandatory tender returnable documents. If mandatory documents are not provided at the tender stage, the tender (for the corrosion protection aspects contained in this Standard) will be considered technically non-compliant and will not be evaluated. The Eskom Engineer, as part of the enquiry, shall provide the Contractor with a list of documents which will be required for tender evaluation purposes and will also indicate when the remaining documents from the list below will be required.

All tender returnable documents to be compiled in English.

### **3.1 COATING MANUFACTURER TENDER DOCUMENTS**

Documentation and information (specific to this project) to be provided from the coating manufacturer shall include:

- a) A Quality Management System that meets or exceeds the requirements of ISO 9001. Relevant and applicable quality certification and the quality management policy to be submitted.
- b) Name of manufacturing facility, web address, e-mail address, contact telephone number and physical address.
- c) Product and system selection, including details of number of coats, NDFT and Maximum DFT for each layer. In each case the manufacturer shall provide recommendations and criteria in the event of coatings inadvertently applied in excess of the Maximum DFT.
- d) Provide the latest product and material safety data sheets as well as manufacturing batch certificates for each of the products being proposed. In the case of batch certificates where twin pack material applies then separate batch certificates for each pack shall apply.
- e) Product data sheets shall contain the following as a minimum.
  - A description of the generic type of paint
  - General properties
  - Recommended and non-recommended uses
  - Service temperatures and chemical resistance limits
  - Surface preparation
  - Application conditions and details including but not limited to: DFT, Over-coating, compatibility, application temperatures, dilutions, application techniques and curing times.
- f) The Product Data Sheet/s shall be signed by the manufacturer, Contractor and applicator. The signed Product Data Sheet/s shall be deemed to be part of this Standard and any further/other subsequent revisions of the Product Data Sheet/s shall be submitted to the Eskom Engineer for reacceptance clearly stating the variations/deviations. No further use/application of the related product is permitted until acceptance by Eskom.
- g) Manufacturing batch certificates containing (as a minimum) the information described in Section 4.6 (h).
- h) For each of the proposed systems submit a coating procedure, indicating (as a minimum) requirements for surface preparation, Min/Max DFT and NDFT's, over-coating times, special requirements or precautions i.e. over-coatability etc.
- i) Maximum continuous and non-continuous operating temperature limitations of each of the proposed coating product/system.
- j) Provide verifiable/auditable evidence that each of the proposed products and systems (for equivalent or greater surface areas as required by this project) has been successfully applied in comparable environments. In this regard two separate projects older than 10 years and three projects completed within the last five years shall be listed. Products that were used in these projects shall have been manufactured by the same facility as in (b) above. The listing shall include contact details for the listed reference projects.

- k) The manufacturer shall propose suitable acceptance criteria specifically in terms of all possible damage and coating deterioration mechanisms as defined in ISO 4628 Part 1 to 6 for each of the systems and then specific coats in the system in the event that these are damaged during the course of the system application i.e. mechanical damage, weathering or aging before application of the subsequent coat. The acceptance criteria will be reviewed by Eskom prior to tender award.
- l) To ensure minimum acceptable work standards, verifiable manufacturer or Contractor data and to assess coating performance, reference areas as prescribed in ISO 12944 - 7 and 8 are required. The manufacturer is required to provide written commitment to this requirement (details as per ISO 12944 - 7).
- m) After tender award and prior to project execution the manufacturer shall submit samples of each coating product and the coating system as proposed in the tender submission. For each product and part of system (step by step) until complete system, two samples will be required for reference purposes. The samples (substrates) shall be prepared as per the requirements of the manufacturer's datasheet and in compliance with the requirements of this Standard. The coating products shall also be applied in accordance with the datasheet. The size of the test sample panels shall be (100mm X 200mm X 2mm). The coating shall be cured as would be in practical situations without any artificial assistance. The manufacturer shall supply the relevant batch certificate for each of the coating products used in the submitted test sample panels.
- n) Eskom shall retain these samples and reserves the right to perform laboratory tests and destructive analysis to confirm/ascertain coating characteristics both prior to tender award and then during various future phases of the project. No deviation in formulation during the execution of the project will be permitted without Eskom approval.
- o) Provide an organogram, specific to this particular supply, detailing all the positions and individuals responsible for technical expertise and logistic support. Curriculum Vitae of these key personnel shall be included with the submission. Suitably qualified technical backup/support, Quality Assurance and Quality Control personnel are considered key in the manufacturing process. In this regard, details of the personnel number, qualification type, level and experience to be provided as part of the organogram.
- p) If no exclusions or qualifications are submitted at the time of tender, the requirements as prescribed in this Standard and/or ISO 12944: Parts 1 to 8 shall apply.

### **3.2 CONTRACTOR COATING APPLICATOR TENDER DOCUMENTS**

Documentation and information (specific to this project) to be provided by the Contractor for the proposed coating applicator shall include.

- a) A Quality Management System that meets or exceeds the requirements of ISO 9001. Relevant and applicable certification and the quality management policy to be submitted.
- b) In the event that painting in a workshop is required then provide the name of the company, facility, web address, e-mail address, contact telephone number and physical address.
- c) Provide verifiable/auditable evidence that the proposed applicator has experience in the application of each of the same proposed products and systems, for similarly sized projects in comparable environments. In this regard two separate projects older than 10 years and three projects within the last five years shall be listed. The listing shall include contact details for the listed reference projects.

- d) If Eskom has previously not assessed and suitably approved the proposed applicator according to the requirements of this standard then the Contractor shall conduct an assessment using the criteria in Annex A and document/record the assessment using Annex B as a basis. The Contractor shall rate the applicator and sign the Annex B form and submit it with the tender.
- e) To ensure minimum acceptable work standards, verifiable manufacturer or Contractor data and to assess coating performance, reference areas as prescribed in ISO 12944 - 7 and 8 are required. The applicator is required to provide written commitment to this requirement (details as per ISO 12944 - 7).
- f) Provide an organogram, specific to this particular supply, detailing all the positions and individuals responsible for technical expertise and logistic support. Curriculum Vitae of these key personnel shall be included with the submission. Suitably qualified applicators, supervisors and inspectors are considered key in the application process. In this regard details of personnel number, qualification type, level and experience to be provided as part of the organogram and to be aligned with the requirements of Annex A and B.
- g) If no exclusions or qualifications are submitted at the time of tender, the requirements as prescribed in this Standard and/or ISO 12944: Parts 1 to 8 shall apply.
- h) Joint performance guarantees provided by the Contractor in collaboration with the coating manufacturer & coating applicator for the applied coating systems as described in detail in Section 4.13 of this Standard.

## **4. REQUIREMENTS**

### **4.1 SPECIFIC REQUIREMENTS**

- a) In all cases the degree of cleanliness for coating systems shall be Sa 2.5 in accordance with ISO 8501/1.
- b) In cases that are considered critical and strategic, coating shall only be performed by applicators with a rating of 3 as defined in 4.3.2 (c).

### **4.2 APPROACH OF THIS STANDARD TO LOW RISK, LOW IMPACT, GENERAL, SPECIAL OR CRITICAL “WORKS PACKAGES” OR APPLICATIONS**

- a) Eskom reserves the right to request all or part of the Mandatory Tender Documents as described in Section 3 depending on the criticality and project magnitude. If certain returnable documents are deemed unnecessary or not applicable by Eskom these will be explicitly listed in the Tender or “Works” information documentation. In all other cases all requirements of Section 3 shall apply.

### **4.3 GENERAL REQUIREMENTS**

#### **4.3.1 Design Considerations**

- a) Steel components shall be designed to be accessible for the purposes of applying, inspecting and maintaining the protective coating system.
- b) The guidelines to ensure accessibility and suitability for painting shall be drawn from ISO 12944-3: ‘Paint and varnishes – Corrosion protection of steel structures by protective paint systems’ Part 3 – ‘Design considerations’.

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#### **4.3.2 Contractor Skills and Competency**

- a) The Contractor shall ensure that there are at all times sufficient suitably qualified, experienced and skilled staff to carry out and supervise all activities.
- b) Staff shall be qualified in terms of the South African Qualification and Certification Committee for Corrosion Protection {SAQCC (Corrosion Protection)} as follows:
  - Applicators: General Heavy Duty Coatings Applicator (PA1)
  - Supervisors: General Paint Supervisors (PS1)
  - Inspectors: Coating Inspectors (Level 1 or Level 2) or NACE CIP Level 1, 2 or 3
- c) The Contractor shall meet the **REQUIREMENT CRITERIA FOR CORROSION PROTECTION COATING APPLICATORS** (See Annexure A) and shall have been rated in accordance with the **CAPABILITY CHECKLIST FOR CORROSION PROTECTION COATING APPLICATORS** (See Annexure B).

#### **4.4 EQUIPMENT**

##### **4.4.1 Measuring and Test Equipment**

- a) The Contractor shall have a blast profile gauge, wet film comb, and a dry film thickness gauge at the shop/site at all times. The Contractor shall also have at the shop/site instrumentation to measure the psychrometric conditions and the substrate temperature.
- b) The electronic dry film thickness gauge shall conform to the requirements of SANS ISO 2808 and shall be calibrated using the smooth calibration disc supplied by the instrument manufacturer.
- c) All test equipment and shims shall have current calibration certificates.

##### **4.4.2 Spray Equipment**

- a) The spray equipment used shall be capable of properly atomising the material and shall be equipped with suitable pressure regulators and gauges. Air caps, needles and nozzles shall be of the type recommended by the coating manufacturer.
- b) All spray painting equipment shall be fitted with suitable oil and moisture traps.

##### **4.4.3 Blast Cleaning Equipment**

- a) Industrial type surface preparation apparatus shall be used to ensure effective and time-efficient cleaning of surfaces. Effective oil and water separators shall be installed and utilised on all airlines used for abrasive blast cleaning. The separators shall be of the 'cartridge' type.

##### **4.4.4 Power Mixers**

- a) All coatings shall be mixed with power mixers. Low speed mixers which do not induce air into the coating shall be utilised.

#### **4.5 COATING MATERIALS**

- a) All materials, i.e. paint, solvents and cleaning agents for a specific paint system shall be supplied by the same manufacturer.

- b) The solvents used shall be those recommended and 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.
- c) Excessive dilution of paints is not permitted. Solvent additions for application purposes shall be in strict accordance with the coating manufacturer's Product Data Sheet.
- d) The maximum capacity of containers shall be 25 litres. Where required, the coating containers shall be of a size large enough to allow mixing in the containers themselves.
- e) The coating manufacturer's recommended shelf life and other storage requirements shall be met.
- f) The colours of the paints to be used shall be as specified by the Engineer. 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 and other relevant information.
- g) All materials (coatings/linings) shall be regularly tested at the manufacturers' factories and bench marked against international versions. The Contractor must make sure that regular quality control tests are carried out to ensure that good quality of the materials is maintained. The results of these tests are to be submitted to the Eskom Engineer.

The following properties shall be closely monitored:

- Quality of raw materials
  - Analytical formulation of finished products
  - Percentage solids by volume
  - Specific gravity
  - Colour and gloss
  - Drying time
  - Viscosity
- h) The Contractor shall ensure that the colour selection of the coat immediately prior to the finishing coat shall be suitable for complete obliteration by the finishing coat.

## **4.6 SURFACE PREPARATION**

### **4.6.1 General**

- a) Sharp edges shall be dressed to a radius of not less than 2 mm, but no more than half of the section thickness. All burrs, rags and weld spatter shall be removed as per the requirements of ISO 12944-3.
- b) Welds shall be free from imperfections (e.g. asperities, undercutting, blowholes, craters, and spatter) which are difficult to cover effectively with a protective paint system. The onus is on the Contractor to ensure that the surfaces are ready for coating.
- c) Preparation of concrete surfaces shall at least include:
  - removal of ridges.
  - rounding of steps.
  - removal of laitance.
  - plugging of holes and honey combing where hole diameter > 15mm and depth > 5mm.

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- removal of curing compound and shutter oils where these are apparent or could be “harmful” to the coating system.
  - removal of grease and oil.
  - careful dust removal.
- d) It is extremely important that the Contractor endeavours to achieve the best surface preparation possible by using the latest technology when it comes to surface preparation apparatus and materials. The minimum degree of surface preparation shall be as stipulated in the detailed coating specifications.

