

**RTD/MAT/17/60: Medupi Power Station Water Treatment Plant Sulphuric Acid
Bund Corrosion Protection Lining (rev2).**

This specification is 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”			
Vessel Type/Capacity		Sulphuric Acid Bund/	
Concrete surfaces (immersed)			
Environment	C5 I, pH 2, temperature range ambient. External surfaces of concrete bund exposed to inland atmospheric conditions and 98% sulphuric acid spills		
Material	Concrete substrate		
Application	Lining of the Internal Surface of the Sulphuric acid Bund.		
Surface Preparation	Abrasive blast. Surface profile as specified by the lining manufacturer		
Generic System			
Option 1	Coating		
	Concrete Primer	Lining	Finishing
	Two component low viscosity surface tolerant concrete penetrant epoxy. One layer, DFT 150µm.	Hand lay-up 25g glass-fibre tissue and epoxy concrete penetrant primer. apply on all floor/wall interfaces a 450g glass fibre bandage and saturate with concrete penetrant epoxy primer	Two component solvent free glass flake polyamine cured epoxy resistant to sulphuric and other acids. Two layers minimum 1mm dry film thickness (DFT). Nominal DFT 1-1.5mm
Option 2	Acid Proof Tiling		
Refer to Option 2 notes under special requirements	Acid-proof membrane comprising a butyl rubber membrane, rhepanol membrane, trowelled bitumen membrane or equivalent approved.	Acid-proof tiles of the ceramic split-plate type as supplied by National Ceramic Industries or equivalent approved.	
Option 3	Acid Resistant Bricks		
Refer to Option 3 notes under special requirements.	Acid-proof membrane comprising a butyl rubber membrane, rhepanol membrane, trowelled bitumen membrane or equivalent approved.	Acid proof bricks	

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1. Special Requirements:
 - 1.1. All requirements of 240-101712128 shall be complied with for the installation of the corrosion protection coating system.
 - 1.2. Inspection and Mark-up of Coating Areas:
A detailed visual inspection shall be carried out to identify and mark-up all areas that need to be lined, tiled or paved with bricks.
 - 1.3. On all floor/wall interfaces apply a 450g glass fibre bandage and saturate with concrete penetrant epoxy primer.
 - 1.4. Fill any pits etc. with epoxy putty or with polymer concrete, as required and re-slope the floor to facilitate correct run-off, if required.
 - 1.5. At any localised loading or drip area, embed a glazed ceramic split-plate type acid-proof floor tile into the lining.
2. General.
 - 2.1. The lining of the Sulphuric acid Bunds shall only be carried out by specialist contractors. Only Eskom approved vendors may carry out this work. The onus is on the specialist contractor to request to be assessed by Eskom.
 - 2.2. It is strongly recommended that engineering expertise (specifically in relation to concrete vessels) be consulted as part of this refurbishment activity. The engineering experts in consultation with the applicator and lining manufacturer shall compile a detailed application procedure for the works. This detailed procedure shall be submitted to Eskom for review and approval before the commencement of any work.
 - 2.3. At the time of tender the engineering experts and applicator shall submit a detailed programme showing how the works will be carried out and completed, including the required lining curing period, within the time constraints of the project.
 - 2.4. Prior to commencement of work, the Supplier 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 the Employer.
 - 2.5. The Supplier shall satisfy himself that the systems he proposes shall be suitable for use in the expected environments.

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- 2.6. Preference should be given to materials offering edge retentive technology which are designed to reduce thinning and coating pull-back over edges. The proposed materials must be able to cover uneven concrete and metal edges or concrete to steel interfaces without additional stripe-coating required. It shall remain the Engineer's prerogative to specify stripe coating of critical areas should he / she so prefer.
- 2.7. Preference should be given to heavily thixotropic materials; designed to be applied on vertical surfaces to the full specified system thickness in a single coat, without sagging or slumping. Where possible, the need for multiple coats in order to achieve the specified system dry film thickness (DFT) should be avoided so as to reduce the potential for inter-coat bond or contamination issues. Materials requiring multiple coats in order to achieve the specified minimum DFT should only be considered as a last resort.
- 2.8. Quality Assurance inspection to be conducted by Eskom lining inspector.
- 2.9. Ensure that the concrete is firm, free of foreign matter, inclusions, blowholes, porosity and non-friable. Loose, defective and friable concrete should be repaired.
- 2.10. All edges and corners shall be smooth and dressed to a radius, except for deliberately chamfered edges.
- 2.11. The detailed application procedure for the works required in 2.2 should prescribe the sealing of joints and cracks.
- 2.12. Conduct pH testing to establish pH levels. pH levels should be between 9 and 10.
- 2.13. Suitable and sufficient tests must be conducted to measure any residual concrete moisture and confirm that the residual moisture levels detected conform to the coating or lining material's minimum requirements and the manufacturer's minimum prescriptions.
- 2.14. It is imperative that all surface dirt and contaminants are completely removed before lining or the adhesion of the repair lining shall be impaired. Using mineral abrasive, grit blast the surface to remove all surface contaminants, surface laitance or weak frangible material.
- 2.15. On completion of grit blasting the surface should be thoroughly vacuumed until no loose dust is evident.
- 2.16. Care shall be taken to ensure adequate protection of surrounding areas and any parts of ancillary equipment i.e. pumps, filters, inlet and outlet piping from grit blasting, overspraying and lining contamination.
- 2.17. Brush, roller or spray apply the lining material in such a manner as to thoroughly wet out the whole surface. The areas to be lined should be gone over several times during the application, in order to obtain a wet surface and as much material soaked into the substrate as possible.

