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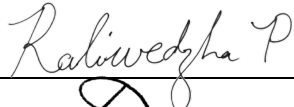


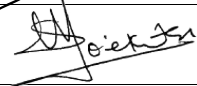
**ESKOM**

**KOEBERG NUCLEAR POWER STATION**

**SPECIFICATIONS ENGINEERING**

Specification Title

<p><b><i>PROJECT SPECIFICATION</i></b></p> <p><b><i>REPAIRS TO THE SEC DRUM AND RAKE SCREEN FILTRATION CONCRETE PITS</i></b></p>
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**KOEBERG NUCLEAR POWER STATION**  
**NUCLEAR ENGINEERING**

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**RECORD OF REVISIONS**

Rev	Date	Description of Revision	Prep.	Rev.	Appr.
0	29/08/2016	Original	BF	DL	RG
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# 1 SCOPE

## 1.1 Introduction

The SEC pump house draws water from the cooling water intake basin, filters it through a series of screens, before pumping the essential cooling water through Bonna pipes (concrete lined steel pipes) which are housed in underground galleries to the RRI/SEC heat exchangers located in the NAB. The seawater is filtered on entering the SEC system suction pits, to remove any debris that could lead to damage to the pumps, clogging up of the heat exchanger or pipes, causing a flow restriction. The filtration consists of two parts, a rake / bar screen and a rotating drum screen. Both the rake screens and the drum screens are supported by concrete structures (hereafter referred to as the concrete pits) as shown in Appendix A.

The SEC drum screen pit is classified as a very corrosive splash zone. Repeated wetting and drying of the concrete provides both a high concentration of chloride ions and sufficient quantities of oxygen and water for corrosion of the reinforcement. Hence, the walls of the pit are experiencing large areas of delamination as a result of chloride induced reinforcement corrosion. Delamination of these walls can cause significant damage to the drum screen and/or water blockages if left unattended.

## 1.2 System Functions

The SEC Pump house is classified as per the Koeberg SAR (Safety Analysis Report) as a Safety Class SC-2 or Safety related Structure and its main functions are:

- The transfer of heat from structures, systems and components (SSC) which are important to safety to an ultimate heat sink viz. the sea. The system is required to transfer the heat load of these SSC under normal operating and accident conditions.
- The SEC pumphouse supports pumps and filtration equipment used for the transportation of cooling water to the Nuclear Island.
- The pump house consist of two units and each unit has two independent trains or pipelines.

During outage X23, the drum screen pits were inspected over an area extending to one metre below the waterline. Special attention was given to areas where stainless steel bolts and plates are used to temporarily hold the delaminated concrete in place to prevent damage to the drum screen. During the inspection the following observations were made:

- Significant cracking was seen in areas where anchor bolts were in close proximity to each other indicating ongoing corrosion and expansion of the rebar behind the delaminated concrete.
- Substantial ongoing propagation of delamination around the anchor bolt (up to 1m around the bolts)

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- During the removal of concrete, it was found that the reinforcing steel bars had lost significant cross section in certain areas of the concrete pits because of chloride-induced corrosion.
- Large areas of delamination were repaired during this outage. However, there are still patches of delaminated concrete on the inside of the drum screen circumference above the waterline, which were not repaired due to outage time constraints.

During outage X24 the rake screen and drum screen pits were again inspected above and below the waterline and the following observations were made:

- Delamination below the waterline was not observed on both rake screen and drum screen pits.
- Large areas of delamination were observed on the rake screen pit and were subsequently repaired.
- Delamination was observed on the drum screen pits in addition to the patches left from the previous outage X23 as attached on Appendix B.

### 1.3 Purpose

The purpose of this document is to define the requirements for the refurbishment/repair of the SEC drum screen and rake screen concrete pits and associated civil structures for Units 1 and 2.

### 1.4 Scope of Work

The scope of work covered by this specification includes the following:

1. Provide access to the areas that require repair.
2. Prepare concrete surfaces for repair (i.e. drum screen pit, rake screen pit, concrete floors and hatch entry points).
3. Repair all reinforcement corrosion defects.
4. Supply and install approved products/materials required to repair concrete surfaces.
5. Supply and install products/materials to serve as additional protection against chloride induced corrosion.
6. Provision of all quality control documents associated with the repairs.