#### **4.6.2 Pre-cleaning**

- a) Oil and grease shall be removed by high pressure water washing with detergent solution and rinsing with clean water prior to abrasive blast cleaning and application of coatings.
- b) Chemical and cleaning contamination shall be removed by means of neutralising or flushing or both. It is important that clean potable water is used for cleaning, or the surfaces will be left contaminated after washing. The surfaces shall thereafter be allowed to dry completely prior to coating or before continuing with the rest of the surface preparation process.

#### **4.6.3 Mechanical and Hand Cleaning**

- a) Mechanical and hand cleaning shall be in accordance with the procedure specified in Clause 5.4 of SANS 10064 (ISO 8540).
- b) The standard of surface preparation shall be in accordance with ISO 8501/1 and as specified in the relevant coating system.
- c) Cleaning by means of hand or power-tools, i.e. wire brushes, chipping hammers, scrapers, grinders, sanders, needle descalers etc. may only be used where specified in the generic coating specification and the condition of the substrate metal is such that efficient cleaning can be achieved and where the protective system is designed for application to brushed or ground surfaces, e.g. in the case of surface tolerant coatings.

#### **4.6.4 Abrasive Blast Cleaning**

- a) Abrasive blast cleaning is by far the preferred method for surface preparation and shall always be considered first before any other cleaning method is used.
- b) Abrasive blast cleaning shall be carried out in accordance with Clause 5.3 of SANS 10064 (ISO 8504) and the degree of cleanliness achieved shall be Sa 2.5 in accordance with ISO 8501/1.
- c) The profile, peak to valley, when measured by SANS 5772 (ISO 8503-4), shall be as specified in the relevant manufacturer’s Product Data Sheet for the primer coating being used.
- d) In general an anchor profile height of 25 to 75µm is recommended for most industrial coating systems up to a dry film thickness of about 250 micron. However, in the case of heavy-duty thicker film systems, the anchor profile needs to be increased in order to cope with the mounting stresses exerted by the coating.

- e) The required blast profile height shall be carefully considered and be within the range of the specified coating system, and as recommended in the Product Data Sheets. It is important that the blast profile does not exceed the specified thickness of the primer or first coat, especially where delays in overcoating are expected / encountered. Any primed or coated surfaces showing signs of “measle” corrosion shall be considered defective and shall be re-blasted.
- f) Good quality abrasives shall be used in order to minimise the amount of waste grit being generated and contamination of the surfaces.
- g) The abrasive may be any abrasive material (except silica sand) which meets the following requirements. It shall be suitable for the substrate. It shall be composed of clean, sound, hard particles free from foreign substances such as dirt, oil, grease, toxic substances, organic matter and water soluble salts. It shall be capable of producing the surface profile as specified for the relevant coating system. The use of re-cycled blasting media is not allowed for the final blast.
- h) The Contractor shall ensure that abrasive materials used conform to all national health and safety standards such as the OHS Act.
- i) All abrasive media shall be stored in an area that is completely dry and covered to allow for good preservation of the materials.
- j) In all cases, after blast cleaning, all traces of blasting media and dust shall be removed from the surface by vacuum cleaning. Cleaned surfaces shall not be contaminated with blast media, oil, grease, rust or other deposits before coating.
- k) Sweep blasting (Micro Blasting) of Galvanized Surfaces shall be carried out only where stipulated in the generic coating system and shall be in accordance with clause 4.3.3 of SAHDGA 01-1990 – Code of Practice for Surface Preparation and Application of Organic Coatings.
- l) The sweep blasting (Micro Blasting) of Galvanized Surfaces must not damage the galvanized surface or remove any of the zinc layer.

#### **4.6.5 Surface Cleanliness**

- a) No coating shall be applied to any surface containing traces of grit, grease, oil, loose rust, mill scale, surface contaminants (i.e. dust), chemical fall-out, salt deposits or corrosion products of any kind.
- b) Chalked, cracked, blistered, rusting, flaking primer/s or intermediate coat/s that have been allowed to age or weather shall not be coated. The requirements of ISO 4628 shall apply in these cases. It is therefore a requirement that the coating manufacturer shall propose suitable acceptance criteria specifically in terms of all possible damage and coating deterioration mechanisms as defined in ISO 4628 Part 1 to 6 for each of the systems and then specific coats in the system. The acceptance criteria will be reviewed by Eskom prior to tender award.
- c) The following requirements shall apply prior to coating application:
  - Freedom from dust and debris shall be less than ‘dust quantity rating’ 1 when tested in accordance with ISO 8502-3.
  - If the blast cleaned surface changes colour, or rust bloom begins to form, the surface shall be re-blasted.

#### **4.6.6 Soluble Salts**

- a) Soluble iron salts such as ferrous chloride and ferrous sulphate are found on surfaces in marine and industrial environments. As these salts are soluble in water they can cause osmotic blistering of coatings which are applied to the steel and must be removed prior to painting.
- b) Soluble salts shall be removed by cleaning and flushing with fresh potable water. Persistent salt deposits may be removed by proprietary solutions with the prior approval of the coating manufacturer and the Eskom Engineer.
- c) All forms of soluble salts levels shall be measured using approved methods such as Weber Reilly Soluble Salts Test Kits or equivalent. The acceptable level of salts shall be as specified by the coating manufacturer.

### **4.7 COATING APPLICATION**

#### **4.7.1 Approval**

- a) No work shall be performed until the Quality Control Plan is approved by Eskom.

#### **4.7.2 Mixing**

- a) The Contractor shall ensure that all paints are mixed in accordance with the manufacturer's instructions.
- b) In the case of two pack materials, the splitting of kits as supplied from the factory is not permitted. The Contractor either has to make use of smaller kits or needs to plan the work in such a way that any unnecessary wastage of paint is avoided.
- c) During application, containers shall be agitated often enough to keep pigments in suspension.

#### **4.7.3 Coating**

- a) All surfaces shall be coated as specified. Surfaces which do not require coating shall be suitably protected.
- b) To ensure minimum acceptable work standards, verifiable manufacturer or Contractor data and to assess coating performance, reference areas as prescribed in ISO 12944 - 7 and 8 are required.
- c) The primer coat shall be applied as soon as possible after the surface preparation operation during the same shift as the blast cleaning operation, but under no circumstances may the primer be applied over rust bloom or over surfaces that have changed colour due to humidity or other contamination.
- d) Coating application and cleaning shall not take place when site conditions are likely to negatively affect these operations. The Contractor shall ensure that the necessary protective equipment is used to prevent contamination of the coatings and to minimise delays due to such site conditions
- e) Successive coats shall be of distinctly different colour to the previous coat to ensure correct intercoat coverage. However, two finishing coats of the same colour may be applied to achieve complete colour uniformity. Special attention shall be given to cracks, crevices and edges to ensure complete coverage and paint thickness. All finishing colours shall be to the Eskom Engineer's approval.

- f) On pre-coated surfaces all traces of soluble salts and other corrosive airborne contaminants shall be removed with potable water and surfaces shall be allowed to dry prior to further paint application.
- g) Concealed surfaces shall be completely coated. Suitable sponges may be used for application of coating to concealed surfaces or back to back angles. In the case where it is impractical to coat the concealed surface, the opening shall be sealed utilising an approved mastic material.
- h) All edges, corners, bolt holes, mouse holes, cut ends and weld beads shall be stripe coated by brush application, prior to the application of the intermediate coat. The stripe coating shall be an additional coat of the specified intermediate coat. In order to assist in its identification, the stripe coat shall be a different colour to both the specified intermediate coat and finishing coat. Under no circumstances shall stripe coating be carried out by roller or spray-application.
- i) The stripe coat is not intended to increase the overall specified dry film thickness of the system but to ensure that the minimum thicknesses required are actually achieved at edges.

#### **4.7.4 Application**

- a) Unless otherwise specified, all coatings applied in the shops or on site shall be applied by airless spray techniques.
- b) In instances where spray application is considered not to be possible, practical or feasible, this must be brought to the attention of the Eskom Engineer at the time of tendering.
- c) The Contractor should note that many of the high build coatings specified in the relevant systems are only capable of achieving their recommended film thicknesses by spray application. Other application methods such as brush and roller can result in lower film builds being achieved per coat.
- d) Unless otherwise specified, all application work shall be carried out in strict accordance with the recommendations and instructions given in the signed Product Data Sheet supplied by the coating manufacturer. This includes required climatic conditions, methods of surface preparation, substrate temperatures, blast profiles, over coating times, application equipment and methods to be utilised and pertinent requirements not listed in this Standard.
- e) In the case of equipment manufacturer's proprietary finishes on items such as pumps, motors, valves etc, these systems may only be used if prior approval has been obtained from the Corrosion Department at RT&D. Where the substrate has received a primer coat in the factory (e.g. galvanised substrate, metallised substrate) the Contractor shall check the compatibility of the coatings that he proposes with the primer coat, and is responsible for this choice.
- f) All coatings shall be evenly applied to form a smooth, continuous, unbroken coating free from tears, runs, sags, wrinkles, blisters, mud-cracking, change in colour or gloss, orange peel, visible pin-holes, dirt, dust or fluff occlusions or any other visible defects. Each coat shall provide complete coverage.
- g) Surfaces which rest on concrete or other floors shall receive the full coating system prior to erection.
- h) The Contractor shall take adequate precautions to protect areas being painted against contamination and fall-out from adjoining sections of the structure during painting operations, should this become necessary.

- i) Coated steel to be embedded in concrete or soil shall be painted so that the coated areas extend at least 100 mm into the concrete or soil, unless otherwise specified.
- j) Where surfaces are to be welded, no paint shall be applied within 50 mm of the weld and the subsequent intermediate and finishing coats (where applicable) shall be stepped at 25 mm intervals to produce a feathered edge for patch repairs after welding. The steps may be achieved by using masking tape at the time of surface preparation and coating applications. The masking tape on the blast cleaned surface adjacent to the weld area shall be left in place to provide temporary protection until the welding is carried out.
- k) The supplier shall apply the full painting system specified on the bearing surfaces of catwalks before the gratings or relevant floor sections are put in place.

#### **4.7.5 Ambient Conditions**

- a) Coatings shall not be applied under the following conditions:
  - When the surface may become damaged by rain, air borne dust, chemical fall-out, fog or condensation and it is anticipated that these conditions will prevail during the drying period, suitable enclosures shall be provided to protect the surfaces.
  - When the ambient air temperature or the steel temperature is outside the coating manufacturer's recommended range.
  - When the ambient relative humidity exceeds 85%.
  - Using the above data, the dew point shall be determined by means of a suitable dew point calculator. During coating application, the substrate temperature shall be at least 3°C above the dew point.

#### **4.7.6 Patch Repairs to Transport and Erection Damage**

- a) The Contractor shall be wholly responsible for surface preparation and coating application. The coated surfaces shall meet the minimum dry film thickness required by required by ISO 12944 'durability requirements'.
- b) Provisions must be made for the repair of handling damage to the coating after erection.
- c) Following erection, all areas of coating damage shall be patch repaired by brush application. The extent of the damage shall be carefully inspected to assess which coats in the system have been damaged. When the damage extends to the steel substrate, all coats in the system shall be re-instated. Areas to be primed shall be cleaned of dust, dirt, grease, salts or other deleterious matter and abrasive blast cleaned to grade Sa 3 of ISO 8501/1. All edges of existing coatings shall be feathered back to a hard edge. The patch primer used shall be in accordance with the requirements of the relevant coating system.

#### **4.7.7 Fasteners and Friction Grip Surfaces**

- a) All nuts and bolts shall be either 'black' or zinc coated as specified.
- b) Friction grip areas shall be left uncoated with the exception of steel work that is either galvanized or primed with inorganic zinc silicate. The uncoated friction grip areas shall be sealed to prevent the ingress of corrodants. The sealer used shall either be a polyisobutene coating, or recommended by the coating manufacturer as being suitable for the environment and compatible with the protective coating system. The sealing material shall be applied either by gun or spatula after erection. Where possible the sealant should be the same colour as the finishing coat

#### **4.7.8 Shop Painting**

- a) The contractor shall furnish the materials specified and ensure that they are applied in strict accordance with this standard.
- b) The contractor shall be wholly responsible for surface preparation and coating application. The coated surfaces shall meet the minimum dry film thickness required by required by ISO 12944 'durability requirements'.
- c) Provisions must be made for the repair of handling damage to the coating after erection.