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- 2.18. Remove any puddling which has occurred on horizontal surfaces by mopping up the excess.
- 2.19. The total DFT of the applied coating system should comply with the recommended minimum and maximum DFT limits as recommended in the latest Product System Data Sheet and specification.
- 2.20. The lining 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 lining.
- 2.21. At the end of the curing period the full cure of the applied lining shall be verified by the applicator and /or lining manufacturer.
- 2.22. All coated surfaces shall be tested for freedom from pin-holes. Any pin-holes found shall be patch repaired and retested. Cognisance shall be taken of the curing requirements of the repaired areas.

3. Surface Preparation for Concrete – General

Concrete, by its nature is alkaline and if any breakdown in the corrosion protection lining occurs, for whatever reason, the acids would rapidly dissolve the concrete. Future repairs are made extremely difficult once the existing concrete has been contaminated, owing to its porous nature. This is true for both tanks & floors as well as bunds etc:

- 3.1. When conducting rehabilitation of exposed concrete, it is imperative that the acid saturated & contaminated concrete be chopped out and repaired, prior to the application of any new acid proofing lining. The pH of the substrate is to be closely monitored and the surface is to be chopped back until a pH in the region of 9 – 10 is achieved.
- 3.2. If concrete has already cracked, then the cracks need to be sealed using one of the following methods to allow for relative crack movement:
 - 3.2.1. Expansion Joints - Previously grouted expansion joints should have the grouting removed. Apply a solvent free, glass flake vinyl ester acrylic (GFVE) co-polymer suitable for immersed chemical environments coating as normal, allowing the coating to enter into the expansion joint and coating the vertical surfaces of the joint. After curing of the coating, re-grout the joint using a suitable polysulphide grouting material.

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- 3.2.2. Mobile Cracks - Where movement is expected to be severe, this can be alleviated by creating a convolute over the area of cracking. Use multi-directional woven reinforcement over the area of movement. Use a PVC or GRP former section to allow the reinforcement to pass over the area of cracking. Overcoat the reinforcement and former with a solvent free, glass flake vinyl ester acrylic ensuring that the coating does not exceed 2mm.
- 3.2.3. Stable Crack - Where joint movement is stable and minor movement owing to pressure changes has to be accommodated. The displacement area is to be treated by attaching tape to form a non-bonded area. Above the tape the area is reinforced using multi-directional fibre prior to over coating with a solvent free, glass flake vinyl ester acrylic.
- 3.3. All new concrete MUST be a minimum of 28 days old prior to the commencement of ANY surface preparation or lining procedures. This is essential to allow the Hydration reaction to complete in the concrete.
- 3.4. Surface preparation is the same for concrete as for steel, namely Abrasive Blast Cleaning. However, owing to the porosity of concrete the requirements for the vacuuming of the substrate prior to commencement of the lining procedure are more stringent and therefore more time consuming.
- 3.5. Abrasive blast cleaning of concrete will reveal pock marks i.e. internal porosity / voids / vacuoles, these will need to be filled using either quick-set cementitious grout or vinyl-ester putty.
- 3.6. The vertical walls of concrete constructions will normally have holes right through the walls left by the use of shuttering tie bars, bolts etc: These holes MUST be fully filled and sealed off using vinyl-ester putty, it is generally unacceptable to merely block or cap these holes.
- 3.7. When coating the concrete, the primer used must be a low viscosity penetrative primer and it MUST totally soak in to the concrete substrate, if this is not successfully attained, the lining system will fail. The primer must be applied by brush in a stippling motion to ensure total absorption.
- 3.8. Owing its friable nature, it is strongly recommended that for concrete exposed to acid / harsh environments, a 100% tissue membrane, hand laminated with GRP techniques and resins should applied to 100% of the concrete surface, prior to application of subsequent corrosion protection layers. The subsequent layers can then be high pressure spray applied. If the 100% tissue membrane is not applied, there is a very real risk of concrete tearing and breakage.
- 3.9. The surface preparation, including the initial application of tissue laminate, is the same for vinyl-ester & Epoxy coatings, Fibre-glass linings, Glass-reinforced Polymer Coatings as well as rubber lining.

