

 Eskom	<b>SOW</b>	<b>Camden Power Station</b>
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Title: **Degas Sump Lining Inspection  
and Repairs**

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Engineering**



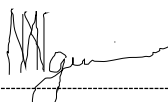

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## 1. Introduction

Part of the production of demineralised water involves the removal of carbon dioxide. At Camden Power Station, water is transferred from the cation vessel to the degasser tower where carbon dioxide is removed and the water is then temporarily stored in the degas sump from where the degas pumps take suction. The water is then pumped to the Anion vessels where the next stage of demineralisation occurs.

There are two degas concrete sumps that have a loose liner system installed i.e. the lining is fixed at the top of the sump and is not attached to the walls of the sump. The lining and the sumps need to be inspected and repaired where necessary.

## 2. Supporting Clauses

### 2.1 Scope

#### 2.1.1 Purpose

The condition of the degas sumps and lining has deteriorated over the years and needs to be repaired.

#### 2.1.2 Applicability

- Auxiliary Plant Engineering
- Auxiliary Plant Maintenance
- Chemical Services

#### 2.1.3 Effective date

See date of authorized signature

#### 2.1.4 Normative References

- [1] Eskom SHEQ policy 32-327
- [2] OHS Act 85 of 1993
- [3] QM-58 Supplier Contract Quality Requirements Specification
- [4] 240-101712128: Standard for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with linings
- [5] 240-48929482:Tender Engineering Evaluation Procedure
- [6] BS 6374: Part 5 – Lining of equipment with polymeric materials for the process industries
- [7] SANS 1198: The manufacture of rubber sheeting for rubber lining
- [8] ISO 9001: Quality Management Systems – Requirements

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[9] 240-106628253: Standard for Welding Requirements on Eskom Plant

### 2.1.5 Informative References

- N/A

## 2.2 Definitions

Approved / Approval	Refers to written approval by the Engineer.
Contractor	Means the person(s) named demineralised in the Contract Agreement.
Demineralised Water	Water which is void of any ions

## 2.3 Abbreviations

Abbreviation	Description
BS	British Standard
ISO	International Organization for Standardization
m	meter
OHS	Occupational Health and Safety
PPE	Personnel Protective Equipment
QCP	Quality Control Plan
SANS	South African National Standards
SHEQ	Safety, Health, Environment and Quality

## 2.4 Process for Monitoring

N/A

## 2.5 Related/Supporting Documents

N/A

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### 3. Scope of Work

The following scope of work shall involve the full spectrum of work required to inspect and repair both the degas sumps and the loose lining.

The Contractor shall take note and make provision that there will be a time delay between the availability of the sumps in order to ensure continued Demin water production.

#### 3.1 Pre-Preparation:

- The contractor must comply with the information in Annexure A, which is the requirement criteria for corrosion protection paint and rubber lining applicators
- As part of the tender returnables, Annexure B must be completed by the contractors
- All documentation requested in RTD/MAT/20/212 Rev 1: Protective Coating Specification for Camden Power Station – Degasser Sumps 1 and 2 (Loose Liner Repair) must be given to Eskom for acceptance. This document can be found in Annexure D
- All material required for the repair should be procured and delivered to site prior to commencement of the task
- The Contractor shall provide a risk assessment per activity to Eskom as the sumps are located within the operating area of the power station. Safety equipment, barriers and plant signage shall be provided by the Contractor
- The Contractor shall ensure a safe working environment and that all work practices comply with Eskom's SHEQ (Safety, Health, Environment and Quality) requirements
- Scaffolding to be installed for each sump prior to any work commencing

#### 3.2 Contractor Responsibilities:

- To ensure a fully functional internal lining system for two Degas Sumps at Camden Power Station.
- Internal inspections has revealed that there appears to be water trapped between the lining and the concrete sump. The Contractor is expected to remove the water, inspect the concrete sump and repair any defects found without damaging the lining. (See Annexure D for more details)
- The supply of all equipment for the repair and testing of the sump and lining system
- For his own traveling and accommodation to perform the entire scope
- For site establishment and storage of all tools and equipment required to execute the entire scope

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### 3.3 Employer Supply

- A connection point for potable water, service air and electrical power at normal voltage for the execution of the scope
- The necessary isolations and access to both sumps
- All scaffolding required for access to the sumps
- Lay Down Area for Site Establishment

### 3.4 Detailed Design specifications

#### 3.4.1 Degas Sump Specifications

- Material of Construction: Concrete sump with loose liner
- Dimensions: Height =  $\pm 4\text{m}$ , Length =  $\pm 7\text{m}$  Width =  $\pm 3\text{m}$ .
- Contents of Degas : De-cationised water

See Annexure C for more information

N.B. Please note all dimensions to be confirmed by the Contractor prior to commencement of any work on site.