#### **4.7.9 Site Painting**

- a) In situations where primer or first coats have been applied in the shop then the finishing coats being applied on site shall be sourced from the same manufacturer as the shop applied primer and intermediate coats.
- b) All shop coated surfaces shall be inspected and examined for mechanical damage on arrival on site. If the damage is excessive it may be preferable to repair this transport damage before erection whilst access is easier. Alternatively all repairs may be carried out after erection. Repairs shall be carried out in accordance with clause 4.7.6.
- c) If site respraying is necessary all other areas not to be painted shall be carefully masked. Any overspray which occurs despite this masking shall be removed by the Contractor.
- d) In the case where coating systems are to be applied in the shop and then later finished on site the Contractor/manufacturer shall define the acceptance criteria specifically in terms of all damage and coating deterioration mechanisms as defined in ISO 4628 Part 1 to 6. The acceptance criteria will be reviewed by Eskom prior to tender award.
- e) The shop applied coats must be thoroughly washed to remove all traces of dust, dirt, grease, salts or any other forms of surface contamination. Where deemed necessary, detergent cleaners, as recommended by the respective coating manufacturers, may be used.
- f) After cleaning, all areas of damaged coating shall be patch repaired as detailed in 4.7.6.
- g) Where more than one coat is being applied on site, surface preparation and washing as per 4.7.9 (h) above shall be carried out between coats in accordance with the coating manufacturer's data sheet.
- h) Where paint is allowed to age before finishing, the coating manufacturer may require that the surface be prepared by light sanding, scrubbing with potable water using a bristle brush and drying before overcoating.
- i) The applicator must continually involve and liaise with the paint manufacturer regarding the specific site conditions to confirm that the requirements as per the product data sheet are achieved. If unsure about over-coating on aged primer or subsequent coats then destructive tests shall be conducted to confirm the soundness of the application over aged primer.
- j) All coatings shall be given adequate time for curing prior to service. On average, for most organic coating systems, full cure is achieved after 7 days at 25°C providing good ventilation is maintained.



## **4.8 SAFETY PRECAUTIONS**

### **4.8.1 General**

- a) Special care needs to be taken when working with all organic coatings. Prior to the use of any coating material, the Material Safety Data Sheets shall be obtained from the relevant coating manufacturer. The Contractor/applicator shall be familiar with the contents of these safety data sheets and ensure that the necessary safety precautions are taken in order to comply with local and national safety and health requirements such as the OHS Act.
- b) During the application of all coatings, care shall be taken to ensure adequate ventilation to allow for good visibility and proper curing of the coatings and to avoid/minimise health and safety risks.
- c) Any solid waste materials or liquids stripped or generated during the coating operations shall be discarded in accordance with the requirements of the appropriate national and/or local authorities or the requirements of Eskom.
- d) The Contractor/applicator shall ensure that he complies with all statutory regulations, municipal by-laws, etc. concerning pollution and the health and safety of his personnel and members of the public who may be affected by his work.
- e) The Contractor/applicator shall provide for all necessary safety precautions and risk assessments.
- f) The Contractor/applicator shall advise Eskom of all hazardous materials to be brought on site.
- g) All painting materials on site shall be stored in designated areas in storage facilities that meet the storage requirements of the paint manufacturer and the safety requirements of the specific site.

### **4.8.2 Contractor's Safety File**

- a) The Contractor's safety officer shall prepare a Safety File for the area to be worked in.
- b) This Safety File shall address the hazardous activities of abrasive blast cleaning and spray painting. The Contractor/applicator shall verify that the personnel carrying out these activities are suitably qualified.

### **4.8.3 Fire Hazards**

- a) The Contractor/applicator shall ensure that adequate precautions are taken to avoid fire hazards.

### **4.8.4 Storage of Hazardous Materials**

- a) 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.
- b) Solvents and volatile materials shall be stored in designated areas.

### **4.8.5 Environment**

- a) The Contractor/applicator shall ensure that any solid waste materials or liquids stripped or generated during the surface preparation and coating processes are discarded in accordance with all statutory and regulatory requirements, or as governed by Eskom's Environmental Management Procedures.

#### **4.8.6 Scaffolding and Rigging**

- a) The Contractor/applicator shall provide and erect such scaffolds and rigging as may be required. All scaffolding and rigging shall comply with the requirements of the OHS Act.
- b) Temporary welded support elements are not permitted except where written approval has been granted by Eskom.

### **4.9 INSPECTION AND TESTING**

#### **4.9.1 Surface Preparation**

- a) The blast profile shall be measured in accordance with SANS 5772 (ISO 8503-4).

#### **4.9.2 Visual Inspection**

- a) Visual inspection for paint film defects shall be performed after each coat is applied. All defects including pinholes, runs, sags, dry spray etc. shall be corrected based on the requirements of ISO 12944 Part 4, before the next full coat is applied. Inspection and rectification shall be based on the requirements of ISO 12944 Part 4.

#### **4.9.3 Dry Film Thickness (DFT)**

- a) DFT shall be measured in accordance SABS ISO 2808 and instruments shall be calibrated using the smooth calibration disc supplied by the instrument manufacturer.
- b) The frequency of dry film thickness readings shall be a minimum of three reading per square metre of coated surface or more such as to be defined in the works package and documented in the applicable QCP, as agreed between the Contractor/applicator and the Eskom Engineer at the start of the coating applications.
- c) The product data sheet shall indicate the required minimum and maximum DFT. The DFT is given in a range for each coat in the relevant coating system. These are the required minimum and acceptable maximum thicknesses. No individual thickness shall be less than 80% of the specified minimum thickness and not more than 20% of thickness measurements taken shall be less than the specified thickness. No individual thickness shall be greater than 120% of the specified maximum thickness.
- d) Where excessive film thickness can be detrimental to the integrity of the coating, the manufacturer's recommended maximum thickness shall apply.
- e) The increase in thickness created by the application of the stripe coat shall not be used to justify recorded thicknesses that are in excess of the maximum specified thickness of the system.
- f) All deficient film thicknesses shall be rectified to the approval of the Eskom Engineer at the Contractor's expense.
- g) Actual readings and not averages shall be recorded.

#### **4.9.4 Adhesion Tests**

- a) Adhesion testing shall be based on the requirements of ISO 12944 Part 4.

- b) Random pull-off adhesion tests shall be carried out on the applied coatings using the ASTM D4541 test method. Adhesion (pull-off) values of the coating to the substrate (A/B) shall be a minimum of 5 MPa with no intercoat adhesion or cohesion failures as determined by a mechanically spring loaded pull-off tester and not by an hydraulic pull-off tester.
- c) The number and location of tests shall be agreed with the applicator at the start of the works. If testing results indicates deficiencies then the number of test will be increased accordingly. Inspection and rectification shall be based on the requirements of ISO 12944 Part 4.
- d) Repairs to the coating damaged by the tests shall be carried out in accordance with clause 4.7.6.

## **4.10 QUALITY ASSURANCE**

### **4.10.1 Contractor Qualification**

- a) The Eskom Engineer may, at his discretion, require a Quality Audit of the Contractor (coating applicator and coating manufacturer) to ensure adequate management, facilities and skilled staff to carry out the work in accordance with the Standard.
- b) The Contractor shall retain full responsibility for the quality of his work and of materials used, irrespective of any quality surveillance that may be carried out by the Eskom Engineer.

### **4.10.2 Quality Control**

- a) The Contractor shall have the necessary equipment and qualified staff to carry out the quality control required to ensure compliance with the Standard.
- b) Quality control shall be carried out by a qualified inspector who is independent of the application activities. Quality control cannot be carried out by the site supervisor or any member of staff involved in production and programming.
- c) The Contractor shall retain at least the following records:
  - Material batch records
  - Signed Product Data Sheets.
  - Psychrometric records (including steel temperatures).
  - Records of surface preparation.
  - Records of dates and times of the application of each coat including repair coats.
  - Dry film thickness measurements per coat including repair coats.
  - Records of specific tests as required by the Eskom Engineer.
- d) These records shall be kept in a format that meets the approval of the Eskom Engineer which will be agreed at the pre-job meeting.
- e) The cost of quality control shall be included in the Contractor's tender price.
- f) Before the commencement of the contract, the Contractor shall prepare the following:
  - A Quality Plan detailing each activity to be carried out during the execution of the works. Each activity shall be supported by a detailed Works Procedure for that activity. The Quality Plan shall also detail the inspection requirements of each specific activity, listing whether it is a review, witness or hold point, and defining the responsibilities of the various parties at each stage of the works.

- The Safety File as required in 4.8.2.
  - The joint guarantee with the applicator and coating manufacturer as required in 4.13.
- g) The Contractor shall provide the necessary documentation to be used during all quality control inspections. Such documentation shall be reviewed and accepted by the Eskom Engineer before coating commences.
- h) The Contractor shall produce evidence that he has copies of, and understands, all reference documents listed under Section 2.2 'References'.

#### **4.10.3 Quality Surveillance**

- a) The Eskom Engineer may either carry out Quality Surveillance of the work or employ an independent technically qualified organisation to carry out Quality Surveillance of the work on his behalf. In the event of dispute, the decision of Eskom shall be final.
- b) For the purpose of carrying out quality surveillance, the Eskom Engineer 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 safe access to surfaces which are coated, to be coated or are in the process of being coated.
- c) The Eskom Engineer or his authorised representative may remove any reasonable samples of materials to be used in the coating application. Rejection of the samples shall 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 material.
- d) The Eskom Engineer or his authorised representative may carry out reasonable destructive tests to ascertain compliance with the Standard. Areas thus damaged shall be repaired by the Contractor to the satisfaction of the Eskom Engineer at no additional cost.
- e) The cost of quality surveillance will be borne by Eskom, except where surveillance results in rejection of the work or when notice by the Contractor results in a fruitless trip, in which cases the cost of surveillance shall be carried by the Contractor.
- f) A report shall be compiled by the surveyor for each visit. A copy of the report will be given to the Contractor on completion of each surveillance visit.

#### **4.10.4 Release Certificate**

- a) The coating/lining applied in the shops will be inspected by the Eskom Engineer or his authorised representative at the Contractor's premises before releasing the coated items for delivery. A clearance certificate will be issued by the contractor authorising the release.
- b) The Contractor shall notify the Eskom Engineer or his authorised representative in advance and timeously of the date on which the coating activities will be complete and ready for inspection.
- c) The coating applied on site will be inspected by the Eskom Engineer or his authorised representative. A final acceptance certificate will be issued after the completion and final inspection and acceptance of each area of the structure.

- d) On completion of the total structure, plant, equipment or contract a final inspection shall be carried out by the Eskom Engineer or his authorised representative and a Contract Completion Certificate issued. Final payments will not be made until this Contract Completion Certificate has been issued. This final 'completion' inspection shall be carried out just prior to the commissioning of the plant.

#### **4.10.5 Records**

- a) On completion of the works, the Contractor shall provide the Eskom Engineer with a Data Book containing all the relevant Quality Control documents and records pertaining to the works.
- b) This data book shall contain, as a minimum, the following:
- The Quality Plan.
  - Copies of all Batch Release Certificates from the manufacturer acquired during the course of the project.
  - Copies of the signed paint manufacturer's data sheets acquired during the course of the project.
  - All relevant QC Records listed in 4.10.2 clause (c).
- c) The Contractor shall submit to the Eskom Engineer the number of copies of the Data Book as required by the contract. In addition, the coating manufacturer shall retain a copy of the Data Book for his own records.

#### **4.11 ALTERNATIVE COATING MATERIAL**

- a) Should the Contractor wish to propose alternative products and/or methods to either coatings or systems, he shall submit a detailed motivation to the Corrosion Department at RT&D. The motivation shall include, but not be limited to, the following:
- Benefit to Eskom
  - Product licensor and technical back-up available
  - Location, experience and ISO quality rating of the production facility
  - Detailed case histories
  - Performance guarantee offered
  - Manufacturer's data sheets for each product
- b) The alternate coating/s or systems shall be defined and classified according to the criteria listed in Annexure E.
- c) Should the proffered case histories be deemed insufficient or inconclusive, additional testing may be required to confirm the adequacy of the alternative coating materials. The costs of such testing will be borne by the Contractor.
- d) Eskom reserves the right to reject the proposed alternative products and will not be in any way obliged to accept testing as described in 4.11(c).

#### **4.12 MAINTENANCE PAINTING**

- a) Maintenance painting covers the repainting of plant and equipment that has been previously painted.
- b) Maintenance painting is carried out when either the original coating system has been damaged or has reached the end of its effective service life, i.e. it has reached a degree of degradation equivalent to Ri 2 of ISO 4628-3.

