

**To be considered as Annexure D of 240-101712128 and 240-106365693: “Standards for the Internal and External Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with Linings”**

**Table 1: Internal Corrosion Protection System**

<p align="center"><b>Components</b></p>	<p><b>Condensate Polishing Regeneration Plant Vessels (CPR) Vessels including Vessels Piping attachment and Flange Faces</b></p> <p>For specific details with respect to vessels sizes, quantities and manufacturing standards etc. refer to the Scope of Work section of the enquiry document.</p>
<p align="center"><b>Material/Substrate</b> <u>(Internal/external)</u></p>	<p><b>Existing steel</b></p> <ul style="list-style-type: none"> <li>• Vessels Wall – Internally rubber lined (aged rubber)</li> <li>• Externally - coated (epoxy/urethane)</li> </ul> <p>For existing steel there is a high probability of soluble salt contamination, both internally and externally. For further details/requirements refer to the relevant sections below.</p> <p>Prior to execution of the project the vessels floors are to be inspected to identify current corrosion protection.</p>
<p align="center"><b>Internal Environment (1)</b> <u>(Internal Immersed)</u></p>	<p><u>Cation</u></p> <ul style="list-style-type: none"> <li>• Temperature (maximum) = 60°C</li> <li>• pH = 1 - 6</li> <li>• Medium = Sulphuric Acid, Concentration (6%)</li> <li>• Pressure = 973kPa.</li> </ul> <p><u>Anion</u></p> <ul style="list-style-type: none"> <li>• Temperature (maximum) = 60°C</li> <li>• pH = 2 - 12</li> <li>• Medium = Caustic, Concentration (5%)</li> <li>• Pressure = 973kPa.</li> </ul> <p><u>Demin Storage</u></p> <ul style="list-style-type: none"> <li>• Temperature (maximum) = 60°C. Operating = 25°C.</li> <li>• pH = 7</li> <li>• Medium = Demineralised Water.</li> <li>• Pressure = 973kPa.</li> </ul> <p>For more specific details with respect to the water analysis refer to the Scope of Work section of the enquiry document.</p>

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<b>Surface Preparation</b> (Internal Surface)	Abrasive blast clean to <b>Grade Sa 3 as per ISO 8501-1</b> .  Suitable substrate profile as per the rubber lining material and adhesive Manufacturer's requirements.
<b>Generic System</b> (Internal Surfaces)	<p><b>Pre-cured Butyl Rubber Lining (Grade B: 40 - 70 IRHD)</b> as per SANS 1198. The adhesion of the rubber lining to substrate shall be <math>\geq 7</math> MPa. In the event that <b>(Grade B)</b> is not available and only <b>(Grade C)</b> is available as a last resort, then the supplier shall indicate the particular properties which do not meet the requirements of <b>(Grade B)</b>.</p> <p>Lining thickness shall be <b>6 mm for the Shell and 3mm for the Beams</b>, refer to section 2.7 for specific rubber thickness criteria.</p>

**Table 2: External Corrosion Protection System**

<b>External Environment</b>	<ul style="list-style-type: none"> <li>- Non-aggressive Indoors</li> <li>- Ambient temperature</li> </ul>
<b>Surface Preparation</b> (External Surface)	<p>Abrasive blast-clean to <b>Grade Sa 2.5 (ISO 8501-1)</b>.</p> <p>The surface profile shall be as specified by the Coating Manufacturer.</p> <p>For small/isolated areas mechanical clean (by rotary bristle tool) to <b>Grade Sa 2.5 (ISO 8501-1)</b></p> <p>The surface profile shall be as specified by the Coating Manufacturer.</p>
<b>Generic System</b> (External Surfaces)	<ul style="list-style-type: none"> <li>• <b>Primer and Intermediate coats = Twin Pack Polyamide Cured Epoxy.</b></li> <li>• <b>Finishing coat = High Build Re-coatable Polyurethane Acrylic</b></li> </ul>
Primer Coat	Apply by spray, one coat Twin Pack Polyamide Cured Epoxy Primer from <b>60 to 80 microns</b>
Stripe Coat	After allowing sufficient time (as recommended by Coating Manufacturer) for the first coat to cure, all edges, weld seams, bolt holes and other crucial areas shall be given an additional stripe coat, by brush/roller, with the same material as the following coat.