### 3.5 Health, Safety & Environmental Requirements

Compliance with all current legislation and Eskom policies and directives is mandatory. The following requirements will be adhered to among others:

- OHS Act
- Environmental regulations

The Contractor will abide by the SHE requirements of Camden Power Station.

The Contractor will be responsible for personal protective equipment (PPE) requirements of Camden Power Station Water Treatment Plant for the Contractor's staff during the duration of execution.

The Contractor shall ensure cleaning of work areas and disposal of any waste materials generated in execution of the scope.

## 4. Acceptance

This document has been seen and accepted by:

Name	Function
S. Sulliman	Chief Engineer

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## 5. Revisions

Date	Rev.	Compiler	Remarks
February 2021	1	N. Naidu	Original Issue

## 6. Development Team

- Hassen Cassim
- Keith Northcott

## 7. Acknowledgements

N/A

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## ANNEXURE A: REQUIREMENT CRITERIA FOR CORROSION PROTECTION PAINT AND RUBBER LINING APPLICATORS

REQUIREMENT CRITERIA FOR CORROSION PROTECTION PAINT AND RUBBER LINING APPLICATORS	
Compiled By: Main Contractor Name:	Date: Company Representative Name: Title: Signature:
<p><b>1. Quality Assurance</b> 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, paint 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 PAINT AND RUBBER LINING APPLICATORS (Continued)		
Compiled By: Main Contractor Name:		Date: Company Representative Name: Title: Signature:
<b>4. Facilities and Equipment</b>		
Rating	Activity Type	Equipment
1	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.
2	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.
3	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.
<b>5. Quality Control Testing Equipment</b>		
<ul style="list-style-type: none"> <li>○ Hygrometer</li> <li>○ Wet film thickness (WFT) gauge.</li> <li>○ Depth profile gauge.</li> <li>○ Surface temperature gauge.</li> <li>○ Electronic dry film thickness (DFT) gauge.</li> <li>○ Pin-hole detection equipment (low voltage wet sponge or high spark) as required.</li> </ul>		
<b>6. Case Histories</b>		
<ul style="list-style-type: none"> <li>○ Records of completed successful contracts.</li> <li>○ List of major clients.</li> </ul>		

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**ANNEXURE B: CAPABILITY CHECKLIST FOR CORROSION PROTECTION PAINT AND RUBBER LINING APPLICATORS**

CAPABILITY CHECKLIST FOR CORROSION PROTECTION PAINT AND RUBBER LINING APPLICATORS (Continued)		
Main Contractor:		
Company Representative Name and Title :	Date:	
	Signature:	
Applicator:	Report No:	
Date of Evaluation:	Vendor Number:	
Scope: Quality Management System compliance, facilities, equipment, skills & general rating.		
<b>Requirements</b>	<b>Y/N</b>	<b>General Comments</b>
<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		
<b>Requirements</b>	<b>No:</b>	<b>General Comments</b>
<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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CAPABILITY CHECKLIST FOR CORROSION PROTECTION PAINT AND RUBBER LINING APPLICATORS (Continued)		
Main Contractor:		
Company Representative Name and Title :		Date:
		Signature:
Applicator:		Report No:
Date of Evaluation:		Vendor Number:
Requirements	Y/N	General Comments
<b>3. Safety</b>		
Is there an appointed Safety Officer		
Is there a comprehensive Safety File		
Requirements		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		
Abrasive Blast Cleaning:		
Compressors		
Blast pots		
Hoses and nozzles		
Water Cleaning:		
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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CAPABILITY CHECKLIST FOR CORROSION PROTECTION PAINT AND RUBBER LINING APPLICATORS (Continued)		
Main Contractor:		
Company Representative Name and Title :		Date:
		Signature:
Applicator:		Report No:
Date of Evaluation:		Vendor Number:
Requirements	Y/N	General Comments
Lining Application		
Brushes		
Rollers		
Conventional spray equipment		
Airless spray equipment		
Specialised Equipment		
Media removal equipment (conveyors etc)		
Vacuum cleaners		
Dehumidifying equipment		
Lighting equipment		
Ventilation equipment		
Requirements	Y/N	General Comments
5. Quality Control Testing Equipment		
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	No:	General Comments
6. Relevant i.e. comparable Case Histories		
Requirements		
Rating		
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 PAINT AND RUBBER LINING APPLICATORS" sheet.		