- c) It is imperative that the coatings used for maintenance painting are either the same materials as originally applied or are compatible with those originally applied. If the new and existing systems are not generically compatible, coating failures will occur.
- d) The degree of maintenance painting required is dependent upon the degree of degradation that has taken place.
- e) The area requiring maintenance painting needs to be carefully assessed to determine the generic type of the existing coating and the extent of maintenance required. This assessment should be carried out by suitably qualified personnel from the Corrosion Department of RT&D.
- f) Maintenance painting specifications must be compiled on a case-by-case basis.

#### **4.13 GUARANTEES**

- a) Eskom requires performance guarantees for the applied coating systems. Such guarantees shall be provided jointly by the Contractor in collaboration with the coating applicator/s and manufacturer's at the time of tender. The typical minimum guarantee period will be 15 years for coating systems with a polysiloxane finishing coat and 8 years for other systems. The criteria for failure will not exceed Ri 2 of ISO 4628-3.
- b) Although visible coating defects such as blistering, cracking, flaking and peeling are not always associated with visible rusting, they indicate defects that could either lead to substrate corrosion or are shielding substrate corrosion that has already taken place beneath the coating. Any such defects noted during the guarantee period shall be the Contractor's responsibility and shall be repaired.

#### **4.14 HANDLING AND STORAGE**

##### **4.14.1 Handling**

- a) All coated components shall be handled using soft slings. Large components shall have sufficient lifting/support points to avoid flexing or bending that could damage the applied coating systems.

##### **4.14.2 Loading**

- a) All coated components to be transported shall be loaded with support blocks, packing between pieces and tight lashing to avoid chafing.

##### **4.14.3 Off-loading**

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

##### **4.14.4 Cover**

- a) Coated items shall be stored under cover where possible.
- b) Shop applied coatings that require site finishing and are sensitive to weathering must be shielded and protected to prevent degradation.
- c) Items not stored under cover shall be stored in such a manner as to avoid retention of water and allow good air circulation.
- d) Items shall be stored on baulks of timber to raise the lowest level above the rain splash zone.



#### 4.14.5 Stacking

- a) Items shall be stacked using timber packings or other approved means to avoid coating to coating contact. Sufficient bearing area of packing shall be used to avoid damage to coatings. The steelwork shall be placed in such a manner as to ensure adequate drainage of rainwater and condensation.

### 5. CORROSION PROTECTIVE SYSTEMS IN ACCORDANCE WITH SANS 12944

#### 5.1 INTRODUCTION

SANS 12944 'Paints and varnishes – Corrosion protection of steel structures by protective paint systems', Part 1-6 deals with protection by paint systems and covers, in the various parts, all features that are important in achieving adequate corrosion protection. It provides guidance for the selection of paint systems for different environments (see SANS 12944-2), surface preparation (see SANS 12944-4) and durability to be expected (see SANS 12944-1). The durability of paint systems is classified in terms of low, medium and high.

#### 5.2 SELECTION

The classification and selection criteria of Corrosion Protection Systems relevant to the respective environmental and operating areas of the plants are given in Annexure E, Tables 1 and 2.

Suitable corrosion protection systems for various general applications and environments are indexed and are detailed in Annexure F.

#### 5.3 DESIGNATION

##### 5.3.1 General

In the case of the following:

- a) General coatings and applications for common applications (abbreviated as CPS) are detailed in Annexure F.
- b) Coating systems for surfaces in contact with the respective **Interior** environments (abbreviated as CPI)
- c) Coating systems for surfaces in contact with the **Exterior** atmosphere, such as high-humidity, pollution, marine environment, etc. (abbreviated as CPE)

##### 5.3.2 Galvanizing

- a) Hot dip galvanizing shall be in accordance with the requirements of SANS 121 (ISO 1461).
- b) Steel to be hot dip galvanized should not contain more than 0,02% phosphorus or more than 0,25% silicon.
- c) Galvanized surfaces that are to receive duplex organic coatings shall not be passivated.
- d) Repairs to damaged galvanizing shall be carried out in accordance with clause 6.3 of SANS 121 (ISO 1461), i.e. either by zinc metal spray or zinc rich paint. The zinc rich paint shall be as approved by the Hot Dip Galvanizing Association Southern Africa or equivalent approved.

### 5.3.3 Powder Coating

- a) When powder coating is specified, both the fabrication of items for powder coating as well as the powder coating application shall comply with SANS 1274.
- b) Textured or 'structured' powder coatings will not be acceptable due to variations in film thicknesses.

## 6. RECORDS

The management process of records generated by this document is discussed in Sections 2.5, 2.6, 3, 4.2 and in Annexures A - F.

## 7. AUTHORISATION

This document has been seen and accepted by:

<b>Name &amp; Surname</b>	<b>Designation</b>
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Zanele Dladla	PEIC Senior Engineer

## **8. REVISIONS**

<b>Date</b>	<b>Rev.</b>	<b>Compiler</b>	<b>Remarks</b>
July 2015	0	H. Cassim	New document drafted for comments review process
February 2016	0.1	H. Cassim	Draft Document for Comments Review
19 September 2017	0.2	H. Cassim	CB updated, formats, etc
20 September 2017	1	H. Cassim	Final Document for Authorisation and Publication

## **9. DEVELOPMENT TEAM**

The following people were involved in the development of this document:

- Hassen Cassim

## **10. ACKNOWLEDGEMENTS**

None

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## APPENDIX A: REQUIREMENT CRITERIA FOR CORROSION PROTECTION COATING APPLICATORS

REQUIREMENT CRITERIA FOR CORROSION PROTECTION COATING APPLICATORS	
<b>Compiled By: Main Contractor Name:</b>	<b>Date:</b> <b>Company Representative Name:</b> <b>Title:</b> <b>Signature:</b>
<p><b>1. Quality Assurance</b></p> <p>Fully operational Quality Management System that meets the intent of ISO900. Required documentation to include:</p> <ul style="list-style-type: none"><li>○ Quality Control check sheets to record paint batch numbers, psychrometric conditions, surface preparation, coating application and special tests as required.</li><li>○ Works Procedures</li><li>○ Daily Activity Reports</li><li>○ Quality Control Plans</li><li>○ Inspection and Test Plans</li><li>○ Contract/Works Programmes</li><li>○ Non-Conformance Reports</li><li>○ Release Certificates</li><li>○ Certificates of Conformance</li><li>○ Data Books</li></ul> <p><b>2. Personnel and Skills</b></p> <ul style="list-style-type: none"><li>○ Appointed Site Manager/representative with project management skills.</li><li>○ Competent site supervisors qualified to SAQCC (Corrosion Protection) Module PS1 'General Painting Supervisors'.</li><li>○ Coating applicators/painters qualified to SAQCC (Corrosion Protection) Module PA1 'General Heavy Duty Coatings Applicator'.</li><li>○ Coating inspectors qualified to SAQCC (Corrosion Protection) 'Coating Inspectors' Level 1 (shop inspections) or Level 2 (site inspections) or NACE Coating Inspection Programme (CIP)</li><li>○ Sufficient personnel must be available to carry out the work within the required time frame.</li></ul> <p><b>3. Safety</b></p> <ul style="list-style-type: none"><li>○ Appointed safety officer.</li><li>○ Fully comprehensive Safety File satisfying both the OHS Act as well as Construction Regulations.</li></ul>	

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**REQUIREMENT CRITERIA FOR CORROSION PROTECTION COATING APPLICATORS  
(Continued)**

**Compiled By: Main Contractor  
Name:**

**Date:**  
**Company Representative Name:**  
**Title:**  
**Signature:**

**4. Facilities and Equipment**

<b>Rating</b>	<b>Activity Type</b>	<b>Equipment</b>
<b>1</b>	On-site patch repairs and top coats. Maintenance painting where abrasive blast cleaning and spraying not required or possible.	Mechanical Cleaning: needle guns, power wire brushes etc. Hand cleaning: wire brushes, scrapers, sand paper etc. Paint Applications: brushes and rollers.
<b>2</b>	Rating 1 activities + Abrasive blast cleaning and priming at fabricator's works or on site. Spraying of any or all coats.	Rating 1 equipment + Surface preparation: compressors, blast pots. Paint Applications: conventional and/or airless spray equipment.
<b>3</b>	Rating 1 & 2 activities + Working in confined areas such as tank linings, Cooling Water duct linings, penstock linings etc.	Rating 1 & 2 equipment + Blast media removal equipment, vacuum cleaners, high pressure water washers, dehumidifiers. Lighting and ventilation equipment. Additional qualified staff required when time constraints require night shifts.

**5. Quality Control Testing Equipment**

- Hygrometer
- Wet film thickness (WFT) gauge.
- Depth profile gauge.
- Surface temperature gauge.
- Electronic dry film thickness (DFT) gauge.
- Pin-hole detection equipment (low voltage wet sponge or high spark) as required.

**6. Case Histories**

- Records of completed successful contracts.
- List of major clients.

## APPENDIX B: CAPABILITY CHECKLIST FOR CORROSION PROTECTION COATING APPLICATORS

<b>CAPABILITY CHECKLIST FOR CORROSION PROTECTION COATING APPLICATORS</b>		
Main Contractor:		
Company Representative Name and Title :		Date:
		Signature:
Applicator:		Report No:
Date of Evaluation:		Vendor Number:
<b>Scope:</b> Quality Management System compliance, facilities, equipment, skills & general rating.		
Requirements	Y/N	General Comments
<b>1. Quality Assurance</b>		
Is a Quality Management System in place		
QC check sheets		
Works Procedures		
Daily Activity Reports		
Quality Control Plans		
Inspection & Test Plans		
Contract/Works Programmes		
Non-Conformance Reports		
Release Certificates		
Certificates of Conformance		
Data Books		
Requirements	Y/N	
<b>2. Personnel Skills</b>		
Number of Site Managers on staff		
Number of Site Supervisors on staff		
Number of Site Supervisors qualified to SAQCC		
Number of Coating Applicators on staff		
Number of Coating Applicators qualified to SAQCC		
Number of Coating Inspectors on staff		
Number of Coating Inspectors qualified to SAQCC		
Sufficient personnel to carry out the contract		

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<b>CAPABILITY CHECKLIST FOR CORROSION PROTECTION COATING APPLICATORS (Continued)</b>			
Main Contractor:			
Company Representative Name and Title :		Date:	
		Signature:	
Applicator:		Report No:	
Date of Evaluation:		Vendor Number:	
<b>Scope:</b> Quality Management System compliance, facilities, equipment, skills & general rating.			
Requirements	Y/N	General Comments	
<b>3. Safety</b>			
Is there an appointed Safety Officer			
Is there a comprehensive Safety File			
Requirements	Y/N	General Comments	
<b>4. Facilities &amp; Equipment</b>			
<b>Surface Preparation Equipment:</b>			
Hand Cleaning:			
Wire brushes			
Scrapers			
Sand paper			
Chipping hammers			
Power Cleaning: (electrical or pneumatic)			
Needle guns			
Power wire brushes			
Power sanders			
<b>Abrasive Blast Cleaning:</b>			
Compressors			
Blast pots			
Hoses and nozzles			
<b>Water Cleaning:</b>			
High Pressure cleaning equipment 68 - 680 bar (1 000 – 10 000 psi)			
Ultra High Pressure cleaning equipment 2 000 – 2 500 bar range (30 000 – 36 000 psi)			

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Requirements	Y/N	General Comments
<b>5. Coating Application</b>		
Brushes		
Rollers		
Conventional spray equipment		
Airless spray equipment		
<b>CAPABILITY CHECKLIST FOR CORROSION PROTECTION COATING APPLICATORS (Continued)</b>		
Main Contractor:		
Company Representative Name and Title :		Date:
		Signature:
Applicator:		Report No:
Date of Evaluation:		Vendor Number:
<b>Scope:</b> Quality Management System compliance, facilities, equipment, skills & general rating.		
Requirements	Y/N	General Comments
<b>6. Specialised Equipment</b>		
Media removal equipment (conveyors etc)		
Vacuum cleaners		
Dehumidifying equipment		
Lighting equipment		
Ventilation equipment		
Requirements	Y/N	General Comments
<b>7. Quality Control Testing Equipment</b>		
Hygrometer		
Wet film thickness (WFT) gauges		
Depth profile gauge (or Testex tape)		
Surface temperature gauge		
Electronic dry film thickness (DFT) gauge		
Pin-hole detection equipment (wet sponge/high spark)		
Requirements	Y/N	General Comments
<b>8. Relevant and comparable Case Histories</b>		
Record of completed successful contracts		

<b>Rating</b>	
Does the applicator qualify for rating 1, 2 or 3. Specifically with respect to item "4. Facilities and Equipment" in Annexure A "REQUIREMENT CRITERIA FOR CORROSION PROTECTION COATING APPLICATORS" sheet.	