### 1.5 Abbreviations

<b>KOU</b>	Koeberg Operating Unit
<b>FFD</b>	Fitness for Duty
<b>HP</b>	Hold Point

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<b>KNPS</b>	Koeberg Nuclear Power Station
<b>NSSS</b>	Nuclear Steam Supply System
<b>NDT</b>	Non Destructive Testing
<b>OHSA</b>	Occupational Health and Safety Act
<b>PAT</b>	Personnel Access Training
<b>QA</b>	Quality Assurance
<b>QC</b>	Quality Control
<b>SA</b>	Sacrificial Anodes
<b>SANS</b>	South African National Standards
<b>SHEQ</b>	Safety Health, Environmental and Quality
<b>WP</b>	Witness Point

## 1.6 Outage regime

During the operation of the plant, the SEC pump house will not be available to conduct inspections and repairs on the drum screen and rake screen pits. However, the work shall be scheduled to be performed in the upcoming maintenance outages X25 on both Unit 1 and 2.

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## 2 REFERENCES

<b>2.1</b>	331-93	Guide for the classification of Plant components, Structures and Parts
<b>2.2</b>	331-170	Koeberg Paint specification
<b>2.3</b>	Act 38 of 2000	Construction Industry Development Board
<b>2.4</b>	DSG-317-094	Specification for Chemical Products and Materials at Koeberg Nuclear Power Station
<b>2.5</b>	KGA - 098	To determine quality programme monitoring and verification requirements
<b>2.6</b>	OHSA No 85/93	Occupational Health And Safety Act No 85 of 1993
<b>2.7</b>	SANS 1200 AH	Standardized specification for civil engineering construction Section G: Concrete (Structural)
<b>2.8</b>	SANS 1200 CC1	Standardized specification for civil engineering construction Section G: Concrete (Structural)
<b>2.9</b>	SANS 5860:2006	Concrete tests - Dimensions, tolerances and uses of cast test specimens
<b>2.10</b>	SANS 5861-3	Concrete test – Making and curing of test specimens
<b>2.11</b>	SANS 5863:2006	Concrete tests - Compressive strength of hardened concrete

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### 3 REQUIREMENTS

- 3.1 The works shall be executed in accordance with general specifications listed in section 2.0 of this document.
- 3.2 The Contractor's personnel shall be security cleared and qualified via the Eskom FFD system.
- 3.3 The Contractor's personnel shall at all times adhere to the Eskom safety and security rules and regulations.
- 3.4 Documents provided by the Contractor, requiring review and approval from Eskom, shall be formally submitted to the Project Manager at least 7 days prior to the expected date of execution, implementation or use of such documents.
- 3.5 The following documentation shall as minimum be submitted to Eskom for approval prior to start of work:
  - Safety Health, Environmental and Quality (SHEQ) documentation as required by the tender documentation,
  - Detailed Work procedures,
  - In-situ and laboratory testing procedures,
  - Accreditation certificates for laboratories,
  - Calibration certificates for in-situ test equipment,
  - Detailed work plans are to be submitted by the Contractor indicating hold and witness points.
  - Laboratory test results for alternate repair materials proposed by the Contractor.
  - Results of mock-up repairs in cases where the Contractor's methodology differs from that specified by Eskom.
- 3.6 No site work shall commence unless the applicable work permits are in place.
- 3.7 All work shall be carried out under the supervision of experienced supervisors.
- 3.8 All personnel performing the work associated with this specification shall have the necessary skills and training to perform the work, to the required standard and quality level.
- 3.9 The Contractor shall provide the Eskom appointed independent quality assurance (QA) and quality control (QC) personnel (hereafter referred to as the Engineer) access to the work site for all hold and witness points. No work shall



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proceed without signoff of the required hold and witness points

- 3.10 The Contractor shall provide Eskom and the Engineer access to the Works for inspection purposes.
- 3.11 The Contractor shall provide Eskom and the Engineer with original test data and material certificates. This documentation shall be kept in a QA/QC data pack together with the original QC plan.
- 3.12 The Contractor shall be responsible for the repair and reinstatement of any damage caused to existing plant buildings and infrastructure which may occur during execution of the works. All damage shall be brought to Eskom's attention prior to the implementation of any repairs. All repair methods shall be approved by Eskom.

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#### **4 ACCESS**

- 4.1 The Contractor shall provide suitable and safe access for the execution and inspection of the works.
- 4.2 The Contractor shall provide Eskom and the Engineer's representative with the necessary access to inspect, witness and document the execution of the works to ensure that repair process is properly controlled and documented.
- 4.3 Repairs shall not be carried out by rope access unless written instruction to do so in restricted areas is received from the Engineer.