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## ANNEXURE C: QUESTIONNAIRE FOR THE SELECTION OF SUITABLE ORGANIC LINING SYSTEM/RUBBER LINING FOR THE INTERNAL CORROSION PROTECTION OF WATER SYSTEMS, CHEMICAL TANKS AND VESSELS AND ASSOCIATED PIPING

The selection of the required organic lining system or rubber lining compound for immersed service is directly dependent upon the properties of the liquid being contained. Each specific liquid will require a specific organic lining or lining compound and it must never be assumed that similar liquids are in fact the same. In the case of rubber lining SANS 1198 'The manufacture of rubber sheeting for rubber lining' covers the requirements for the manufacture of rubber sheeting of soft and hard (ebonite) rubber for lining of pipes and pipe fittings of diameter at least 25 mm, and other metal or concrete equipment. It includes a classification of the linings that enables the requirements to be specified by a line call-out.

The following information is required by the paint applicator/rubber lining applicator to select the suitable lining or compile the required line call-out for the rubber compound to be used.

1.0 LOCATION OF COMPONENT	
1.1 Name of power station	Camden Power Station
1.2 Component Identification i.e. Plant Code	Degas Sump 1 and 2
2.0 COMPONENT DETAILS	
2.1 Capacity of Component	Approximately 80 m3 each
2.2 Dimensions	Height = approx. 4m Length = approx. 7m Width = approx. 3m
2.3 No of access man-holes	1
2.4 Size of access man-holes	
2.5 Location of access man-holes	On top
2.6 Diameter and length of pipework	
2.7 Material of construction (mild steel etc.)	Mild Steel (assumed)
2.8 Please provide A4 drawing of component with this questionnaire	
3.0 ACCESS COMPONENT	
3.1 Is access available to locate compressors and equipment next to the component?	Yes
3.2 If adjacent access is not available how long will air and spray hoses need to be?	
4.0 TYPE OF WORK	
4.1 New works – clean original steel	
4.2 Maintenance work – previously lined	X
4.3 Concrete i.e. Water retaining structures	X
4.3.1 Are surfaces new, dry, cured, post	

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service?	
4.3.2 Is there spalling, cracking, exposed rebar?	Internal inspections have not been conducted as yet as the sump is still in service
4.3.2 What is allowable duration for lining activity?	7 days, there are 2 sumps on site and should be refurbished 1 at a time
4.4 Type and age of previous lining	HDPE (assumed) suspended bag type lining, approx. 8 years
4.5 Condition of the previous lining	Suspected tear in the bag lining sump 2
4.6 Total surface area to be lined (m <sup>2</sup> )	Approximately 122 m2 per sump
<b>5.0 SURFACE PREPARATION</b>	
5.1 Can abrasive blast cleaning be carried out inside the component/vessel/tank with consideration of access/confined space, ventilation etc.	Yes
<b>6.0 PROPERTIES OF LIQUID CONTAINED IN OR IN CONTACT WITH THE COMPONENT</b>	
<b>6.1 Acids/alkalis</b>	
6.1.1 Type of acid/alkali	
6.1.2 pH of acid/alkali	3 - 4
6.1.3 Concentration of acid/alkali	
<b>6.2 Organic liquids – organic acids, fats oils or solvents</b>	
6.2.1 Type of organic liquid	
6.2.2 pH of organic liquid	
6.2.3 Concentration of organic liquid	
<b>6.3 Petroleum products – petrol, diesel etc</b>	
6.3.1 Type of petroleum product	
<b>6.4 Water – type of water</b>	
6.4.1 Potable water	In all cases a water analysis is required and shall contain the following parameters as a minimum; pH, Turbidity (FTUs), Conductivity (µS.cm <sup>-1</sup> ), Total aerobic bacteria (CFUs/ml), Total anaerobic bacteria (CFUs/ml), Chlorides (mg.kg <sup>-1</sup> ), Sulphate (mg.kg <sup>-1</sup> ). A range of analysis (min, max, average) is required for each of the parameters.
6.4.2 Cooling Water	
6.4.3 Raw water (with micro-organisms?)	
6.4.4 Water treatment process waters (provide specific composition/concentration) i.e. % hydrochloric acid, sulphuric acid, caustic soda, ammonia, etc.)	Water exiting the cation vessel is stored in the Degas sumps before being pumped to the anion vessel. Hence the water is not completely de-ionised yet
6.4.5 Distilled/demineralised/de-ionised	
6.4.6 Condensate	
<b>6.5 Temperature &amp; Pressure of liquid</b>	