## APPENDIX C: QUESTIONNAIRE FOR THE SELECTION OF SUITABLE COATINGS FOR THE EXTERNAL CORROSION PROTECTION OF PLANT, EQUIPMENT AND ASSOCIATED PIPING

### QUESTIONNAIRE FOR THE SELECTION OF SUITABLE COATINGS FOR THE EXTERNAL CORROSION PROTECTION OF PLANT, EQUIPMENT AND ASSOCIATED PIPING

The selection of the required coating for service is directly dependent upon the environmental exposure of the plant and equipment.

The following information is required by the coating applicator to select a suitable coating to be used for specific environments, guidance for surface preparation grades and durability to be expected.

<b>1.0 LOCATION OF COMPONENT</b>	
1.1 Name of power station	
1.2 Component Identification	
1.3 Component Type	
<b>2.0 COMPONENT DETAILS</b>	
2.1 Capacity of Component	
2.2 Dimensions	
2.3 No of access man-holes	
2.4 Size of access man-holes	
2.5 Location of access man-holes	
2.6 Diameter and length of pipework	
2.7 Material of construction (mild steel etc)	
2.8 Please provide A4 drawing of component with this questionnaire	
<b>3.0 ACCESS COMPONENT</b>	
3.1 Is access available to locate compressors and equipment next to the component	
3.2 If adjacent access not available how long will hoses need to be	
<b>4.0 TYPE OF WORK</b>	
4.1 New works – clean original steel	
4.2 Maintenance work – previously coated	
4.3 Type and age of previous coating	
4.4 Condition of the previous coating	
4.5 Total surface area to be coated (m <sup>2</sup> )	

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**QUESTIONNAIRE FOR THE SELECTION OF SUITABLE COATINGS FOR THE EXTERNAL CORROSION PROTECTION OF PLANT, EQUIPMENT AND ASSOCIATED PIPING (continued).**

<b>5.0 SURFACE PREPARATION</b>	
5.1 Can abrasive blast cleaning be carried out on the component	
<b>6.0 PROPERTIES OF THE COMPONENT</b>	
6.1 Environmental conditions of component	
6.1.1 Outdoors	
6.1.2 Marine, Industrial or Rural	
6.1.3 Indoors- describe conditions and type of plant.	
6.1.4 Insulated	
6.1.5 Non-insulated	
6.2 Temperature	
6.5.1 Normal operating temperature	
6.5.2 Maximum or peak temperatures	
6.5.3 Minimum temperatures	
<b>7.0 EXTERNAL SURFACES EXPOSED TO ATMOSPHERIC CONDITIONS</b>	
8.1 Atmospheric Exposure (Temperature range)	
8.2 Atmospheric Exposure (Humidity and/or frequency of wetting/immersion)	
8.3 Atmospheric Exposure (Nature and severity of pollution)	
<b>8.0 GENERAL</b>	
8.1 Provide any further information considered relevant to ensure the selection of the most appropriate coating/rubber lining material i.e. photographs of previous components/coating condition	
8.2 In the case of refurbishment work what is the shut-down period during which this lining work must be carried out (number of days)	

**Note:** In the case of refurbished components all mechanical and welding repairs must be carried out before any lining applications are started.

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**QUESTIONNAIRE FOR THE SELECTION OF SUITABLE COATINGS FOR THE EXTERNAL  
CORROSION PROTECTION OF PLANT, EQUIPMENT AND ASSOCIATED PIPING, (continued).**

**REQUEST SUBMITTED BY:**

Name:.....

Designation:.....

Department:.....

Power Station.....

Contact Details:

Tel:.....

Cell:.....

e-mail:.....

Signature:.....

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**APPENDIX D: SAMPLE HEADING FOR APPENDIX  
PROJECT SPECIFIC SPECIFICATION**

PROJECT SPECIFIC SPECIFICATION		
POWER STATION	PROJECT	COMPONENT
Environment		
Material		
Temperature		
Typical Applications		
<b>New Works</b> Surface Preparation		
	Primer	Finishing
Generic System		
<b>Notes:</b>		
1.		

## APPENDIX E: CLASSIFICATION AND SELECTION CRITERIA OF PROTECTIVE COATING SPECIFICATIONS

### E.1 Classification of Corrosion Protection Systems

The classification of suitable corrosion protection systems for various applications and environments are as follows:

- a) General coatings and applications for common applications (abbreviated as CPS)
- b) Coating systems for surfaces in contact with the respective **Interior** environments (abbreviated as CPI)
- c) Coating systems for surfaces in contact with the Exterior atmosphere, such as high-humidity, pollution, marine environment, etc. (abbreviated as CPE) and by the nature of the substrate and the operating conditions to which the coatings will be subjected to
- d) ferrous, non-ferrous, non-metallic
- e) operating temperatures

In the case of interior coatings, these are further divided into two groups:

- f) Those intended for “normal” applications (abbreviated as CPINA), which are coatings used in atmospheres that can be termed “normal”, i.e. non-aggressive in nature, i.e. internals of offices, service buildings, etc.
- g) Systems in the second group (abbreviated as CPIA) are used for installations (and plant contained therein) where the atmosphere can be termed “aggressive” i.e. it contains high humidity, water, acidic, basic or marine vapours, etc.

In the case of outdoor corrosion protection systems, these may be exposed to high humidity, marine and polluted atmospheres, as well as ultra-violet light radiation. These coatings are classified as the CPE range.

### E.2 Table/s defining substrates, operating conditions and descriptions of selection criteria for corrosion protection systems.

- a) ISO 12944 corrosivity category C1 to C5-I and C5-M, high durability applies in the case of atmospheric exposure.

In instances such as concrete, masonry, wood, etc., where ISO 12944 does not cater for or specifies suitable coating systems, the approved Contractor and coating supplier is required to propose suitable systems offering “high durability” as defined in ISO 12944. The proposal is to be submitted in accordance with Section 4.11.

**Table 1: Selection Criteria and Classification for Indoor Applications**

Type of Substrate	Operating Conditions	Classification	
		NORMAL CONDITIONS	AGGRESSIVE CONDITIONS
Ferrous	Cold Surface: temperature < 80°C	CPIN101C	CPIA101C
	Hot Surface: 80°C < temperature < 200°C	CPIN102M	CPIA102M
	Hot Surface: temperature > 200°C	CPIN103H	CPIA103H
Non-Ferrous	Cold Surface: temperature < 80°C	CPIN201C	CPIA201C
	Zinc metal-sprayed and hot dip galvanised surfaces	CPIN202Z	CPIA202Z
	Aluminium	CPIN203A	CPIA203A
	Stainless Steels	CPIN204SS	CPIA204SS
Non-metallic	Gypsum and cement plaster ceilings and walls- Decorative	CPIN301	CPIA301
	Gypsum and cement plaster ceilings and walls- Decorative with special hygiene requirements	CPIN302	CPIA302
	Wood surfaces with special colour requirements	CPIN303	CPIA303
	Wood surfaces to be varnished	CPIN304	CPIA304
	Concrete floors-thin films (not exposed to oils, solvents or grease)-slight traffic areas and /or may require special hygiene requirements.	CPIN305	CPIA305
	Concrete floors-medium films-exposed to moderate oils, solvents, grease, traffic areas	CPIN306C	CPIA306C
	Concrete floors-ultra thick films-exposed to heavy chemicals and/or traffic areas	CPIN307C	CPIA307C

**Table 2: Selection Criteria for Outdoor Applications**

Type of Substrate	Operating Conditions	Classification	
		NORMAL CONDITIONS	AGGRESSIVE CONDITIONS
Ferrous	Cold Surface: temperature < 80°C	CPEN101C	CPEA101C
	Hot Surface: 80°C < temperature < 200°C	CPEN102M	CPEA102M
	Hot Surface: temperature > 200°C	CPEN103H	CPEA103H
Non-Ferrous	Cold Surface: temperature < 80°C	CPEN201C	CPEA201C
	Zinc metal-sprayed and hot dip galvanised surfaces	CPEN202Z	CPEA202Z
	Aluminium	CPEN201A	CPEA201A
	Stainless Steels	CPEN202SS	CPEA202SS
Non-metallic	Decorative system for concrete and cement rendering	CPEN301	CPEA301
	Impermeable system for concrete plinths	CPEN302	CPEA302
	Wood surfaces with special colour requirements	CPEN303	CPEA303
	Wood surfaces to be varnished	CPEN304	CPEA304
	Colour coding requirements on HDPE, PVC, GRP, etc.	CPEN305	CPEA305

## ANNEXURE F: INDEX AND SPECIFICATION OF PROTECTIVE COATINGS FOR GENERAL APPLICATIONS AND INSTALLATIONS

### F 1 INDEX OF PROTECTIVE COATINGS FOR GENERAL APPLICATIONS AND INSTALLATIONS

Specification No	Typical Applications
CPS 01	Aggressive External Environment - < 80°C. This system is applicable to all steel work, conveyor structures, plate work, the external surfaces of piping, the internal and external surfaces of ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures up to 80°C.
CPS 02	Aggressive Environment < 80°C – Galvanised. Steelwork and conveyor structures internal and external to buildings operating at temperatures up to 80°C. Only applicable to steel sections that are less than 12 m in length and less than 1.2 m in width and are able to be hot-dip galvanised. (This is an alternative to CPS 01)
CPS 03	Non-Aggressive External Environment - < 80°C. This system is applicable to all steel work, conveyor structures, plate work, the external surfaces of piping and external surfaces of ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures up to 80°C.
CPS 04	Internal or External Environment - 81°C to 200°C - Un-Lagged. This system is applicable to all un-lagged steel work, plate work, the external surfaces of piping and ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures from 80°C to 200°C.
CPS 05	Internal or External Environment - 201°C to 540°C - Un-Lagged. This system is applicable to all un-lagged steel work, plate work, the external surfaces of piping and ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures from 200°C to 540°C.
CPS 06	Lagged steel work, plate work, piping and ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures from ambient to 150°C.
CPS 07	Lagged steel work, plate work, piping and ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures greater than 150°C.
CPS 08	Metal Sprayed Coatings
CPS 09	Hot Dip Galvanising
CPS 10	Nuts, bolts, fasteners, flat washers and spring washers in industrial and marine environments.
CPS 11	Proprietary Equipment such as pumps, motors, gearboxes etc.
CPS 12	Hand-railing and stanchions.
CPS 13	Open grid floor grating, stair treads and fixing systems.
CPS 14	Cable ladders, cable trays and associated support structures
CPS 15	Control panels, switchgear cabinets, power and lighting distribution boards
CPS 16	Transformers
CPS 17	Sheeting and cladding (engineering note)
CPS 18	Buried External coating of pipework (engineering note)

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CPS 19	Cathodic Protection (engineering note)
CPS 20	Acid Proof Tiling
CPS 21	Acid Resistant Bricks
CPS 22	Glass Reinforced Plastic
CPS 23	Structural Wrapping

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**F 2 SPECIFICATIONS OF PROTECTIVE COATINGS FOR GENERAL APPLICATIONS AND INSTALLATIONS**

<b>CPS 01 - Aggressive External Environment - &lt; 80°C</b>			
Environment	Atmospheric – Marine and Industrial – ISO 12944 C5-M/I		
Material	Mild steel		
Temperature	Ambient to 80°C		
Typical Applications	This system is applicable to all steel work, conveyor structures, plate work, the external surfaces of piping, the internal and external surfaces of ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures up to 80°C.		
<b>New Works</b> Surface Preparation	Abrasive blast clean to Grade Sa 2½ Surface profile as specified by the primer coating manufacturer		
	Primer	Intermediate	Finishing
Generic System	two component epoxy zinc primer (min 80% zinc in the dry film)	two component recoatable epoxy micaceous iron oxide intermediate coat	two component polysiloxane finishing coat
<b>Notes:</b>			
<ol style="list-style-type: none"> <li>1. Primer and intermediate coats to be applied in the shops with due cognisance being taken of the overcoating time requirements between the various coats.</li> <li>2. Stripe coating to be carried out in accordance with Clause 4.7.3(h)</li> <li>3. All site repairs to handling and erection damage shall be carried out in accordance with Clause 4.7.6.</li> <li>4. Finishing coat applied on site after erection in accordance with Clause 4.7.9 (g).</li> <li>5. Nuts, bolts and washers shall be hot dip galvanized.</li> <li>6. All nuts and bolts to be patched with intermediate coat prior to the application of the finishing coat.</li> </ol>			