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Intermediate Coat	Allowing sufficient time for the primer coat and stripe coat to cure, the Manufacturer's recommendations shall be adhered to in this regard, apply by spray, one coat Twin Pack, High Build Polyamide Cured Epoxy Intermediate Coat from <b>120 to 150 microns</b> .
Final Coat	<p>Allowing sufficient time for the intermediate coat to cure, the Manufacturer's recommendations shall be adhered to in this regard, apply by spray, one coat Twin Pack, High Build Re-coatable Polyurethane Acrylic Finish from <b>50 to 60 microns</b>.</p> <p><b>Total System Minimum DFT = 230 to 290 microns.</b></p> <p><b>The colour of the final/finishing coat shall be as per the requirements of document 240-145581571: Standard for the Identification of the Contents of Pipelines and Vessels.</b></p>

**With respect to aspects not mentioned in the above coating specification table (e.g. mixing ratios, pot life, straining, thinning, induction times, over-coating and curing times), the manufacturer's recommendations shall be strictly adhered to.**

## **1. Background**

There is no information of any previous inspections for the Matla CPR vessel's rubber lining i.e. the condition of the existing rubber. The current rubber lining scope of work defines complete rubber lining replacement. However this specification recommends that the final/actual rubber lining scope of work will be defined based on the condition of the rubber lining during the inspection. To account for various conditions, two options such as rubber lining patch repairs or complete rubber lining replacement are considered in this document.

Rubber lining inspections shall be carried out by the Contractor and Eskom representative and thereafter inspection findings shall be documented. Based on the inspection findings, Eskom with recommendations from the Contractor, will decide upon the suitable rubber lining option (either rubber lining patch repairs or complete replacement).

### **Option 1 - Rubber Patch Repairs**

Assess the condition of the existing rubber lining through detailed visual inspection and pin-hole detection testing (no more than 3 kilovolts per mm). Identify and mark-up the defects or the areas requiring the repairs.

The Contractor shall compile a rubber patch repair procedure and submit to Eskom for approval. As a minimum, the repair procedure shall include the following:

- Pin-hole detection testing on the existing rubber lining.
- Cutting out, stripping and removal of the existing rubber in the marked-up areas as per the above inspections.
- Surface preparation of the substrate after removal of the existing rubber. For smaller areas to be patch repaired where abrasive blast cleaning is impractical, the Rubber Liner or Contractor shall propose a suitable cleaning method. The cleaning method shall be submitted to Eskom for review and approval before commencement of the work.
- Provision shall be made for mechanical repairs i.e. welding and grinding where necessary before new rubber patch repairs. The Contractor shall propose substrate repair procedures and submit these to Eskom for approval.
- Care shall be taken during welding and surface preparation to protect the remaining rubber lining from any damage such as mechanical damage, welding/grinding sparks, and welding spatter.
- Once the mechanical repairs and surface preparation are completed then conduct rubber lining patch repair of the affected areas. The total surface area to be rubber lined will be determined by inspection.

### **Option 2 - Complete Rubber Lining Replacement**

After inspection step in option 1 is completed and inspection findings documented; if the damage covers a large surface area, Eskom with recommendations by the Contractor will decide on complete rubber replacement.

- The Rubber Liner or Contractor shall remove most of the existing rubber lining by initial removal techniques such as cutting out, stripping and flapper disc grinding.
- Subsequent surface preparation shall be by means of abrasive blast cleaning method.
- After the old rubber lining is removed and initial surface preparation is completed, a detailed visual inspection shall be carried out to check for defects of the substrate surface. Where necessary mechanical repairs i.e. welding and grinding shall be carried out before new rubber is installed. The Contractor shall propose substrate repair procedures and submit these to Eskom for approval. The procedure shall be agreed by both parties before commencement of work.
- Corrosion Protection shall only proceed once all mechanical or welding activities on the vessels have been completed and released in terms of the applicable mechanical repair Quality Control Plan (QCP).