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6.5.1 Normal operating temperature	Ambient = approx. 14 deg C
6.5.2 Maximum or peak temperatures	40 deg C
6.5.3 Minimum temperatures	-4 deg C
6.5.4 Pressure of Liquid	Atmospheric
6.5.5 Maximum pressure of liquid	Atmospheric
6.5.6 Flow rate of liquid	
6.5.7 Will vacuum conditions occur?	No
6.7 If applicable, abrasion characteristics of the liquid	
6.7.1 Provide information of content, particle size, and physical characteristics of abrasive suspended matter likely to be present	
<b>7.0 OPERATION OF COMPONENT</b>	
7.1 Is the component operated on a continuous or batch process basis	Continuous
7.2 Ion exchange vessels	Specifics to be provided as per points 6.4 and 6.5 above for both the process condition as well as the regen condition in the same vessel.
7.3 Will the applied lining be subjected to any thermal shock, if so describe the operation.	No
<b>8.0 GENERAL</b>	
8.1 Provide any further information considered relevant to ensure the selection of the most appropriate organic lining/rubber lining material i.e. photographs of previous components/coating condition	The previous liner has failed twice since RTS and we would therefore like to replace the liner with a more durable product
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)	7 days, there are 2 tanks on site and should be refurbished 1 at a time
8.3 Provide information and details of whether corrosion protection by lining will interface with areas such as flanges, crevices and transition areas to other protective lining systems which would necessitate specific consideration. Schematics, photographs or appropriate drawings will be required to provide specific recommendations.	

**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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**ANNEXURE D: RTD/MAT/20/212 Rev 1: Protective Coating Specification for Camden Power Station –Degasser Sumps 1 and 2 (Loose Liner Repair)**

To be considered as Annexure D of 240-101712128: "Specification for the Internal Corrosion Protection of Water Systems, Chemical Tanks and Vessels and Associated Piping with Linings."	
<b>Vessel/Components</b>	Degasser Sump Surface Area = 122m <sup>2</sup> Height = 4m, Length = 7m Width = 3m.
<b>Internal Immersed (Material/Substrate)</b>	Concrete and existing Elastomeric polymer ethylene vinyl acetate (EVA) loose liner.  It is recommended that the composition/polymer type of the existing loose liner be verified/confirmed as EVA from the previous contractor's databook. Likewise the thickness of the existing liner to be verified/confirmed from the previous contractor's databook or by destructive testing/measurement.
<b>Internal Immersed (Environment)</b>	<ul style="list-style-type: none"> <li>• Operating Temperature: ambient 14°C, maximum 40°C, minimum -4°C.</li> <li>• Pressure: atmospheric.</li> <li>• pH = 3 to 4</li> <li>• Medium: De-cationised water (water with most positively charged ions removed)</li> </ul>
Surface Preparation	
<b>Preparation prior to Liner Section Replacement</b>	The loose liner on the floor section extending onto the walls and up to the weld shall be cut and removed. The liner shall be cut above the existing weld. The distance of the cut above the existing weld shall be sufficient in order to ensure all weld affected material above the existing weld is removed and the new weld edge of the liner exactly as per the rest of the liner in term of mechanical properties.
<b>Concrete Sump Substrate</b>	After removal of the affected floor section of liner the exposed concrete surfaces (including the surfaces behind the still remaining liner above) shall be washed and rinsed with clean