<b>CPS 02 - Aggressive Environment &lt; 80°C - Galvanised</b>		
Environment	Atmospheric – Marine and Industrial – ISO 12944 C5-M/I	
Material	Mild steel	
Temperature	Ambient to 80°C	
Typical Applications	Steelwork and conveyor structures internal and external to buildings operating at temperatures up to 80°C. Only applicable to steel sections that are less than 12 m in length and less than 1.2 m in width and are able to be hot-dip galvanised. (This is an alternative to CPS 01)	
<b>New Works</b> Surface Preparation	Sweep blast or, Galvanized iron pre-cleaner	
	Intermediate	Finishing
Generic System	two component recoatable epoxy micaceous iron oxide intermediate coat DFT was per manufacturers technical data sheet	two component polysiloxane finishing coat  DFT was per manufacturers technical data sheet

**Notes:**

1. Galvanizing to be un-passivated.
2. The intermediate coat to be applied in the shops with due cognisance being taken of the requirements to clean the galvanized surfaces.
3. Stripe coating to be carried out in accordance with Clause 4.7.3 (h)
4. All site repairs to handling and erection damage shall be carried out in accordance with SANS 121 (ISO 1461) and Clause 4.7.6.
5. Finishing coat applied on site after erection in accordance with Clause 4.7.9 (g).
6. Nuts, bolts and washers shall be hot dip galvanized.
7. All nuts and bolts to be patched with intermediate coat prior to the application of the finishing coat.
8. Refer to the Corrosion Department at RT&D if this system is being used as an alternative to CPS 01.

<b>CPS 03 - Non-Aggressive External Environment - &lt; 80°C</b>		
Environment	Atmospheric – Inland – ISO 12944 C3	
Material	Mild steel	
Temperature	Ambient to 80°C	
Typical Applications	This system is applicable to all steel work, conveyor structures, plate work, the external surfaces of piping and external surfaces of ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures up to 80°C.	
<b>New Works</b> Surface Preparation	Abrasive blast clean to Grade Sa 2½ Surface profile as specified by the primer coating manufacturer	
	Primer	Finishing
Generic System	two component recoatable epoxy zinc phosphate primer DFT was per manufacturers technical data sheet	two component polyurethane acrylic finishing coat DFT was per manufacturers technical data sheet
<b>Notes:</b>		
<ol style="list-style-type: none"> <li>1. Stripe coating to be carried out in accordance with Clause 4.7.3 (h). using the primer.</li> <li>2. All site repairs to handling and erection damage shall be carried out in accordance with Clause 4.7.6.</li> <li>3. Finishing coat applied on site after erection in accordance with Clause 4.7.9 (g).</li> <li>5. All 'black' nuts and bolts to be patched with the primer and intermediate coats prior to the application of the finishing coat.</li> <li>6. All galvanized nuts and bolts to be patched with intermediate coat prior to the application of the finishing coat.</li> </ol>		

<b>CPS 04 - Internal or External Environment - 81°C to 200°C - Un-Lagged</b>		
Environment	Atmospheric – Inland, Marine and Industrial – ISO 12944 C1 to C5-M/I	
Material	Mild steel – un-lagged	
Temperature	81°C to 200°C	
Typical Applications	This system is applicable to all un-lagged steel work, plate work, the external surfaces of piping and ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures from 80°C to 200°C.	
<b>New Works</b> Surface Preparation	Abrasive blast clean to Grade Sa 2½ Surface profile as specified by the primer coating manufacturer	
	Primer	Finishing
Generic System	two component zinc ethyl silicate primer (min 85% zinc in the dry film) DFT was per manufacturers technical data sheet	ambient temperature curing silicone acrylic DFT was per manufacturers technical data sheet
<b>Notes:</b>		
<ol style="list-style-type: none"> <li>1. Stripe coating to be carried out in accordance with Clause 4.7.3 (h). using the finishing coat.</li> <li>2. All site repairs to handling and erection damage shall be carried out in accordance with Clause 4.7.6.</li> <li>3. Finishing coat to be applied on site after erection in accordance with Clause 4.7.9 (g).</li> <li>4. All 'black' nuts and bolts to be patched with the epoxy zinc primer prior to the application of the finishing coat.</li> <li>5. All galvanized nuts and bolts to be patched with finishing coat prior to the application of the full finishing coat.</li> </ol>		

<b>CPS 05 - Internal or External Environment - 201°C to 540°C - Un-Lagged</b>		
Environment	Atmospheric – Inland, Marine and Industrial – ISO 12944 C1 to C5-M/I	
Material	Mild steel – un-lagged	
Temperature	201°C to 540°C	
Typical Applications	This system is applicable to all un-lagged steel work, plate work, the external surfaces of piping and ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures from 200°C to 540°C.	
<b>New Works</b> Surface Preparation	Abrasive blast clean to Grade Sa 2½ Surface profile as specified by the primer coating manufacturer	
	Primer	Finishing
Generic System	two component zinc ethyl silicate primer (min 85% zinc in the dry film)	ambient temperature curing heat resisting silicone aluminium
<b>Notes:</b>		
<ol style="list-style-type: none"> <li>1. Primer coat to be applied in the shops.</li> <li>2. Stripe coating to be carried out in accordance with Clause 4.6.3 (h) using the finishing coat.</li> <li>3. All site repairs to handling and erection damage shall be carried out in accordance with Clause 4.7.6.</li> <li>4. Finishing coat to be applied on site after erection in accordance with Clause 4.7.9 (g).</li> <li>5. All nuts and bolts to be patched with the finishing coat prior to the application of the full finishing coat.</li> </ol>		

<b>CPS 06 - Internal or External Environment - &lt; 150°C - Lagged Works</b>		
Environment	Atmospheric – Inland, Marine and Industrial – ISO 12944 C1 to C5-M/I	
Expected Durability	ISO 12944 High	
Material	Mild steel - lagged	
Temperature	Ambient to 150°C	
Typical Applications	This system is applicable to all lagged steel work, plate work, piping and ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures from ambient to 150°C.	
<b>New Works</b> Surface Preparation	Abrasive blast clean to Grade Sa 2½ Surface profile as specified by the primer coating manufacturer	
	Primer	Finishing
Generic System	two component heat resisting epoxy phenolic primer DFT was per manufacturers technical data sheet	two component heat resisting epoxy phenolic finishing coat DFT was per manufacturers technical data sheet
<b>Notes:</b>		
<ol style="list-style-type: none"> <li>1. Both coats to be applied in the shops.</li> <li>2. Stripe coating to be carried out in accordance with Clause 4.6.3 (h) using the primer.</li> <li>3. All site repairs to handling and erection damage shall be carried out in accordance with Clause 4.7.6.</li> <li>4. All nuts and bolts to be patched with the primer prior to the application of the finishing coat.</li> </ol>		



<b>CPS 07 - Internal or External Environment - &gt; 150°C Lagged Works</b>	
Environment	Atmospheric – Inland, Marine and Industrial – ISO 12944 C1 to C5-M/I
Expected Durability	ISO 12944 High
Material	Mild steel - lagged
Temperature	Greater than 150°C
Typical Applications	This system is applicable to all lagged steel work, plate work, piping and ducting with wall thickness greater than 2mm internal and external to buildings operating at temperatures greater than 150°C.
<b>New Works</b> Surface Preparation	Wire brush to Grade St 3
	Primer
Generic System	polyvinyl butyral holding primer DFT was per manufacturers technical data sheet
<b>Notes:</b> Coating to be applied in the shops. Coating to be applied and repaired immediately prior to lagging.	

<b>CPS 08 Metal Sprayed Coatings</b>	
Surface Preparation:	Abrasive blast-clean to Grade Sa 3.
Metal Spraying:	All metal spraying shall be carried out by Electric Arc spraying process. Maximum atomisation of wire shall be attained at all times to obtain a fine grained, dense sprayed film.
Metal Spray Types:	<p>(1) Generally zinc and aluminium sprayed coatings shall be carried out in accordance with SANS 1391: – Part 1.</p> <p>(2) The wire analysis shall be:            Zinc                    99,995% minimum            Aluminium    98,0 minimum</p> <p>(3) Copper and bronze decorative finishing systems shall at all times be applied over flash coats of either zinc or other suitable flash wire materials.</p> <p>(4) Colour development of bronze and copper finishes shall be approved prior to actual work commencement. Samples of the final colour shall be submitted for approval by Eskom.</p>
Coating Thickness:	<p>Unless otherwise agreed to by Eskom the minimum coating thicknesses shall be as follows:</p> <p>Zinc                    125 micrometres            Aluminium    125 micrometres            Copper                150 micrometres            Bronze                150 micrometres.</p>
General:	<p>(1) Where zinc and aluminium coatings are being applied, followed by a further paint system, the Contractor shall obtain Eskom's approval of the metal sprayed coatings prior to painting being commenced.</p> <p>(2) The final metal sprayed surface shall be free of lumps, un-atomised wire and other surface irregularities.</p>

<b>CPS 09 Hot Dip Galvanising</b>	
Surface Preparation:	All weld areas shall be abrasive blast-cleaned to Grade Sa 2,5. Following abrasive blast cleaning of the welds, all items shall be suitably pickled, rinsed, dried and fluxed.
Galvanising:	All items shall be hot dip galvanised in accordance with SANS ISO 1461, to a minimum coating thickness as laid down in the appropriate tables of SANS ISO 1461. All nuts, bolts, clips and other items required for the fixing of galvanised articles shall be hot dip galvanised to this Standard. Electro-galvanised items will not be acceptable.
Tolerances:	Tolerances on all threaded articles shall be according to SANS ISO 1461. Threaded items shall be spun in a Centrifuge during the galvanising process.
Note:	<i>In addition to the requirements of SANS ISO 1461, the following criteria with respect to white rust and passivating treatments shall apply.</i>
White Rust:	All material shall be free from excessive white rust and black staining when it is handed over to Eskom. To assist in meeting this requirement, close attention shall be paid to the manner in which the material is stacked and stored at the galvaniser's works and also during its subsequent handling until such time as it is handed over to Eskom. Material which has been inspected at the galvaniser's or manufacturer's works and passed by Eskom's appointed inspectors will still be liable to rejection if it has been found that excessive white rust has developed between the date of inspection and the date when the material is handed over to Eskom. If the material is affected by excessive white rust the Contractor may clean it (using non-metallic brushes) before handing over and if weight of zinc coating still meets the requirements specified in the appropriate tables of the SANS ISO 1461, the material will be accepted.
Passivation:	Unless galvanised items are to be subsequently painted, all items shall be passivated. The passivating coating shall be applied to the material immediately after galvanising to afford temporary protection to the galvanising surfaces. This coating shall be even, and shall be sufficiently transparent to enable Eskom's appointed inspectors to examine the underlying surfaces for any defects.

<b>CPS 10 - Aggressive Environment - Fasteners</b>	
Environment	Atmospheric – Marine and Industrial – ISO 12944 C5-M/I
Expected Durability	ISO 12944 High
Material	Mild steel
Temperature	Ambient to 540°C
Typical Applications	Nuts, bolts, fasteners, flat washers and spring washers.
<b>New Works</b>	<p>All nuts, bolts, fasteners (including holding down bolts), flat washers and spring washers used in marine environments shall be either hot-dip galvanised or sherardized.</p> <p>Hot dip galvanizing to be in accordance with SANS 121 (ISO 1461):                      Minimum zinc thicknesses shall be as follows:                      Articles of diameter less than 12 mm - 45 micron                      Articles of diameter of 12 mm or greater - 55 micron</p> <p>Sherardizing to be in accordance with SANS 53811:                      Minimum zinc thicknesses shall be as follows:                      Class 45 - 45 micron</p>
<b>Notes:</b>	
1. After installation all nuts and bolts shall be degreased and shall be fully coated in accordance with the specification for the respective area of the plant.	