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4. Option 2. Acid Proof Tiling.

4.1. General.

4.1.1. The Supplier shall satisfy himself that the systems he proposes shall be suitable for use in the expected environments.

4.1.2. Prior to commencement of work, the Supplier 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 the Employer.

4.2. Surface Preparation.

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.

4.3. Material Requirements.

4.3.1. The thickness of the tiles shall be either 15mm or 20mm, depending on the service requirements.

4.3.2. Tiles shall conform to DIN 18166, "Ceramic split tiles".

4.3.3. Pointing material shall comprise either furane or phenolic resin or equivalent approved.

4.4. Application Process.

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

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5. Option 3. Acid Resistant Bricks.

5.1. General.

5.1.1. The Supplier shall satisfy himself that the systems he proposes shall be suitable for use in the expected environments.

5.1.2. Prior to commencement of work, the Supplier 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 the Employer.

5.2. Surface Preparation

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.

5.3. Material Requirements.

5.3.1. Acid-proof membrane comprising a butyl rubber membrane, rhepanol membrane, trowelled bitumen membrane or equivalent approved.

5.3.2. Acid-proof bricks as supplied by Didier or SA Industrial Linings or equivalent approved.

5.3.3. Pointing material shall comprise either furane or phenolic resin or equivalent approved.

5.4. Application Process.

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

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6. Returnable in Tender document:

- 6.1. Supply of the latest revisions of the specified Material Product Data Sheets and Material Safety Data Sheets.
- 6.2. Detailed Program for the complete project (bar chart).
- 6.3. Detailed Quality Control Plan (QCP) specific for the refurbishment contract.
- 6.4. Method Statement to explain in sufficient detail the work conducted.
- 6.5. Information with respect to interfaces with activities (as in point above) being performed by other contractors.
- 6.6. Recycling of spent abrasive grit is not permitted. What type and grade of abrasive grit will be used? Supplier details to be provided.
- 6.7. Explanation of the sequence/order of work areas. The information to be detailed by narrative and to be indicated on drawings.
- 6.8. The applied lining system shall be guaranteed jointly by the lining manufacture and applicator. This guarantee with proposed terms and conditions shall be submitted at the time of tender.

7. Information and Works Information to be provided by Eskom in Enquiry Document:

- 7.1. Drawings and dimensions of WTP Sulphuric Acid Bunds.
- 7.2. Surrounding plant layout to enable the contractor to plan storage and work areas (site establishment).
- 7.3. Exact location of where mechanical repair/works, re-lining and/or lining repair in the system will take place.
- 7.4. Anticipated or expected times/duration of above activities.
- 7.5. Information with respect to interfaces with activities (as in point above) on the WTP channels being performed by other contractors.
- 7.6. Duration of the works.

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8. Roles and Responsibilities of Eskom/Coating Contractor/Other contractors as follows:
- 8.1. Who will ensure the required isolation of WTP Sulphuric Acid Bunds?
 - 8.2. Who will remove manway covers?
 - 8.3. The contractor to provide scaffolding/tarpaulin around the WTP Sulphuric Acid Bunds and dust extraction equipment to facilitate dust/grit containment during surface preparation of the channels.
 - 8.4. What inspections are to be conducted?
 - 8.5. Who will perform the inspections?
 - 8.6. Who will be responsible for mechanical repairs of the substrate (if so required)?
 - 8.7. Who will perform final inspections?
 - 8.8. Who will install and close manways on completion?
 - 8.9. Is the contractor required to perform lining repairs due to mechanical damage after WTP pipeline re-assembly?
 - 8.10. Who is responsible for final site clearing – debris, empty paint tins etc?
 - 8.11. Who will provide electrical supply?
 - 8.12. Who will provide compressed air?
 - 8.13. Who is responsible for other services – toilets, catering?
 - 8.14. Specific requirements:
 - 8.15. Who is responsible for disposal of abrasive grit?
 - 8.16. Eskom/Power Station specific safety requirements and general site requirements.