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<b>Preparation</b>	potable water. Washing/cleaning shall extend as far as is practical behind the remaining liner as to ensure no further damage to the liner and liner welds. The concrete surfaces shall be cleaned, inspected and repaired. The repair of the concrete shall include bevelling/contouring of all sharp/abrupt edges and corners.
<b>Required Generic System</b>	
<b>Protective Liner onto Concrete Substrate</b>	<ul style="list-style-type: none"> <li>• A geotextile layer of min. 500 g/m<sup>2</sup> shall be laid on the floor in order to provide a protection/cushion layer between the concrete and new liner. The geotextile shall be placed with a minimum overlap of 10 cm.</li> </ul>
<b>Replacement of (EVA) liner</b>	<ul style="list-style-type: none"> <li>• The existing liner polymer type and thickness shall be confirmed. If determined/confirmed not to be EVA then the polymer type shall be determined and the correct replacement liner i.e. same polymer and thickness to suite the existing liner shall be sourced.</li> <li>• Loose liner in the form of sheets to be cut and trimmed to ensure correct weld preparation dimensions, overlap and profile.</li> <li>• The mechanical properties, manufacture and installation of the liner system shall be in accordance with the requirements specified in EN 13361 "Geosynthetic barriers. Characteristics required for use in the construction of reservoirs and dams" and EN 13362 "Geosynthetic Barriers. Characteristics required for use in the construction of canals".</li> <li>• The welding process shall be governed by the following SANS standards: <ul style="list-style-type: none"> <li>➤ SANS 10269 - Welding of Thermoplastic - Welding Processes: Part 4: Hot gas extrusion Welding.</li> <li>➤ SANS 10268 – Part 10 Welding of Thermoplastic - Welding Processes: Part 10: Weld defects</li> </ul> </li> </ul>

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	<ul style="list-style-type: none"> <li>➤ SANS 10269 Welding of Thermoplastic - Approval of Welders</li> <li>➤ SANS 10270 Welding of Thermoplastic - Approval of Welding procedures and welds.</li> </ul>
<b>After welding and post weld testing and leak testing of the entire sump application of a secondary mastic sealing system.</b>	<ul style="list-style-type: none"> <li>• The seam welds should be capped with a polyisobutene cold-flow, viscous-elastic, non-cross-linked mastic tape.</li> <li>• The area to be capped should extend 25mm on either side of the seam welds.</li> </ul>
<b>1. Specific Requirements</b> <p>1.1. The installer shall have suitable equipment and qualified personnel as described/specified in the section below, "2. Tender Returnables", point 2.3, to ensure the lining system is correctly installed in accordance with this specification and referenced standards.</p> <p>1.1. The installer shall make use of an inspection schedule as part of the quality control. The inspection schedule form shall be as outlined in Annex H of EN 14879-5 "Organic coating systems and linings for protection of industrial apparatus and plants against corrosion caused by aggressive media - Part 5: Linings on concrete components" and submit this as part of the quality control record.</p> <p>1.2. All liner materials, including materials used for protection of the welds and for jointing/welding shall be capable of withstanding the chemical and thermal loading of the environment.</p> <p>1.3. Upon delivery the liner/sheeting shall be accompanied by an inspection certificate in accordance with 3.1 of EN 10204: "Metallic products — Types of inspection documents" for the sheeting and welding materials. The test parameters and acceptance criteria shall be in accordance with those as specified in EN 13361 and EN 13362</p> <p>1.4. As part of the contractor's QCP upon delivery of the liner material, the contractor shall:</p>	

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- Mark rolls or portions of rolls which appear damaged.
  - Ensure that rolls are properly labelled and that labelling corresponds with QC documents.
  - Complete roll numbers, date, roll size and log any damage on the Material Delivery Checklist.
- 1.5. Once the damaged liner has been cut/removed the exposed concrete surfaces shall be washed.
- 1.6. After washing of the concrete and a sufficient drying period a screed mixture or a suitable fast curing cementitious product shall be used to fill any damaged areas/voids in order to build up the floor to a suitably flat surface for supporting the lining. This step is not for the purposes of concrete rehabilitation or structural integrity but merely to ensure that the substrate is smooth and flat to provide the required support to the lining in the event of accidental pedestrian traffic or other incidents of short term light loading.
- 1.7. The 90 degree corners between the horizontal and vertical surfaces at the pipe inlet/outlet joints and walls needs to be contoured and profiled with a triangular section of concrete to smoothen the change between the horizontal and vertical direction.
- 1.8. Once the repair of the floor has been completed and suitably cured set/firm in order to allow foot traffic a free laying geotextile sheet of polypropylene (PP) shall be laid over the entire surface area of the concrete floor.
- 1.9. The lining installer shall check the substrate to ensure that it has been suitably prepared (flat and smooth) to accept the lining system. This step shall be a hold point in the QCP for all involved parties.
- 1.10. This layer must be polypropylene especially when the concrete is new or repaired with mortar. The high pH of cement destroys geotextiles of other qualities. The density of the base protection layer shall be min. 500 g/m<sup>2</sup>.