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## 5 CONFIRMATION OF THE EXTENT OF REPAIRS

- 5.1** The Engineer (Eskom) shall identify the areas for repair prior to the execution of the works.
- 5.2** The Engineer shall mark out the extent of the area to be repaired by performing a hammer survey of the concrete inside and around the delaminated/spalled areas or visibly damaged concrete.
- 5.3** The Engineer (Eskom) shall mark out the perimeter of the repair to define the boundaries of the repair area.
- 5.4** The Contractor shall extract cores for testing chloride profiles as a function of depth under the supervision of the Engineer's representative. The position where these samples are to be taken and the depth shall be identified by Eskom's Engineer.
- 5.5** No holes shall be drilled into the concrete without performing a scan of the concrete to determine the position of the reinforcement.
- 5.6** A cover meter or suitable penetrating radar scanner shall be used to detect embedded rebar prior to drilling or coring **[Witness point]**. The Contractor is required to demonstrate that he is able to detect the rebar with his scanning equipment.
- 5.7** The following criteria shall be used to classify repair methods required:
- Smaller than 0.10 m<sup>2</sup> - use trowelled repair method (Section 6)
  - Smaller than 4 m<sup>2</sup> – use cast repair method (Section 6).

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## 6 PREPARATION OF CONCRETE SURFACES FOR REPAIR

It is essential to evaluate the concrete removal operations and their impact on the structure's integrity throughout the repair process and to limit the extent of damage to the structure and the existing concrete.

The need for temporary supports, shoring, bracing, and strengthening should be assessed by the Contractor who is responsible for the temporary works. The Employers' engineer shall be responsible for the overall integrity of the structure.

The Contractor shall ensure that the temporary works do not jeopardize the integrity of the structure. The following process is specified:

- 6.1 Mark out the boundary of the area to be repaired at least 50 mm beyond the edge of the area identified in the delamination survey and marked as described in the previous section. The boundary shall comprise straight lines which are either horizontal or vertical.
- 6.2 Use an angle grinder to cut a groove approximately 10 mm deep along the marked area to be repaired. The concrete must be cut back at an angle of approximately 45° to the surface such that the repair undercuts the existing surface of the concrete which will remain in place. No feather edges are permitted.
- 6.3 Break out the concrete on the inside of the cut perimeter of the repair. Concrete removal should continue until no further delamination, cracking, or significant corrosion is observed along the reinforcing steel. During the excavation works, the Contractor should continuously conduct a hammer/sound test on the adjacent concrete outside of the repair perimeter. If the delaminated area expands, the Engineer shall be informed and permission obtained to exceed the perimeter while the excavation is on-going. This will prevent rework after QC intervention points are initiated.
- 6.4 Undercut the first layer of reinforcing steel. Care should be used to prevent further damage to the reinforcing. Excavate to half the depth of the second layer reinforcement **OR** until sound concrete is found. This depth of excavation shall be used for costing. NOTE: The Contractor shall not break out concrete behind the second layer of reinforcement without Engineer's permission. If the second layer of reinforcement shows signs of corrosion, the Engineer shall be informed to determine the extent to which additional breaking out of concrete is required. If the second layer of rebar is exposed then the rebar shall be tied back into the remaining concrete at regular intervals by means of steel hooks epoxied into the concrete. This detail is to be approved by Eskom's engineer.
- 6.5 Clean the excavated surface area with a less invasive and aggressive method such as abrasive blasting, shot blasting, and water blasting. High pressure washing with potable water has shown to be effective and is the current preferred method at KNPS. The surface shall be clean of any grit, sand, water and dust.