## **2 Specific Project Requirements**

- 2.1 To enable proper inspection as detailed in section 1 above the vessels need to be emptied and all components that are removable shall be removed from the vessel. These components include but are not limited to the laterals, nozzles and distribution pipes.
- 2.2 Based on the inspection findings it might be necessary to conduct repairs on the vessel before corrosion protection application therefore provision shall be made for mechanical repairs i.e. welding and grinding.
- 2.3 For these mechanical repairs, it is strongly recommended that the appropriate engineering subject matter experts (welding engineers and NDT subject matter experts) are consulted. The engineering experts in consultation with the Rubber Liner or Contractor and Lining Manufacturer shall compile substrate repair procedures for the works and submit to Eskom for review and approval.
- 2.4 The Eskom standard 240-101712128 (Section 5 in particular), SANS 1201, SANS 1198 and BS 6374-5 shall apply for the manufacture, selection and installation of rubber lining. The Rubber Liner/ Contractor to take note of the selected type of rubber required in the table above. NOTE: Special Requirements as per SANS 1198, Table 4, Property Column (Special points (I), (III), (V) and (VI)) shall apply.
- 2.5 The type of rubber for lining shall be one of those given in SANS 1198, as specified by the Rubber Liner, to meet Eskom's requirements namely Pre-cured Butyl rubber (**Grade B with 40-70 IRHD**) or possibly **Grade C** strictly based on the requirements in the tables at the top of this document. Only Grade B rubber will be considered at tendering stage.
- 2.6 All components in the vessel shall be rubber lined except components constructed from stainless steel or plastic. These components include distribution pipes and nozzle plates. As part of the method statement the Contractor shall consider and propose steps and measures to ensure a leak tight seal between the nozzles and nozzle plate. The measures shall describe how the rubber lining will be applied to the nozzle plate to ensure the rubber is completely flat to facilitate nozzle assembly. The rubber lining on the nozzle plate shall serve a dual purpose of corrosion protection and as a gasket.
- 2.7 The rubber lining thickness of 6 mm is specified for the shell and 3mm for the beams on condition that this thickness is suitable for the flange arrangement and eventual fitment/re-assembly in terms of existing piping/flange length and alignment. The Rubber Liner or Contractor shall confirm the specified thickness as satisfactory for the application.

- 2.8 The rubber lining Manufacturer, adhesive Manufacturer and Rubber Liner or Contractor shall select relevant primer and or adhesive system for the type of rubber lining material, substrate and service conditions to ensure compatibility.
- 2.9 All parts comprising systems i.e. Rubber Lining and Organic Coating, in this specification sheet, shall be supplied by the same Manufacturer. Should this not be possible the coating/rubber lining Supplier shall confirm suitability or compatibility of the particular product with his system.
- 2.10 The solvents used shall be those recommended and manufactured by the Coating Manufacturer. Where the recommended 'solvent' and 'clean-up thinners' for a material differs, the 'clean-up' solvent must not be added to the paint for dilution purposes.
- 2.11 Surface preparation by abrasive blasting shall be performed by means of blasting equipment capable of removing remaining/residual rubber, rust and suitably preparing the substrate to the required cleanliness of Grade Sa 3 or Sa 2.5 as specified for the internal or external surfaces.
- 2.12 The requirement for surface preparation of all metallic surfaces for immersion is strictly Grade Sa 3 (ISO 8501-1), in which case the surfaces shall be blast cleaned to white metal where all traces of rust, mill scale and other foreign matter are removed.
- 2.13 Power and hand tool cleaning is only applicable to the external surface and for localised patch repairs. Hand-tool cleaning for isolated/localised areas may be utilised provided the required standard of finish is achieved. For all external applications and internal patch repair applications final mechanical cleaning shall be by bristle blaster in order to create a surface profile.
- 2.14 Cleaning by means of hand or power-tools, i.e. wire brushes, chipping hammers, scrapers, grinders, sanders, needle descenders, bristle blasters etc. may only be used where accepted by the Eskom Engineer and where the position and condition of the substrate metal is such that efficient cleaning and surface profile can be achieved.
- 2.15 Burnishing of the surface shall not be permitted.
- 2.16 In all cases, after wire brushing or grinding, all traces of loose material shall be removed from the surface by vacuum cleaning. Cleaned surfaces shall not be contaminated with oil, grease, rust or other deposits before primer application.

- 2.17 After tender award the Manufacturer shall supply batch certificate for each of the lining/coating products. Specifically for rubber lining all tests, parameters, and results shall be as per the requirements of SANS 1198 Table 4. These tests shall be conducted as per SANS 1198 by an ISO 9001 certified independent laboratory. These test results or certificates shall be submitted to Eskom after tender award and before commencement of work to verify mechanical and chemical properties in the product data sheets.
- 2.18 After tender award and prior to project execution the Manufacturer shall submit test samples of the lining system as proposed in the tender submission. Two samples shall 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 size of the test sample panels shall be (200 mm X 300 mm X 3 mm), with a rubber lining thickness of 5 mm. The lining 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 lining products used in the submitted test sample panels.
- 2.19 In addition to the panel samples above, representative (considering different batches), loose rubber sheeting 500 mm X 500 mm, with a rubber lining thickness of 5 mm shall be submitted for tensile testing to ensure conformity to SANS 1198.
- 2.20 Specifically for the tensile testing, specimens shall be prepared as per SANS 10037 "Type 1 Dumb-bell". The Rubber Liner or Manufacturer shall provide written commitment to this requirement at the tender stage.
- 2.21 During rubber lining of the vessels the Rubber Liner shall prepare (200 mm X 300 mm X 3 mm) test panels with a rubber lining thickness of 6 mm, at the same time and under the same conditions as the vessels. The prepared test panels shall be sent to Eskom for adhesion/peel testing as per the requirements of SANS 1201 section 9.4.
- 2.22 Corrosion protection shall only proceed once all mechanical repairs or activities i.e. cutting and welding have been completed and released in terms of the fabrication Quality Control Plan (QCP). And under no circumstances shall this work be performed until the corrosion protection QCP and Method Statement have been accepted by the Eskom Engineer.