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- 1.11. Prior to any welding of the liner all dust, debris or any other deleterious matter such as moisture, oils, greases shall be removed from the surrounding weld joint surfaces.
- 1.12. The new liner sheeting is to be positioned and tacked using heat guns or gum tape.
- 1.13. The liner sheets shall be placed with an overlap of 5 cm to 8 cm depending on the welding device (machine or hand welder). No welding liquids, type THF (Tetra-HydroFuran) are allowed to assist in the welding process.
- 1.14. During the welding process, suitable measures shall be taken against any negative effects of the environment (e.g. temperature and possibility of condensation). Welding shall not be permitted when the ambient temperature is less than 10 °C OR the dew point is <3 °C above the substrate temperature OR the relative humidity RH > 75%.
- 1.15. The liner around the outlets of the sump and columns have to be configured and installed carefully (loose flange and fix flange). The liner shall be fixed between 2 compressible layers in the flange construction.
- 1.16. The welding of the liner shall be in accordance with the SANS Welding of Thermoplastic listed in the table above. NOTE: A Welding Procedure shall be submitted as part of the Method Statement at the time of tender.
- 1.17. The liner shall be visually examined for flaws such as cracks, blisters, voids, inclusions of foreign material and any damage to the lining surface or seams. The liner shall be tight and resistant to the expected fluid load. The correct extrusion angle must be used to ensure even substrate pre-heat extrusion flow.
- 1.18. All welds shall be pinhole and defect free and tight after completion of assembly, fixing and welding. The contractor/installer shall replicate a sample weld and evaluate the seam strength and continuity by performing an air pressure test as per ASTM D5820, one hour after welding. The applied pressure may not decrease more than 20 % for EVA or through the development of air bubbles.
- 1.19. After completion of the required weld and leak testing all the welds in the sump shall be covered with a cold-flow, viscous-elastic, non-cross-linked poly-isobutene polymer mastic in tape and paste form.

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- 1.20. The area to be covered should extend 25mm on either side of the weld.
- 1.21. It is imperative that all surface dirt and contaminants are completely removed before sealing or the adhesion of the sealant shall be impaired.
- 1.22. Surface preparation should be sequenced by wiping clean the substrates with isopropanol first then mechanical cleaning (buffing) and a final isopropanol clean prior to the sealing application.
- 1.23. The sealant system shall be applied after and over the lining weld repair system application.
- 1.24. The sealant tape 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 seal.

## 2. Tender Returnables

At the time of tender the contractor shall provide the following:

- 2.1. A valid ISO9001 certificate. A valid ISO9001 certificate for the liner manufacturer. The certificate shall clearly indicate the appropriate engineering/manufacture applicability to the liner product.
- 2.2. Provide verifiable references that the manufacturer (as selected by the installer) and the installer have successfully applied either bolted liner or cast liner or loose liner systems in applications totalling 3 times the surface area as required by this project within the last 5 years. The listing shall include contact details for the listed reference projects. The verifiable evidence shall include contact details, signed QCP's or Release Certificates for the listed reference projects.
- 2.3. Welder qualifications as per SANS 10269 and EN 13067, Plastics welding personnel — Qualification testing of welders — Thermoplastic welded assemblies – Group of materials 2 and 4 OR MERSETA Manufacturing, Engineering and Related Services Sector Education and Training Authorities accredited training NQF Level 2 and a minimum of 2 years' experience in a thermoplastic fabrication environment.

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The supervisor's qualification as per above and if according to MERSETA then NQF Level 2 and a minimum of 5 years' experience in a thermoplastic fabrication environment.