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- 6.6** All exposed surfaces of the reinforcement should be thoroughly cleaned of all loose concrete, rust, oil and other contaminants. Sandblasting may be used. For areas still showing rust, wire cupping using the grinder shall be used and is the preferred method currently at KNPS. All loose concrete, aggregate, rust, oil and other contaminants should be removed from concrete surface and reinforcing steel. **[HOLD POINT]**
- 6.7** Cleaning the steel to bright metal is not required. Once the Engineer has accepted the cleaned state of the rebar, the rebar is to be coated immediately.
- 6.8** Where loss of reinforcement is greater than 10% by area, the Engineer shall be notified, and the corroded bar shall be spliced with an equivalent bar to make up the lost area. The splice length shall be 50 times the bar diameter. Suitable mechanical connections (couplers) may be considered where splicing is undesirable or impractical. The couplers (such as those described in ACI 439.3R) shall meet the requirements of ACI 318. Testing of couplers would be required prior to or during the project. However, should a situation arise where the minimum lap length cannot be achieved or a mechanical coupler cannot be installed, then an alternative method would be required. The Contractor will be required to drill/anchor the reinforcement using an approved epoxy as shown in Appendix C. This will only be considered on a case-by-case basis and is subject to approval by Eskom. **[HOLD POINT]**
- 6.9** Rebar that is exposed after the breaking out of delaminated concrete shall be tied to every 2nd rebar of the second layer, including areas where the second layer of rebar is not fully exposed. The Contractor shall ensure that the first layer of rebar is returned to its original position and is tied securely to the second layer rebar ensuring electrical continuity.
- 6.10** Use a high-pressure water jet to thoroughly clean the concrete surface in and around the repair area before the application of migrating corrosion inhibitor.
- 6.11** Embedded galvanic anodes shall be installed ensuring electrical conductivity with the reinforcement. The anodes shall be alkali-activated with an internal pH of 14 or greater to keep the zinc active over the life of the anode and non-corrosive to the rebar. The connecting wires to the rebar shall not be wound around the sacrificial zinc anode but shall be cast into the zinc. Anodes to be spaced no more than 600 mm apart. The Contractor shall install the sacrificial anodes in accordance with ACI RAP-8 and the manufacture's specification.
- 6.12** The electrical continuity of the anodes and the embedded reinforcement shall be inspected and signed off by the Engineer prior to the application of any repair product which may conceal these connections. **[HOLD POINT]**
- 6.13** The exposed rebar is to be coated. Ensure that the exposed concrete surface is not coated during this process.
- 6.14** Install formwork as required or apply grout by trowel according to the

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manufacturer's specification. Formwork shall be used in all areas greater than 0.1 m<sup>2</sup> in size. No formwork shall be installed without the completion and acceptance of all witness and hold points specified in the previous steps. The cover to the rebar shall be the same as the original construction specification.

- 6.15** Mix repair mortar or grout according to the manufacturer's specification. The Contractor shall place the mortar or grout within the specified pot life of the material specified by the manufacturer. Any grout or mortar not placed within the specified time shall be disposed of at the cost of the Contractor.
- 6.16** Pour or place grout into the required position or formwork.
- 6.17** The Contractor shall produce at least 3 (three) 150 x 150 x 150 mm test cubes for every 150 litres or 10 x 25 kg bags of repair mortar used in the cast in place repair process. The cubes shall be identified in such a way that they can be associated with the relevant repair area. For trowelled applications, 3 (three) 50 x 50 x 50 mm test cubes for every 25 kg bag or part thereof shall be produced. The making and storing of concrete cubes shall strictly adhere to the requirements in SANS 5861 and any deviation from the code will be considered a non-conformance.
- 6.18** Where formwork is not used, profile the vertical surface so that it is flush with the existing surface, unless the specified cover is not achievable, in which case the repair shall stand proud of the existing concrete surface. The Contractor shall ensure that concrete surfaces do not cause any interferences with mechanical / rotating equipment surrounding the repair area.
- 6.19** Formwork to remain in place for at least 2 days.
- 6.20** After stripping of formwork, the repaired area shall be made smooth and shall be free of defects such as honeycombing and voids. Repair areas shall be inspected by the Engineer's representative prior to any cosmetic finishing is implemented. **[HOLD POINT]**
- 6.21** Apply a surface coating (Hydrophobic) to the entire concrete surface as per manufacturer's specification. Once all the cosmetic finishes have been done the entire surface of the zone under repair shall be coated with a hydrophobic coating (not only the repaired area). The Contractor shall ensure that the entire wall is free from dust/dirt before the coating is applied. **[WITNESS POINT]**.
- 6.22** Access to repaired areas shall not be permanently removed before final inspection and acceptance of the completed repair. Acceptance of the completed repair shall be carried out by Eskom's Engineer. **[HOLD POINT]**

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## 7 MONITORING OF REPAIRS

- 7.1 The Contractor shall provide the Engineer with access to the repairs in order to perform visual inspections to check for shrinkage cracking at the following stages:

### **Cast Repairs:**

- Immediately after formwork is removed
- 3 days after formwork is removed

### **Trowelled repairs**

- 24 hours after applying the repair mortar
- 3 days after applying the repair mortar

- 7.2 Cracks in the repair zones shall be marked out, measured and photographed for record purposes.