### **3 General Requirements**

- 3.1 Sharp edges shall be dressed to a radius of not less than 3 mm. All burrs and weld spatter shall be removed. Welds shall be free from imperfections (e.g. asperities, undercutting, blowholes, craters, and spatter).
- 3.2 Weld beads with a surface irregularity exceeding 3 mm or with sharp crests having a radius less than 3 mm shall be ground.

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- 3.3 All welds shall be free of slag, inclusions and pinholes. Adjacent areas shall be free of weld spatter, which shall be removed by grinding or scraping.
- 3.4 All surfaces shall be completely dry and free from contaminants such as traces of oil, grease, etc., before surface preparation is carried out.
- 3.5 After initial blasting of representative patches soluble salt testing shall be performed by the Bresle soluble salt test method. If not within acceptable limits (as per the Manufacturer requirement but not exceeding 100 mg/m<sup>2</sup>), the surfaces shall then be washed/decontaminated by High Pressure (HP) water washing using fresh/clean water (with a conductivity reading of maximum 100 µS/cm) at a minimum pressure of 300 bar. A salt decontamination chemical additive with demonstrated capability of removing salts may be used in conjunction with HP cleaning.
- 3.6 Soluble salt testing shall be repeated on representative test patches and if acceptable then proceed with blasting and application steps – if not then repeat HP washing until the salt contamination has been removed to within acceptable limits.
- 3.7 Prior to any surface preparation all surfaces that are or are likely to be contaminated with oil or grease shall be solvent cleaned with a suitable water-soluble biodegradable alkaline cleaner/detergent or with appropriate organic solvents.
- 3.8 Cleaning may be performed by using rags for small areas, or a spray gun for large areas. The detergent/solvent-cleaned surfaces shall then be thoroughly washed down with fresh/clean water ensuring that the oil-water emulsion formed is completely removed from the metal. Special attention shall be paid to drillings, bolt holes, etc.
- 3.9 Degreased and water washed surfaces shall be checked for residual oil and grease using the atomized water spray test as per ASTM F21 and further degreasing shall be carried out if residual oil or grease is found to be present. In instances where there is no or poor natural lighting then the interpretation of the ASTM F21 shall be assessed by means of ultraviolet light i.e. back light.
- 3.10 A black light test shall be used to check for oil contamination. Zero oil and grease contamination are the acceptable limit. Washing with fresh/clean water containing a suitable degreasing agent of partially painted components shall take place between coats, if surfaces are found to be contaminated.
- 3.11 During the corrosion protection process on site care shall be taken to ensure adequate protection of the surrounding areas and any parts of the ancillary equipment i.e. pumps, filters, valves seats, drains, inlet and outlet piping from abrasive blasting and spent grit particles, paint.