<b>CPS 11 Proprietary Finishes</b>		
Environment	Atmospheric – Very Low to Marine – ISO 12944 C1 to C5-M	
Expected Durability	ISO 12944 High	
Material	Mild steel	
Temperature	Ambient to 80°C	
Typical Applications	Proprietary Equipment such as pumps, motors, gearboxes etc. Refer to clause 4.7.4 (e). If the manufacturer’s coating system is deemed inadequate for the site environment but is considered upgradeable, the following system may be applied over the original system.	
<b>New Works</b> Surface Preparation	Hand clean, abrade and degrease as per coating manufacturer’s recommendations.	
	Primer	Finishing
Generic System	two component epoxy barrier/tie coat	two component polyurethane acrylic finishing coat
<b>Notes:</b>		
<p>1. Conduct an adhesion test on the proprietary coating in accordance with SANS 5159. If the adhesion coefficient is less than 8, return item to manufacturer for replacement. If the adhesion coefficient is 8 or 10, apply upgrade system as above.</p> <p>2. Confirm compatibility between the proposed tie-coat and proprietary coating.</p> <p>3. All upgrade coatings to be applied at Contractors shops prior to shipment to site and installation unless otherwise instructed in the equipment order.</p> <p>4. All site repairs to handling and installation damage shall be carried out in accordance with Clause 4.7.6.</p>		

<b>CPS 12 - Hand-Railing/Stanchions</b>		
Environment	Atmospheric – Very Low to Marine – ISO 12944 C1 to C5-M	
Expected Durability	ISO 12944 High	
Material	Mild steel	
Temperature	Ambient to 80°C	
Typical Applications	Hand-railing and stanchions.	
<b>New Works</b>	The hollow tubing hand-railings and stanchions shall be hot dip galvanized in accordance with SANS 121 (ISO 1461) and then duplex coated as detailed below.	
	Primer	Finishing
Generic System	galvanising tie-coat/ primer	two component polyurethane acrylic finishing coat
<b>Notes:</b>		
<ol style="list-style-type: none"> <li>1. The galvanized surface shall not be passivated.</li> <li>2. Any transport and erection damage to the hot dip galvanized coating shall be repaired in accordance</li> <li>3. Surface preparation shall be by means of sweep blasting or a suitable galvanized iron cleaner as recommended by the coating manufacturer.</li> </ol>		

<b>CPS 13 - Grating, Stair Treads and Fixing Systems</b>		
Environment	Atmospheric – Very Low to Marine – ISO 12944 C1 to C5-M	
Expected Durability	ISO 12944 High	
Material	Mild steel	
Temperature	Ambient to 80°C	
Typical Applications	Open grid floor grating, stair treads and fixing systems.	
<b>New Works</b>	Stair treads and open grid flooring shall be hot dip galvanized to SANS 121 (ISO 1461) and then duplex coated as detailed below.	
	Primer	Finishing
Generic System	galvanising tie-coat/ primer	two component polyurethane acrylic finishing coat
<b>Notes:</b>		
<ol style="list-style-type: none"> <li>1. The zinc coating thickness shall be as specified for the section thickness and for ISO 12944 C5-M Marine environment.</li> <li>2. The galvanized surface shall not be passivated.</li> <li>3. Surface preparation shall be by means of sweep blasting or a suitable galvanized iron cleaner as recommended by the coating manufacturer.</li> <li>4. The design and fabrication of the grating shall be appropriate for the process of hot dip galvanizing.</li> <li>5. The fixing systems shall be either hot dip galvanized or sherardized.</li> <li>6. The flooring sections shall be made to measure before hot dip galvanizing so that modifications that damage the galvanizing are not necessary.</li> <li>7. All site repairs to handling and installation damage shall be carried out in accordance with SANS 121 (ISO 1461).</li> </ol>		



<b>CPS 14 - Cable Structures</b>	
Environment	Atmospheric – Very Low to Marine – ISO 12944 C1 to C5-M
Expected Durability	ISO 12944 High
Temperature	Ambient to 80°C
Typical Applications	Cable ladders, cable trays and associated support structures.
<b>New Works</b>	<p><b>Inland:</b> All components to be hot dip galvanized to SANS 121 (ISO 1461)</p> <p><b>Marine:</b> All components to be hot dip galvanized to SANS 121 (ISO 1461) followed by powder coating with an approved powder coating system in accordance with SANS 1274. The thickness of the powder shall be a minimum of 100 to 120 micron.</p>
<b>Notes:</b>	
<ol style="list-style-type: none"> <li>1. The duplex coating shall comprise a minimum of two coats, i.e. either two coats of powder or a wet a</li> <li>2. Textured or 'structured' powder coatings will not be acceptable due to variations in film thicknesses</li> <li>3. Fixing systems shall be either hot dip galvanized or sherardized.</li> <li>4. All site repairs to handling and installation damage and the coating of the fixing systems shall be car</li> </ol>	

<b>CPS 15 - Control panels, cabinets and boards</b>	
Environment	Atmospheric – Very Low to Marine – ISO 12944 C1 to C5-M
Expected Durability	ISO 12944 High
Temperature	Ambient to 50°C
Typical Applications	Control panels, switchgear cabinets, power and lighting distribution boards.
<b>New Works</b>	<p><b>Inland internal and external to buildings and Marine internal to buildings:</b> Control panels, switchgear cabinets, power and lighting distribution boards shall be powder coated with an approved powder coating system in accordance with SANS 1274. The thickness of the powder shall be a minimum of 100 micron.</p> <p><b>Marine external to buildings:</b> Control panels, switchgear cabinets, power and lighting distribution boards shall be fabricated from stainless steel.</p>
<p><b>Notes:</b></p> <ol style="list-style-type: none"> <li>1. Textured or ‘structured’ powder coatings will not be acceptable due to variations in film thicknesses.</li> <li>2. All site repairs to handling and installation damage shall be carried out in accordance with Clause 4.7.6.</li> </ol>	

<b>CPS 16 - Transformers</b>	
Environment	Atmospheric – Very Low to Marine – ISO 12944 C1 to C5-M
Expected Durability	ISO 12944 High
Material	Mild steel
Temperature	Ambient to 80°C
Typical Applications	Transformers
<b>New Works</b>	Transformers shall be coated in accordance with the latest revisions of Eskom Specifications 34-1658, depending upon the type and size of transformer being supplied. A proposal based upon the requirements listed in Section 4.11 ALTERNATIVE COATING MATERIAL, must be collated and submitted to the RT&D Corrosion Department at ERID for review of the required specification. Proprietary Equipment, refer to clause 4.7.4 (E)
<b>Notes:</b> 1. The transformer supplier must submit his particular detailed Coating Procedure Specification to RT&D, Corrosion Department of Eskom for approval.	

<b>CPS 17 - Sheeting and Cladding</b>	
Environment	Atmospheric – Very Low to Marine – ISO 12944 C1 to C5-M
Expected Durability	ISO 12944 High
Temperature	Ambient to 80°C
Typical Applications	Sheeting and cladding (Engineering Note)
<p><b>1. Introduction</b>                      This engineering note is a guide to the selection of sheeting and cladding materials. There are a number of sheeting and cladding materials available from various suppliers. As cladding is difficult to maintain it is preferable to select a material that will last for the service life of the power station with minimum or no maintenance. All suppliers offer guidance as to initial material selection with respect to the corrosivity of the micro-environment and required service life. It is therefore recommended that cladding requirements are discussed with the suppliers at the design stage of the power station.</p> <p><b>2. General Considerations</b>                      Cladding is deemed to have failed when the sheet or membrane is perforated and allows access of the external environment, e.g. rain. The longevity or service life of a cladding material is therefore the sum of the life of the coating and the life of the base metal to perforation. Obviously, once the coating is spent, corrosion of the substrate metal is unsightly and although the cladding membrane has not perforated, it is considered to have failed. This point must be taken into account when selecting a material for a corrosive environment where aesthetics are also of concern. Where a performance guarantee is offered by the suppliers, clarification on the interpretation of the guarantee must be sought with respect to 'life to perforation' and/or 'life to recoating'.</p> <p><b>3. Fasteners</b>                      Fasteners should have equal or better corrosion resistance than the cladding materials which they support and care should be taken to avoid galvanic effects between the two materials. Electroplated coatings are not allowed as they are generally too thin to provide effective long term protection in aggressive environments. When inherently resistant materials such as stainless steel fasteners are used, due regard to galvanic corrosion should be given. Quite often stainless steel fasteners used with less noble metals such as aluminium, fail due to the galvanic corrosion of the aluminium around the hole in contact with the stainless steel causing enlargement of the hole and lifting of the sheeting. In aggressive environments where protective coatings have been applied to the structural steelwork, hook-bolts rather than screws that pierce the steelwork should be considered. These latter fasteners damage the coating on the steelwork and create isolated areas of corrosive attack to the steelwork.</p> <p><b>4. Sealing of Laps</b>                      The areas of overlap created at the ends and sides of the sheets provide ideal sites for accelerated crevice corrosion. These areas are narrow enough to draw in moisture by capillary action but not wide enough to allow ventilation. The concentration effects caused by alternative wetting and drying create highly corrosive environments that lead to rapid corrosion and perforation of the sheets. Such areas should be protected by sealants or coatings applied to both of the mating surfaces. When sealing beads only are used, these beads should be positioned at the external edge of the lap in order to prevent moisture ingress. If they are incorrectly positioned they can actually create crevice areas.</p>	

**CPS 17 - Sheeting and Cladding(continued)**

Alternatively a polyisobutene coating should be considered as a sealant.

**5. Corrosion At Cropped Ends.**

The coil coated cladding materials suffer from corrosion at cropped ends where the coated sheet has been cut or cropped. This operation exposes the steel to the corrosive environment. In the milder inland environments the galvanized zinc layer does afford some protection. However in aggressive marine environments this protection is short lived. To avoid the necessity of patch repairing cut ends, the cladding should be rolled to length so that end laps are eliminated.

**5.1 Material Selections**

Aluminium – coated and uncoated

Stainless Steel – coated and uncoated

‘Galvalume’

‘Zincalume’

Mild Steel – galvanised – coated and uncoated

<b>CPS 18 - Buried Pipework</b>	
Environment	Buried– ISO 12944 C1 to C5-M
Expected Durability	ISO 12944 High
Material	Mild steel
Temperature	Ambient to 80°C
Typical Applications	External coating of pipework (engineering note)
<p>1.General                      This engineering note details the selection of the wrapping or coating systems for the external protection of buried pipework.                      The type of wrapping or coating system selected is governed by the corrosivity of the soil, the pipe diameter and the method of jointing e.g. flanges, spigot and socket or VJ couplings.                      If the pipeline is to be cathodically protected, provision must be made for the electrical continuity bonding of the pipeline across the couplings.</p> <p>2. Tape Wrapping Systems                      Material Factory or field applied polyethylene film laminated to a pressure sensitive, non-hardening thermoplastic adhesive.                      Thickness 1,0 mm                      viscous elastic polyisobutene coating                      Thickness 2,0 mm</p> <p>3. Spray Applied Coating                      Material Factory applied polyurethane, polyester or vinyl ester coating                      Thickness 1 mm</p> <p>4. Fusion Bonded Epoxy                      Material Factory applied fusion bonded epoxy pipe coating                      Thickness 250 to 400 micron</p> <p>5. Fusion Bonded Medium Density Polyethylene                      Material Factory applied fusion bonded medium density polyethylene                      Thickness 1,6 to 3,5 mm depending upon pipe diameter</p> <p>6. 3LP (3 layer or 'trilaminate' polyethylene system)                      Material Factory applied fusion bonded epoxy/polyethylene adhesive/high density                      Thickness 2 to 3 mm</p>	

<b>CPS 19 - Cathodic Protection</b>	
Environment	Buried– ISO 12944 Im1 to Im3
Expected Durability	ISO 12944 High
Material	Mild steel
Temperature	Ambient to 80°C
Typical Applications	The cathodic protection of buried pipework (engineering note)
<p>This engineering note details the activities that must be carried out before, during and after the installation of buried pipework that requires cathodic protection.</p> <p>A suitable external protection system must be selected in accordance with CPS 18.</p> <p>1. Activities Before Installation</p> <ul style="list-style-type: none"><li>a) Soil resistivity survey along the pipeline route or a grid survey of the plant area.</li><li>b) Provisional cathodic protection design using either an impressed current system or sacrificial anodes.</li></ul> <p>2. Activities During Installation</p> <ul style="list-style-type: none"><li>a) Progressive continuity bond installation at all joints.</li><li>b) Installation of progressive temporary cathodic protection if required.</li></ul> <p>3 Activities After Installation</p> <ul style="list-style-type: none"><li>a) Stray current survey</li><li>b) Current drainage test</li><li>c) Final design of cathodic protection system</li><li>d) Installation of cathodic protection system</li><li>e) Commissioning of the cathodic protection system</li><li>f) Direct Current Voltage Gradient (DCVG) survey of the buried pipeline to verify the condition of the external coating. Defects to be repaired by the pipework installation Contractor.</li></ul>	

<b>CPS 20 - Acid Proof Tiling</b>	
Environment	Aggressive Chemical spillage
Expected Durability	ISO 12944 High
Material	Acid Proof Tiling
Temperature	Ambient to 80°C
Typical Applications	Chemical proofing all plinth supports, bund areas of pumps, general floor areas, walls up to door height surrounding tanks that contain hydrazine, ammonia, sulphuric acid, sodium hydroxide and passivated chemicals, as well as effluent sumps.