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## 8 PRODUCTS/MATERIALS REQUIRED FOR THE REPAIRS

8.1 The following materials are recommended to perform the local repairs as described in the preceding section.

- **Protective coating for Steel** - SikaTop Armatec 110 EpoCem or equivalent
- **Protective coating for concrete** – Sika Hydrophobic coating or equivalent
- **Bonding agent for trowelled repairs** - SikaTop Armatec 110 EpoCem or equivalent
- **Corrosion inhibitors for concrete** - Sika FerroGard -903+ or equivalent
- **Sacrificial anodes** – Sika FerroGard Patch Galvanic anode range or equivalent
- **Trowelled concrete repairs** - Sika MonoTop – 615HB or equivalent
- **Anchorfix** – Hilti RE 500 V3 or equivalent.
- **Other concrete repairs** - SikaGrout 212 bulked up with 9 mm stone with reduced water content [~3.0 litres per bag] or equivalent

It must be noted that Prostruct materials have been used at Koeberg Nuclear Power Station concrete structures with Prostruct 531 as a self-compacting grout.

- 8.2 Only materials approved by the Engineer may be used in the execution of the works. Any deviation from the originally specified material shall be presented to Engineer for evaluation prior to application or installation.
- 8.3 Material samples, certificates, documents and other technical information presented to Eskom shall not relieve the Contractor of his responsibility to check actual dimensions / tolerances of the works, prevent the incorrect selection and use of materials, and erroneous interpretation of the specifications.
- 8.4 The Contractor shall be responsible for the timeous submission of the list of materials to be used during the works for approval in accordance with DSG-317-094. The repair mortars (for towel-applied, cast application) shall have an electrical resistivity similar to the parent concrete under similar moisture conditions. Reference values and test procedures will be specified by the Engineer. Further requirements for repair materials may be specified by the Engineer, based on structural requirements and mortar application methods.
- 8.5 The Contractor is encouraged to undertake selected representative initial identification tests for the product he intends to use in accordance with Table 2 of EN 1504 Part 3.



- 8.6 The selected repair material shall comply with the performance criterion as stipulated in Table 1 below.

Performance Characteristic	Requirement
Compressive Strength	> 45 MPa but < 60 MPa
Adhesive bond	>1.5 MPa
Elastic modulus	>20 GPa
Drying Shrinkage	<400 microstrain

- 8.7 The selected repair material shall comply with the durability criterion highlighted in (Durability indexes and their Use in Concrete Engineering: Prof. Mark Alexander, UCT) stipulated below in Table 2.

Durability Indexes	OPI (log scale)	Sorptivity (mm/ $\sqrt{h}$ )	Conductivity (mS/cm)
Full Acceptance of Field Specimens	> 9.4	< 9	< 1.00
Laboratory concrete	> 10	< 6	< 0.75

These Durability Indexes shall be conducted in accordance with SANS 3001-CO3: Concrete durability index testing.

- 8.8 The Contractor may propose the use of alternative materials to those presented above for acceptance by the Engineer. Alternatives will only be considered if the necessary test data and validation of the material's suitability for the application is provided to the Engineer for consideration. The Contractor shall provide justification to why he has chosen a specific product as an equivalent and the Engineer will review the justification before the approval of the product. The Contractor will not send the Engineer a list of materials to choose from without any justification from the Contractor.

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## 9 APPLICATION OF PROTECTIVE COATINGS

- 9.1 All concrete surfaces of the SEC drum screen and rake screen pits shall be coated with a hydrophobic coating. Surface coatings may not be used in the pits. The Contractor shall not apply hydrophobic coating over any existing coating or any surface which has not been adequately cleaned.
- 9.2 Concrete surfaces shall be prepared for coating as per the manufacturer's specification.
- 9.3 All concrete surfaces shall be cleaned with high pressure water jet.
- 9.4 The Contractor shall take special precautions to ensure that the coating applied to the concrete surface before the pot life of the material is reached and applied to the ideal surface condition as indicated by the manufacturer.

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## **10 QUALITY CONTROL**

- 10.1** The works shall be categorised as quality level Q3.
- 10.2** The Contractor shall provide Eskom with an installation Quality Plan for approval.
- 10.3** Quality control on the site shall be carried out by the Engineer or his appointed representative in accordance with the Contractor's Quality plan and the contents of this specification, with specific emphasis on hold and witness points defined in section 6 and 7 above.
- 10.4** The Contractor shall be required to sign off on all hold and witness points.
- 10.5** The Contractor shall not progress with any activity which is preceded by another activity that includes a hold or witness point without sign-off by the Engineer or his representative.
- 10.6** All repaired areas shall be photographed and documented by the Engineer's representative at various stages during the repair process.