- 3.12 No abrasive blasting or lining applications shall take place when conditions are likely to affect these operations. Clauses 4.1.1.2 to 4.1.1.5 of BS 6374-5 shall apply.
- 3.13 Different grades and types of blasting media exist. It is important that the correct abrasive be used in combination with a specific corrosion protection system to achieve the specified surface profile. The required blast profile height should be carefully considered. The Contractor shall select an appropriate abrasive type and mesh size to attain the specified surface profile.
- 3.14 Only inert mineral grit or steel grit abrasives shall be used. Sand or silica-based abrasives shall not be used. Abrasive material for blast cleaning shall be used in line with local environmental regulations.
- 3.15 The abrasive shall be used in accordance with the Manufacturer's specifications and shall be clean, sound, hard particles free from foreign substances such as dirt, oil, grease, toxic substances, organic matter and water-soluble salts. It is important that good quality abrasives are used to minimize the amount of waste grit and dust generated and contamination of the surfaces.
- 3.16 The use of re-cycled blasting media for the final blast is strictly prohibited.
- 3.17 All abrasive media shall be stored in an area that is completely dry, covered and protected from weather.
- 3.18 All compressed air for blasting and coating/lining activities shall be free from entrained moisture and oil. All traps shall be in a functional condition. The compressed air shall be tested at regular intervals using clean white clothes to assess cleanliness and dryness. This requirement shall be included in the QCP.
- 3.19 On completion of grit blasting the surface shall be thoroughly vacuumed until no loose dust is evident. The process shall be repeated until the required level of dust and debris removal is achieved.
- 3.20 The level of cleanliness required shall be less than "dust quality rating" 1 when tested in accordance with ISO 8502-3. It is imperative that all surface dirt and contaminants are completely removed before lining or the adhesion of the lining shall be impaired.
- 3.21 The profile height of the blasted surfaces should be within the range of the specified coating system. Refer to the Manufacturers Product Data Sheets. Unless otherwise specified by the Coating Manufacturer, a profile height of 25 microns to 50 microns is recommended for most coatings systems.

- 3.22 It is important that the blast profile does not exceed the specified DFT of the primer. Blast cleaning of severely corroded surfaces may result in high profiles i.e. > than 100 microns. In these cases, the primer shall be applied by brush/roller to ensure complete wet-out of the pitted/jagged surface. However, agreement should be reached between the Applicator and Primer Manufacturer as to the most suitable profile range, with due consideration of the application method, for the specific primer.
- 3.23 During the corrosion protection process on site care shall be taken to ensure adequate protection of the surrounding areas and any parts of the ancillary equipment i.e. pumps, filters, valves seats, drains, inlet and outlet piping from abrasive blasting and spent grit particles, paint.
- 3.24 Cleaned surfaces shall not be contaminated with oil, grease, rust or other deposits before coating application. Unnecessary traffic prior to painting/lining shall be avoided.
- 3.25 The Contractor shall ensure that during surface preparation and corrosion protection activities the relative humidity (RH) in open, undercover shop environments is less than 80 % RH and for the vessel internal space is less than 60% RH. Ambient temperatures shall be between 5 °C and 30 °C or as per the Manufacturer recommendations, whichever is the more stringent. The maximum/minimum substrate temperature at the time of coating application shall be strictly in accordance with the product data sheet. During stable weather conditions environmental parameters shall be measured and recorded at least 4 times per shift.
- 3.26 During periods of inclement or cold weather conditions the environmental parameters shall be measured and recorded hourly. If the latest two readings of any of the parameters indicate a deteriorating trend which would likely exceed parameter/s limit then no final surface preparation or spray application shall be permitted. All measurements shall be recorded at the steel surface. Dew point requirements shall be as per the Product Datasheet or Eskom standards 240-101712128 and 240-106365693.
- 3.27 To avoid recontamination and flash rusting of the surfaces, the primer shall be applied within 8 hours after final surface preparation of the steel surfaces. Under no circumstances shall the blast be permitted to stand overnight.
- 3.28 If the pre-cleaned substrate has been exposed for more than 8 hours or the cleanliness grade of the substrate has deteriorated then the substrate will require rework to reinstate the required grade of cleanliness in accordance with ISO 8501-1.

- 3.29 Individual rubber sheets shall be tailored to fit the surface to be lined. The lining shall be bonded to the manhole flange faces. The mating surface of the flange face to gasket shall be suitably dressed such that the face is acceptably flat to ensure sealing between the liner and the gasket. The application and flange arrangement shall be as per SANS 1201 Figure 7 a) or c) and the Eskom Engineer requirements.
- 3.30 All joints of lined rubber shall be strapped as per BS 6374-5.
- 3.31 All surfaces shall be pinhole tested before strapping with the testing starting from the top of the vessel downwards as the scaffolding is being dismantled to ensure the lining is pinhole free and if required additional repairs shall be performed and once cured then the repair areas shall be retested. The process to be repeated until a pinhole free lining is achieved.
- 3.32 The rubber lining Manufacturer and Rubber Liner or Contractor shall specify the test voltage and the length of spark (no less than 2 kilovolts per mm). If the rubber Manufacturer cannot comply then a detailed motivation describing the reasons why this requirement can't be met shall be submitted for review, acceptance or rejection
- 3.33 The installed lining shall present a smooth appearance and be free of voids, blisters, pinholes, cracks, open seams, entrapped air or any other defects which will impair its use. Defective areas shall be cause for rejection of the lining.
- 3.34 For all inspections of all surface preparation and coating/lining activities the surfaces shall be clean allowing unhindered visual access to the surface. The Contractor shall provide sufficient and adequate lighting (Cool White) to enable inspections. Cell phone lighting is not acceptable
- 3.35 Prior to commencement of rubber lining/coating the Applicator shall submit detailed repair procedures in accordance with BS 6374-5. Any defects such as mechanical damage, cuts, blisters, lack of adhesion and poor joints shall be marked up and repaired according to BS 6374-5 Clause 5.2.4.
- 3.36 For the coating the spray operator shall ensure application in a smooth and controlled motion. The spray operator shall be equipped with a "wet comb" and frequently monitor the wet film thickness to prevent/reduce a wide spread of DFT's.
- 3.37 After allowing sufficient time for the first coat to cure, all edges, weld seams and other crucial areas shall be given an additional stripe coat, by brush application, with the same material as the following coat. Should the use of a primer be omitted, stripe coating shall be carried out immediately prior to the spray application of the first coat.