2.4. A detailed method statement explaining all required steps as specified in this specification for the repair of the concrete, replacement of the floor section of the liner, welding and weld protection and testing of the liner as follows:

- Inspection of the concrete surface before lining to ensure cleanliness of all debris or defects that could impact the flatness of the substrate.
- A detailed application plan describing the design, type, dimensions and installation steps and procedure.
- Sheet panel layout (including location of seams arrangement and dimensions of welds in the liner at the concrete walls and floor.
- Panel identification correlating to the batch or roll number.
- Seam preparation and testing.
- Trial welds and welding procedures as per SANS 10270.
- Test panels preparation and testing.
- The required testing of ambient temperature, surface temperature of the liner and relative humidity.
- Measures and inspections to ensure that the weld is protected against any deleterious contaminants such as greases or oils or debris and dust from the installation of the fixing attachments. Measures and inspections to ensure there is no droplet or obvious water runoff from a saturated concrete substrate in the welding zone areas.
- All inspection, testing and acceptance criteria for final inspection of welds for defects. This will include air pressure testing and weld characteristics i.e. lack of penetration.

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- 2.5. At the time of tender the contractor shall submit a detailed, project specific Quality Control Plan (QCP). The QCP shall be based on the detailed installation procedure/method statement and shall consider as a minimum (1) suitable substrate condition, (2) liner panel measurement and cutting, (3) environmental conditions acceptance, weld joint cleanliness and welding process and (4) all required testing steps and inspections.
- 2.6. All necessary valid calibration certificates of all test instruments and equipment shall be submitted with the tender. Note that the cost for all tests and inspections shall be for the contractor/installer. Upon successful tender award Eskom reserves the right to request further revision, clarification or additions in accordance with or as required by this specification.
- 2.7. At the time of tender the contractor/installer shall provide a definitive statement with respect to exclusions or deviations from this specification sheet. If there are none then the statement needs to reflect this. If no exclusions or deviations are defined at the time of tender, the requirements as prescribed in this specification and all other referenced standards shall apply.
- 2.8. The installed liner shall be guaranteed by the installer. This guarantee with proposed terms and conditions shall be submitted at the time of tender.

### **3. Safety Requirements and Considerations**

- 3.1. During the weld repair activities, care shall be taken to ensure adequate ventilation and lighting, to allow for good visibility and to avoid/minimise health and safety risks.
- 3.2. A confined space/s (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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- 3.3. Flammable Atmospheres: Gases, vapours and dusts can become trapped in CSs and create flammable or explosive atmospheres, and include combustibles e.g. Hydrogen, Acetylene, Adhesive, Primer and thinning/cleaning solvents, etc.
- 3.4. Walking / Working Surfaces and Visibility: Poor lighting may add to hazards caused by an irregular, sloped, or constricted working surface.
- 3.5. The Liner or 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.
- 3.6. Any solid waste materials or liquids stripped or generated during the lining operations shall be discarded in accordance with the requirements of the appropriate national and/or local authorities or the requirements of Eskom.
- 3.7. The Liner or 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 Liner or Contractor shall provide the personnel with the appropriate required PPE.
- 3.8. The Liner or Contractor shall provide for all necessary safety precautions and risk assessments.
- 3.9. The Liner or Contractor shall advise Eskom of all hazardous materials to be brought on site.
- 3.10. All lining 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. 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 shall be located (indoors/outdoors), typical ambient temperature for the particular season of the year and the maximum storage temperature limits as per the Manufacturers recommendations.

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3.11. The Liner or Contractor's Safety File for the area to be worked it shall address all the hazardous activities of abrasive blast cleaning and spray painting. The Liner or Contractor shall verify that the personnel carrying out these activities are suitably qualified.

3.12. The Liner or Contractor shall ensure that the abrasive materials used conform to all National Health and Safety Standards.

3.13. Specifically with respect to CSs and based on the descriptions and definitions of safety risks as per the above points it is imperative that the Contractor's/Applicator's Method Statement shall describe in detail, the measures and mitigation steps for the risks and hazards as identified in this specification sheet. It is compulsory that these safety risks/mitigation measures and any others as identified by the Contractor/Applicator be included in the Method Statement. Prior to the commencement of any work the Method Statement shall be submitted for review, acceptance/rejection by the respective Risk and Safety office/department.

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