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## **11 INSTALLATION REQUIREMENTS**

- 11.1** The Contractor shall use proven and accepted engineering, construction practices to complete the work. Detailed method statements are to be submitted to the Engineer for approval prior to the start of the works.
- 11.2** All equipment and materials shall be handled, transported and stored in accordance with the requirements of the OHSWA and additional rules and requirements of the Koeberg Site, and specific storage conditions specified by the material manufacturer.
- 11.3** All method statements submitted to Eskom shall not relieve the Contractor of his responsibility, with reference to workmanship and safety.
- 11.4** The Contractor shall make every effort to reduce the amount of wastage of material.
- 11.5** The Contractor shall ensure that no debris or equipment to be used inside of the pits, falls to the bottom of the pits. The Contractor shall appoint a competent person to ensure adequate housekeeping of materials and equipment during the works. The Engineer will conduct unannounced site visits to ensure that these requirements are met.

## 12 MEASUREMENT AND PAYMENT

**12.1.** All works shall be carried out in accordance with the Contract.

**12.2.** No additional work shall be carried out without written consent from the Employer and acceptance of the related compensation event.

**12.3.** Payment shall be made according to the Contract. All supporting services including, but not limited to, the following shall be included in the price:

- Induction training and obtaining of security clearances for access.
- All labour and equipment to access the works.
- All safety measures and equipment required to perform the work in accordance with Koeberg site, local and national regulations.
- The hiring and procurement of all tools and equipment necessary to perform the work.
- The housekeeping of the site as a result of the work.
- Protection of existing services, equipment and infrastructure from damage or fouling during the execution of the works.
- Removal and disposal of construction waste and debris.

**12.4.** The method of pricing the works shall be as listed in Table .

**Table 3: Method of Pricing**

Activity	Method pricing
Excavation of concrete in marked out areas	To be priced on the area of the marked up zone. The depth of excavation is based on the range cover between 50mm and 100mm depending on the condition found, the diameter of the first layer of rebar (25 mm maximum) and a further half the depth of the second layer reinforcement. The excavation includes for local excavation behind second layer of rebar so that the first layer of rebar can be tied to the second layer of rebar. The excavation includes for all equipment, material, things required to complete the works in accordance with the requirements of this specification. NOTE: The excavation can be further than half the depth of the second layer of reinforcement if corrosion is seen on the second layer and instructed by the Engineer.

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Activity	Method pricing
Replacement of Rebar	To be priced on the rebar and couplers used to replace corroded rebar in accordance with this specification. This can include anchoring & drilling of rebar to the concrete using an approved epoxy (Appendix C).
Installation of Anodes	<p>Installation consists of:</p> <ul style="list-style-type: none"> <li>• Drilling of holes for the purpose of installing the anodes</li> <li>• Electrical continuity connections</li> <li>• Application of conducting mortar</li> </ul>
Cast in-situ concrete repairs	To be priced on the area of the repair and includes the preparation of the substrate and rebar, volume of cast concrete, area of formwork, surface coats and all other things required to ensure completion of the repair in accordance with this specification. This item also includes for the cost of making / taking samples and testing these in the laboratory, as required by this specification.
Coating (Hydrophobic)	Cleaning and coating (and possible removing of existing coating) to be applied to all concrete surfaces.
Estimated Quantities in (m <sup>2</sup> )	<p>Unit 1 Train A = 20 m<sup>2</sup></p> <p>Unit 1 Train B = 12 m<sup>2</sup></p> <p><b>Please note</b> that the above quantities will increase, as the final inspection will be completed on outage 125 which includes rake screen inspection to give actual quantities due to the ongoing degradation from last inspection.</p> <p>Unit 2 Train A and Train B quantities including rake screen will be determined on outage 225 inspection as most of the repairs were done in previous outages.</p>