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- 3.38 Multiple coats shall be applied as per the tables at the top of this specification sheet. Single coat systems are not permissible.
- 3.39 Where the coating has completely cured or allowed to age before finishing, before application of a subsequent coat the surface shall be prepared by light sanding, scrubbing with potable water using a bristle brush and drying before over-coating.
- 3.40 Application of subsequent coats shall be in accordance with the specified system. The required over-coating intervals as mentioned in the latest Product Data Sheet shall be observed and adhered to.
- 3.41 The number of coats and DFT per coat required to achieve the total film DFT shall be agreed between the Contractor and Coating Manufacturer and will be dependent upon the method of application chosen.
- 3.42 The total DFT of the applied coating system shall comply with the recommended minimum and maximum DFT limits as recommended in the latest Product System Data Sheet and this specification.
- 3.43 The range of DFTs of each coat shall be as follows; 90 % of random readings shall be equal to or greater than the minimum specified DFT. No individual reading shall be less than 80 % of the specified DFT.
- 3.44 In the case of solvent borne coatings no individual reading shall be greater than 150 % of the Manufacturer's maximum specified DFT. All deficient film DFTs shall be rectified prior to release of components.
- 3.45 All finishing colours for external surfaces shall be in accordance with the Eskom requirements; 240-145581571: Standard for the Identification of the Contents of Pipelines.
- 3.46 The coating shall be evenly applied to form a smooth, continuous, unbroken layer free from misses, sags, runs, tears and other defects that could affect the integrity of the coating.
- 3.47 All areas of coating damage shall be patch repaired. The extent of the damage shall be carefully inspected to assess which coats in the system have been damaged and which surface preparation methods are most suitable and appropriate. The Eskom Engineer shall accept/reject the Contractor's recommended method of surface preparation i.e. mechanical power and hand tool cleaning. When more widespread repairs are required and when the damage extends to the steel substrate mechanical cleaning by rotary bristle tool to Sa 2.5 is required.

- 3.48 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 all edges of existing paint shall be feathered back to a hard edge.
- 3.49 The patch primer used shall be in accordance with the requirements of the relevant coating system. The over-coating onto an existing coating by subsequent intermediate and finishing coats (where applicable) shall be stepped at 25 mm intervals to produce a feathered edge. Specifics of such instances shall be assessed on a case-by-case basis.
- 3.50 Provision shall also be made for the repair of handling damage to the coating after installation/assembly/erection. Spot repairs shall reinstate each of the previous coats and shall commence directly after the localised surface preparation.
- 3.51 The supply and cost of all testing, inspection and specialized testing equipment shall be the Contractor's responsibility. QC shall be performed by the Applicator and the Quality Assurance inspection shall be conducted by Eskom. A series of witness and hold points shall be agreed such that Eskom may witness any of the above tests. Eskom may elect to carry out its own tests at these times.

#### **4 Tender Returnables**

**Note that the returnables as detailed below shall be returned as part of the Contractor's Tender document/submission.**

##### **4.1 Mandatory Tender Returnables**

- 4.1.1 At the time of tender verifiable evidence shall be submitted that the Rubber Liner/ Coating Applicator has experience in the application of corrosion protection systems in comparable environments i.e. tanks/confined spaces. In this regard the experience shall, as a minimum, be equal to the surface area as defined in the enquiry documents.

This verifiable evidence shall be for projects where vessels have been successfully lined by the Contractor, within the last five years. The verifiable evidence shall include formal signed off QCP's or release certificates, total surface area of the vessels lined and contact details, for at least 3 similar projects.