This engineering note details the activities that must be carried out before, during and after the installation of works that requires acid proof tiling.

#### 1. General

- a) A proposal based upon the requirements listed in Section 4.11 ALTERNATIVE COATING MATERIAL, must be collated and submitted to the RT&D Corrosion Department at ERID for review of the required specification.
- b) The Contractor shall satisfy himself that the systems he proposes shall be suitable for use in the expected environments.
- c) Prior to commencement of work, the Contractor shall inspect the concrete surfaces to ensure that they are suitable for receiving his proposed system. Any area found to be unacceptable shall immediately be indicated to Eskom.

#### 2. SURFACE PREPARATION

- a) All concrete surfaces shall be thoroughly cleaned of all dust, laitance, loose particles, oils, greases, curing compounds and any other deleterious matter. Cleaning may be carried out by acid etching, wire brushing, mechanical scrubbing, water blasting or sand blasting. The method of cleaning used shall be as per the tiling manufacturer's recommendations. Voids, air pockets, omegas, etc., shall be filled with a suitable filler or mortar.

#### 3. MATERIAL REQUIREMENTS

- a) Acid-proof membrane comprising a butyl rubber membrane, rhepanol membrane, trowelled bitumen membrane or equivalent approved.
- b) Acid-proof tiles of the ceramic split-plate type as supplied by National Ceramic Industries or equivalent approved.
- c) The thickness of the tiles shall be either 15mm or 20mm, depending on the service requirements.
- d) Tiles shall conform to DIN 18166 - 1974, "Ceramic split tiles".
- e) Pointing material shall comprise either furane or phenolic resin or equivalent approved.

#### 4. APPLICATION PROCESS

- a) The manufacturer's recommended procedures in respect of membrane laying, tile bedding, joint formation and pointing application shall be submitted to Eskom. These recommendations shall be strictly adhered to during the application of all systems.



<b>CPS 21 - Acid Resistant Bricks</b>	
Environment	Atmospheric – Very Low to Marine – ISO 12944 C1 to C5-M
Expected Durability	ISO 12944 High
Material	Acid Resistant Bricks
Temperature	Ambient to 80°C
Typical Applications	Chemical proofing all plinth supports and bund areas of pumps and tanks that contain hydrazine, ammonia, sulphuric acid, sodium hydroxide and passivated chemicals, as well as to the off-loading areas for acids and alkalis.

This engineering note details the activities that must be carried out before, during and after the installation of works that requires acid resistant bricks.

**1. General**

- a) A proposal based upon the requirements listed in Section 4.11 ALTERNATIVE COATING MATERIAL, must be collated and submitted to the RT&D Corrosion Department at ERID for review of the required specification.
- b) The Contractor shall satisfy himself that the systems he proposes shall be suitable for use in the expected environments.
- c) At the time of tender, the Contractor shall submit full technical details of his proposed systems to Eskom for approval.
- d) Prior to commencement of work, the Contractor shall inspect the concrete surfaces to ensure that they are suitable for receiving his proposed system. Any area found to be unacceptable shall immediately be indicated to Eskom.

**2. SURFACE PREPARATION**

- a) All concrete surfaces shall be thoroughly cleaned of all dust, laitance, loose particles, oils, greases, curing compounds and any other deleterious matter. Cleaning may be carried out by acid etching, wire brushing, mechanical scrubbing, water blasting or sand blasting. The method of cleaning used shall be as per the tiling manufacturer's recommendations. Voids, air pockets, omegas, etc., shall be filled with a suitable filler or mortar.

**3. MATERIAL REQUIREMENTS**

- a) Acid-proof membrane comprising a butyl rubber membrane, rhepanol membrane, trowelled bitumen membrane or equivalent approved.
- b) Acid-proof bricks as supplied by Didier or SA Industrial Linings or equivalent approved.
- c) Pointing material shall comprise either furane or phenolic resin or equivalent approved.

**4. APPLICATION PROCESS**

- a) The manufacturer's recommended procedures in respect of membrane laying, tile bedding, joint formation and pointing application shall be submitted to Eskom. These recommendations shall be strictly adhered to during the application of all systems.

<b>CPS 22 - Glass Reinforced Plastic</b>	
Environment	Atmospheric – Very Low to Marine – ISO 12944 C1 to C5-M
Material	Glass Reinforced Plastic
Temperature	Ambient to 80°C
Typical Applications	Plant item to be protected by means of glass reinforced plastic (GRP).
<p>This engineering note details the activities that must be carried out before, during and after the installation of works that requires glass reinforced plastic protection.</p> <p>1. Materials</p> <p>a) The Contractor shall satisfy himself that the systems he proposes shall be suitable for use in the expected environments.</p> <p>2. SURFACE PREPARATION</p> <p>a) The various surfaces shall be sand blasted to eliminate laitance, oil, grease etc., and leave a uniformly roughened substrate.</p> <p>b) The abrasive blasting process shall be followed by thorough cleaning and dusting, preferably by vacuum.</p> <p>c) It is essential that the surface be completely dry before the primer is applied, i.e. substrate moisture to be less than 5% (use of moisture meter).</p> <p>3. Priming</p> <p>a) Diluted resin shall be used to prime the entire substrate. The spreading rate shall be 200 to 300 grams per square meter.</p> <p>b) Significant hollows in floors shall be filled with an approved mortar to get a smooth surface.</p> <p>4. APPLICATION PROCESS</p> <p>a) The laminate is applied by hand lay-up.</p> <p>b) The following system shall be used to form three layers:  Resin approximately 400g/m<sup>2</sup> for impregnation of the mat.  Fibreglass mat approximately 300g/m<sup>2</sup>.  Resin approximately 700g/m<sup>2</sup>.  The final layer shall be as follows:  Resin approximately 400g/m<sup>2</sup> for impregnation of surface mat.  Fibreglass surfacing mat approximately 50g/m<sup>2</sup>.  Resin finishing coat approximately 500g/m<sup>2</sup>.</p> <p>c) The total thickness of the above system will be 4 to 4.5mm. The laminating procedure shall conform to a standard equal to Level 2 Table 1 of SANS 141.</p>	

**CPS 22 - Glass Reinforced Plastic (continued)**

- d) Care shall be taken to eliminate air bubbles trapped after application of each fibreglass layer.
- e) Each strand mat layer shall be overlapped and staggered so that joint line does not coincide.
- f) Marks shall be placed on each layer to identify the number of layers applied.
- g) To the final top coat, paraffin will be added in order to prevent direct contact between polyester surface and air.
- h) In case of floor, required to carry traffic, the system described above shall be used with addition of graded silica sand on top of the final coat of resin to get a non-skid surface.

**5. ACCEPTANCE CRITERIA**

- a) The full areas shall be visually inspected.
- b) The surface shall be free of pinholes or discontinuities.
- c) Samples or resin bonded fibreglass laminate (applied on 500 X 500 concrete slabs) shall set the minimum acceptable standard for lining on site.
- d) Tack free acetone test and a Barcon hardness of 31 shall be achieved after application of the finish coat.
- e) Soundness and adhesion shall be checked according to SANS 141. A direct pull-off adhesion test shall be used to test adhesion of suspect laminates.

**CPS 23 - Structural Wrapping**

Environment	Atmospheric – Very Low to Marine – ISO 12944 C1 to C5-M
Expected Durability	Greater than 25 years

This engineering note details the activities that must be carried out before, during and after the installation of works that requires structural wrapping protection. Either a viscous elastic Polyisobutene mastic type coating or Structural Steel High Tack Structural Steel Tape can be used.

1. Surface Preparation:

- a) All surfaces to be wrapped shall be cleaned of grease, salt, dust, loose paint/corrosion product.
- b) All edges of the original sound paint should be feathered back using a suitable grade emery paper.
- c) Areas where localised corrosion has taken place or where rust patches are visible shall be prepared by thorough hand wire brushing followed by rubbing with emery paper to a surface finish in accordance with Swedish Code of Practice SIS 055900 Grade St 2.
- d) All corroded areas shall be patch primed by brush with a single coat of Twin Pack Epoxy Zinc Rich Primer.
- e) Primer Coat:  
A primer coat will only be required when Structural Steel High Tack Structural Steel Tape is chosen.
- f) Following cleaning, drying and priming of the surfaces, all surfaces shall (unless designated otherwise) receive one liberal coat of S.S. High Tack Structural Steel Primer.
- g) Application shall be by brush or roller at an average spread rate of 4m<sup>2</sup>/l.
- h) The primer shall be allowed to flash-off for a period of at least 20 minutes before proceeding with tape application.
- i) All areas that have been primed shall receive the tape application within the same working day.
- j) Areas of primer not covered shall be deemed to be "dead" and shall be reprimed.

2. Tape Application:

Horizontal and Vertical Application (on conventional steel members):

- a) Choose widths of tape which permit overlaps of at least 25mm to be made in a downward direction "Weatherboarding Effect" on vertical surfaces and on the upper face of horizontal surfaces.
- b) Do Not overlap tape on the underside of horizontal surfaces.
- c) Apply tape by unrolling along member so that the thick compound side (inside roll) is in contact with the steelwork.
- d) Do Not attempt to apply tape in lengths greater than 2m.
- e) Press and Smooth down as application proceeds with particular attention to the overlaps. (Minimum overlap 25mm unless specified otherwise.)

**CPS - 23 Structural Wrapping (continued)**

- f) The tape should never be placed on two faces and then stretched into the angle between them; the angle should be formed and then the tape smoothed on to the adjacent faces.
  - g) Apply sufficient tension to give complete adherence but Do Not Stretch the tape at any time.
  - h) Avoid folds and air pockets, pressing out any which may appear.
  - i) To cover bolt-heads, nuts and exposed threads the tape must be X-cut and pressed firmly round the base of the bolt head and nut to ensure no air entrapment.
  - j) In the case of High Tack Structural Steel Tape, a mastic should be applied to form a smooth profile over the bolt heads, nuts and exposed threads.
  - k) Using a separate piece of tape cut a circular disc of sufficient diameter to adequately cover the mastic profiled bolt and nut
  - l) Place this in position and press down firmly to ensure no air entrapment.
  - m) Should crevices be encountered at mating surfaces of bolted connections or elsewhere, these shall be sealed with a continuous application of Mastic.
  - n) The mastic shall be pressed into the crevice using a putty knife or paint scraper and smoothed off along edges to provide a suitable profile for tape application.
3. Covercoat Application:  
This applies to High Tack Structural Steel Tape only.
- a) On completion of the tape application and within a maximum period of 7 days, all surfaces shall receive a liberal coat of Cementitious Basecoat 429. (The liquid component of the basecoat kit should be mixed with the powder component in the as supplied kit ration of 1:1).
  - b) Apply the cementitious basecoat by brush at a spread rate of 0.5 m<sup>2</sup>/l minimum.
  - c) Allow to dry for a minimum period of 12 hours.
  - d) Apply a second coat of Cementitious basecoat 429 (at a spread rate of 0,75 m<sup>2</sup>/l minimum incorporating a Scrim Tape which is placed into the wet basecoat in a similar fashion to the taping procedure. The scrim shall be fully saturated by the basecoat.
  - e) Overlaps on scrim should be positioned such that they do not coincide with tape overlaps.
  - f) Allow to dry for a minimum of 12 hours before proceeding.
  - g) Apply by brush or roller two full coats of Acrylic Topcoat at a spread rate of 4 m<sup>2</sup>/l per coat.
  - h) An intercoat drying time of 4 hours shall elapse.
  - i) Each coat shall be of distinctly different colour with the final coat colour being to the approval of Eskom.