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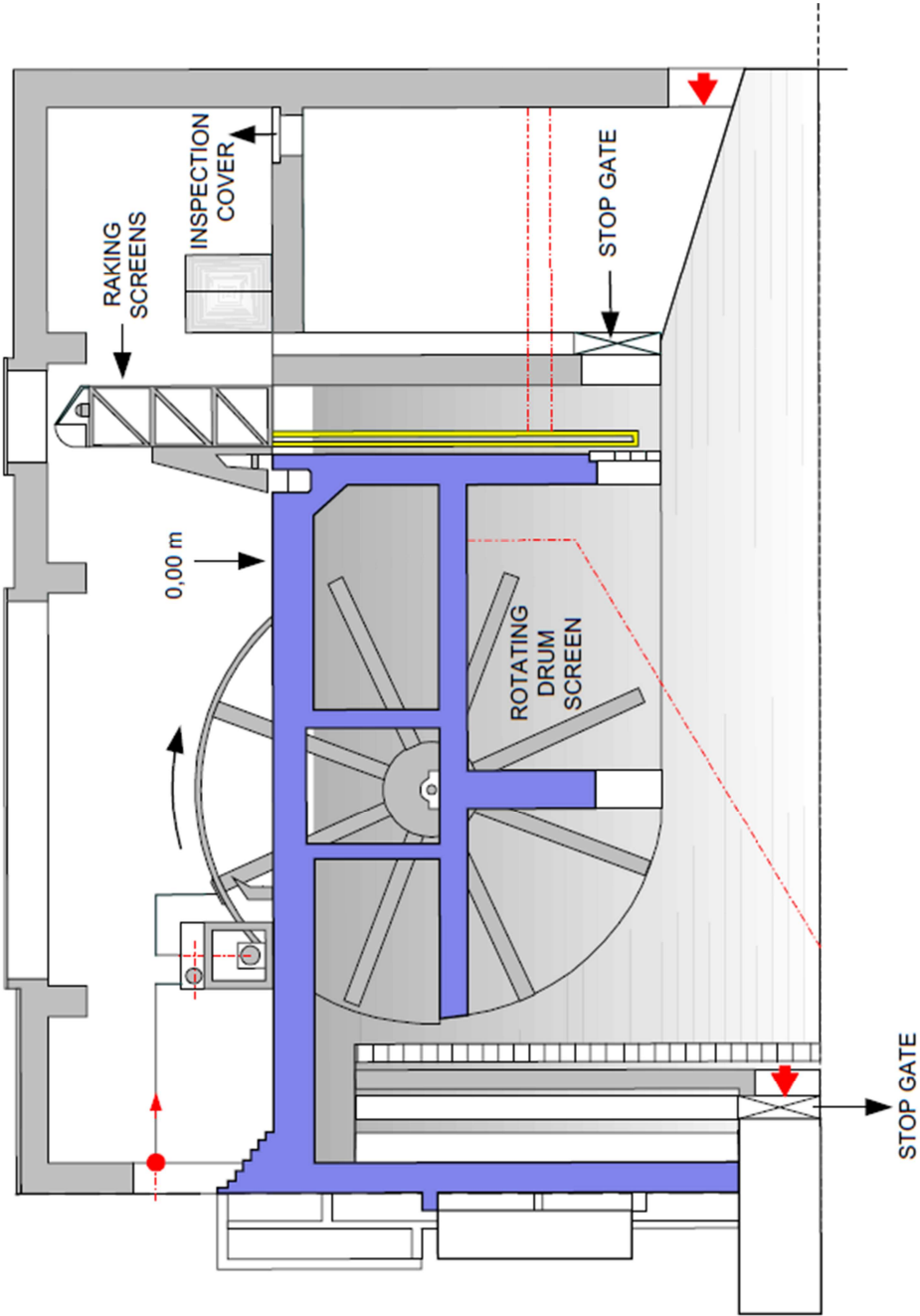
General Notes:

1. Costs to include the supply of labour, equipment, compressed air, safety equipment, other PPE, and any other service, equipment, material, things required to complete the works. No compensation will be granted for any over break, or wastage of the cementitious repair mortar / products. Scaffolding will be provided by the Contractor.
2. The Contractor shall supply a detail method statement describing the logistics, the sequence of operations and each aspect of the work. In addition, the Contractor is required to supply a detailed test schedule which demonstrates compliance of the materials and methodology to the specification.