##### **4.2 Tender Returnables for Evaluation**

- 4.2.1 The System Supplier or Rubber Liner or Coating Applicator or Contractor shall supply individual product datasheets and material safety datasheets (MSDS) for all products comprising the system i.e. rubber lining, adhesives, tack coats, primer, intermediate, top coats and solvents. As a minimum the following shall be submitted:

- A description of the generic type of rubber lining and coating material.
- Rubber lining/coating physical and chemical properties (for rubber lining Table 4 of SANS 1198 shall apply).
- Recommended and non-recommended uses.

Service temperatures and chemical resistance limits. For the chemical resistance, special property, (III), (V) and (VI) as per 240-101712128 and SANS 1198 Clauses 4.2.2 (d), 4.2.3 (b) in conjunction with the environment and operating conditions in the table above in this specification sheet shall apply. Confirmation that the lining shall not contaminate the system/process fluid to be handled. The approved test results or certificates from the independent laboratory shall be written in English.

- Maximum recommended service temperature which shall be a minimum of 30 % greater than the maximum temperatures as is indicated in the table at the top of this specification sheet.
- Surface preparation requirements.

4.2.2 A detailed procedures/method statements shall be submitted to Eskom at the time of tender detailing all steps, procedures and activities of the coating/lining application process. The steps to be considered includes:

- The methods, steps, sequence and equipment required for ventilation and dust mitigation.
- Grease decontamination and washing.
- Soluble salt decontamination.
- Methods for dust and debris removal, maintaining and ensuring cleanliness between adhesives and lining shall be described.
- The Method Statement shall detail the precise sequence and breakdown of work areas/activities in order to apply the system with due consideration of dust contamination.
- The Method Statement shall also consider the most efficient methods and sequencing to avoid unnecessary delays that may have an impact i.e. time required for removal of spent abrasive grit and dust/debris.

- All inspection interventions during and after completion of corrosion protection installation shall be considered and included.
- The Method Statement shall describe all measures and details for establishing and maintaining:
  - The environmental conditions as required by this specification.
  - The required ventilation for the prevention and/or management of fumes and dust build-up. The number of extraction fans; mounting diameters, sizes and mounting methods of fans to manholes; power rating of fans; positioning of fans and direction of intended air flow shall be described and detailed.

4.2.3 A detailed Quality Control Plan (QCP) shall be submitted at the tender stage and shall detail all inspections and tests with acceptance criteria during lining/coating application. Inspections during lining/coating application shall at least cover compressed air blotter test for blasting and spray applications, surface preparation, environmental parameters, rubber thickness, hardness, adhesion, continuity and visual tests. Tests for continuity shall be carried out using the high frequency spark test method.

4.2.4 List of deviations or exclusions from this specification. If there are none then there shall be a definitive written statement to such effect. This mentioned list of deviations or definitive written statement shall be used as part of the contract. In addition to this statement the Contractor, Rubber Liner or Manufacturer shall also provide a definitive statement of the submission of samples as prescribed above.

## **5 Safety Requirements and Considerations**

- 5.1 During the application of all coatings/lining systems, care shall be taken to ensure adequate ventilation and lighting, to avoid/minimise health and safety risks.
- 5.2 Special care needs to be taken when working with all organic coatings/linings. Prior to the use of any coating material, the Material Safety Data Sheets shall be obtained from the relevant Coating Manufacturer.
- 5.3 A confined spaces (CSs) may be defined as an enclosed, restricted, or limited space in which, because of its construction, location or contents, or any work activity carried on therein, a hazardous substance may accumulate and/or an oxygen-deficient atmosphere may occur, and/or in which a dangerous liquid or dangerous concentration of gas, vapour, dust or fumes may be present. It includes any chamber, tunnel, pipe, pit, sewer, container, valve, pump, sump, chute, bunker, silo, gearbox, tank, receiver, drum or any similar construction, equipment, machinery or object.