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### 13 ATTACHMENTS

#### Appendix A – SEC Drum screen and Rake screen pits











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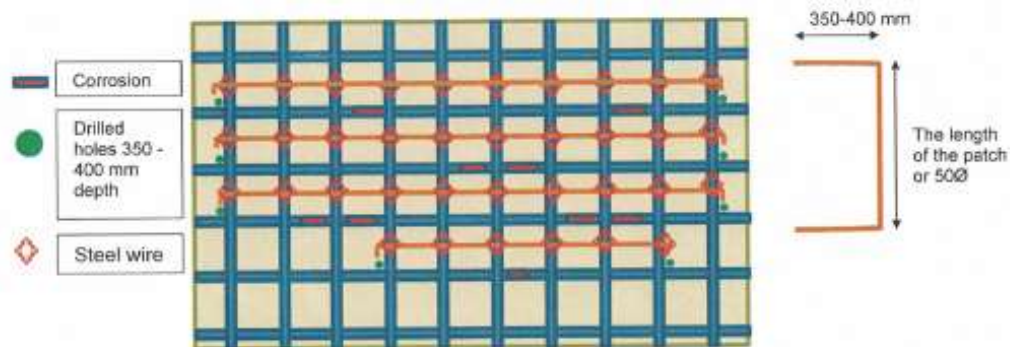


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## Appendix C – Alternative rebar Dowelling Method (see below for notes)

The contractor shall install **horizontal rebar** using the following procedure:

1. Measure the length of the corrosion across the horizontal bar
2. Drill a hole of 350 mm depth on either side of the vertical rebar. Ensure minimum lap length of 50Ø or the entire length of the patch.
3. Anchor a solid Y16 bar across the corroded area using HILTI-500 V3 anchor fix epoxy. Rebar shall be spaced at 100 mm c/c
4. Ensure that the holes are adequately cleaned prior to installation of rebar (*Hold point*)
5. Tie the bar to the outside of the vertical rebar and if possible tie to the horizontal rebar.
6. Check if the anode is making a connection to the newly installed steel rebar. (*Hold point*)
7. Coat the bar with the appropriate coating and make sure the back of the bar is coated.
8. The repair shall be made to stand proud from the surrounding concrete surface to achieve the desired cover.

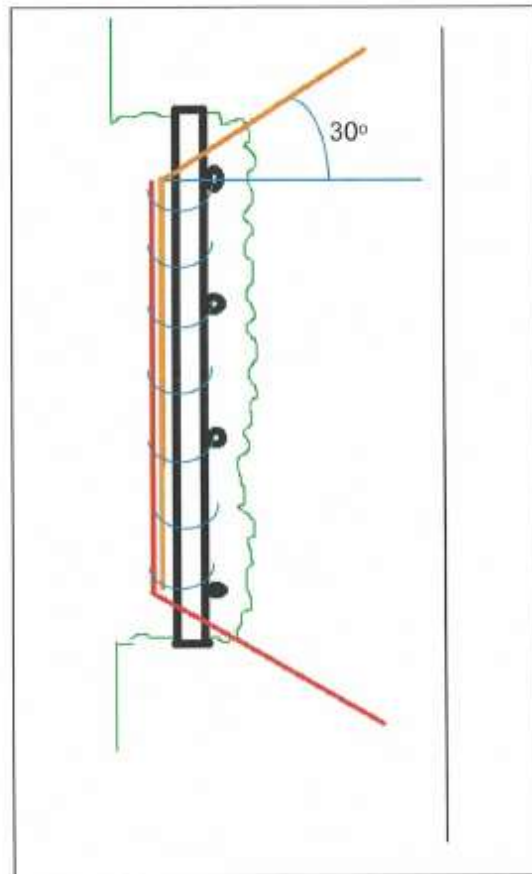


The contractor shall install **vertical rebar** using the following procedure:

1. Drill a hole of 350 - 400 mm depth on either side of the vertical rebar at a 30 degree inclination. Ensure minimum lap length of 50Ø or the entire length of the patch.
2. Anchor a solid Y16 bar into the top and the bottom of the corroded area using HILTI-500 V3 anchor fix epoxy.
3. Ensure that the holes are adequately cleaned prior to installation of rebar (*Hold point*)
4. Tie the bar to the outside of the vertical rebar along the entire length of the bar @ 100 c/c spacing and if possible tie to the horizontal rebar.
5. Check if the anode is making a connection to the newly installed steel rebar. (*Hold point*)

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6. Coat the bar with the appropriate coating and make sure the back of the bar is coated.
7. The repair shall be made to stand proud from the surrounding concrete surface to achieve the desired cover.



**Please note** the correction on the above Appendix C – Rebar Doweling method.

- Under *Horizontal rebar* procedure, Item 2; Drill a hole of 350mm depth on either side of horizontal rebar.
- A minimum solid Y16 should be anchored on both Horizontal and vertical rebar procedure.