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- 5.4 Flammable Atmospheres: Gases, vapours and dusts can become trapped in CSs and create flammable or explosive atmospheres, and include combustibles e.g. Hydrogen, Acetylene, Rubber and thinning/cleaning solvents, etc.
- 5.5 The Contractor shall be familiar with the contents of the 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.
- 5.6 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.
- 5.7 The Contractor shall ensure compliance with all statutory regulations, municipal by-laws, etc. concerning pollution and the health and safety of personnel and/or members of the public who may be affected by the work. The Contractor shall provide the personnel with the appropriate required PPE.
- 5.8 The Contractor shall advise Eskom of all hazardous materials to be brought on site.
- 5.9 The Contractor's Safety File shall address all the hazardous activities of abrasive blast cleaning and spray painting. The Contractor shall verify that the personnel carrying out these activities are suitably qualified.
- 5.10 The Contractor shall ensure that the abrasive materials used conform to all National Health and Safety Standards.
- 5.11 All materials shall be stored in designated areas in storage facilities that meet the storage requirements of the coating/rubber Manufacturer. The Contractor shall be responsible for the provision of appropriate storage/shipping containers as required. These containers shall include the appropriate refrigeration/conditioning systems for temperature control. This requirement shall be dependent on where the container will be located (indoors/outdoors), typical ambient temperature for the particular season of the year and the maximum storage temperature limits as per the Manufacturer's recommendations.
- 5.12 The Contractor shall provide for all necessary safety precautions and risk assessments.



## **6 Reference Documents**

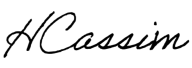

The latest revision of the referenced standards shall apply. Where conflict exists between any of these documents the more stringent requirement shall apply.

- 6.1 240-101712128: Standard for the internal corrosion protection of water systems, Chemical Tanks and Vessels and Associated Piping with Coatings.
- 6.2 240-106365693: Standard for the External Corrosion Protection of Plant, Equipment and Associated Piping with Coatings.
- 6.3 240-145581571: Standard for the Identification of the Contents of Pipelines.
- 6.4 ASTM D4414: Standard practice for measurement of wet film DFT by notch gauges.
- 6.5 ASTM D4541: Standard Method for Pull-off Strength of Coatings using Portable Adhesion Testers.
- 6.6 ASTM D5162: Standard Practice for Discontinuity (Holiday) Testing of Nonconductive Protective Coating on Metallic Substrates.
- 6.7 ASTM E376: Measuring coating DFT by magnetic field or eddy current electro-magnetic test Methods.
- 6.8 ASTM F21: Standard Test Method for Hydrophobic Surface Films by the Atomizer Test.
- 6.9 BS 6374-5: Lining of equipment with polymeric materials for the process industries.
- 6.10 ISO 2409: Paints and varnishes – Cross cut test
- 6.11 ISO 4624: Paints and varnishes – Pull-off test for adhesion.
- 6.12 ISO 4628 – 1: Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 1: General introduction and designation system.
- 6.13 ISO 4628 – 3: Paints and varnishes – Evaluation of degradation of coatings – Designation of quantity and size of defects, and of intensity of uniform changes in appearance – Part 3: Assessment of degree of rusting.
- 6.14 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.

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- 6.15 ISO 8502-3: Preparation of steel substrates before application of paint and related products – Test for the assessment of surface cleanliness – Part 3: Assessment of dust on steel surfaces prepared for painting (pressure sensitive tape method).
- 6.16 ISO 8502-6: Preparation of steel substrates before application of paint and related products – Test for the assessment of surface cleanliness – Part 6: Extraction of soluble contaminants for analysis – The Bresle method.
- 6.17 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. (May be used as an alternative to SANS 5772).
- 6.18 ISO 9001: Quality Management Systems - “is defined as the international standard that specifies requirements for a quality management system (QMS). Organizations use the standard to demonstrate the ability to consistently provide products and services that meet customer and regulatory requirements.”
- 6.19 ISO 9223: Corrosion of metal and alloys – Corrosivity of atmospheres – Classification.
- 6.20 ISO 12944-3: Paint and varnishes – Corrosion protection of steel structures by protective paint systems. Part 3: Design considerations.
- 6.21 SANS 1198: The manufacture of rubber sheeting for rubber lining.
- 6.22 SANS 1201: The application of rubber linings to pipes, pipe fittings and vessels.
- 6.23 SANS / ISO 2808: Paints and Varnishes: Determination of film DFTs (Can be used as alternative to ASTM E376).
- 6.24 SANS 5770: Preparation of steel substrates before the application of paints and related products – Test for the assessment of cleanliness of blast-cleaned steel surface – Freedom from certain soluble salts.
- 6.25 SANS 5772: Preparation of steel substrates before the application of paints and related products – Surface roughness characteristics of blast-cleaned steel surfaces – Profile of blast-cleaned surfaces determined by a micrometre profile gauge (Can be used as alternative to ISO 8503-4).
- 6.26 SANS 10037: Rubber, vulcanized or thermoplastic - Determination of tensile stress-strain properties.

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